Collective knowledge advancement as a pedagogical practice in teacher education

An explorative case study of student group work with wiki assignments in the interplay between an offline and a global online setting

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1 Introduction

1.1 New types of knowledge production on the Internet

Although our society is built upon people producing knowledge together, it is apparent that the Internet is now changing these conditions. For example, well-known scholars like Benkler (2006) and Castells (2010) claim that new forms of *large-scale cooperation* constitute the most important innovation in the new network society. Benkler (2006, p. 5) claims that these new large-scale cooperative efforts build on peer production of information, knowledge, and culture in an online setting. New collaborative projects are emerging in diverse areas such as encyclopedias, news, entertainment, fan fiction communities, and game communities. One of the most prominent example is the success of the encyclopedia Wikipedia, which allows anyone to make contributions in an online setting (Giles, 2005; Malone, Laubacher, & Dellarocas, 2009).

The introduction of the term "Web 2.0" marked a turning point (O'Reilly, 2005). While the first generation of web software in the 1990s provided easy access to a vast amount of information, it was still quite difficult to publish information on the web. Web 2.0, or the second generation of Internet technologies, made it much easier for people to interact and collaborate with each other. New online environments attracted an enormous number of users, who could also publish their own content. Since the World Wide Web was created in 1990, it grew from under 40 million Internet users in 1995 to about 1.5 billion users in 2009. In 2009, more than 60% of the population in developed countries had access to the Internet, and this percentage has been increasing rapidly (Castells, 2010).

Castells (2010) claims that the revolution in communication technologies intensified in the years after the turn of the century. Traditional mass media (television, radio, newspapers) are gradually being replaced by a system of horizontal communication networks that rely on the use of the Internet and wireless communication. These new networks are built upon peoples' initiatives, interests, and desires. The use of social media (e.g., Facebook) has now become so common that many consider online cultural expressions and personal experiences to be a fundamental part of our daily lives. The Internet plays an important role in all parts of our lives—in work, personal connections, information, entertainment, public services, politics, and religion. Young people are participating in new online communities and social networks as part of their daily lives. The Internet is now considered to be a more important source of information than other traditional media.

Furthermore, the industrial-based economy is now being transformed into an information-based economy. The Internet is not only changing the way people interact but also how they exchange information. Jobs in the future will rely more on abstract tasks than on routine tasks and manual tasks, the latter of which will be done by machines (Benkler, 2006; Castells, 2010). New types of online networks are also emerging that do not rely on market signals or managerial commands. They disturb the foundations of liberal markets and democracies, because they are radically decentralized, collaborative, and nonproprietary. Resources are shared between widely distributed, loosely connected individuals who cooperate with each other all over the world. While traditional mass media had unidirectional links to the end

points, the architecture in the networked information environment is distributed with multidirectional connections among all nodes (Benkler, 2006). These networks let people share all types of digital information, such as unimodal text (e.g., Scribd), photos (e.g., Flickr), and videos (e.g., YouTube). These networks integrate local and global media and transcend traditional space limitations with the establishment of the online setting as a significant new human environment (Castells, 2010).

The most important catalysts behind this development have been new communication technology and the declining price of computation, communication, and storage. The economic costs of becoming a speaker have been radically reduced. In the traditional information economy, only a few people could afford or had access to publishing technology. Today, this technology is broadly distributed in society through personal computers and network connections. Because it is so easy to reach people in an online setting, there has been a huge increase in people who are joining forces and producing collective knowledge together (Benkler, 2006). However, although many people are publishing and sharing their own work in enormous compilations on social sharing sites, it is unclear to what degree people are actually building new collective knowledge together on the Internet. Regarding this issue, the online encyclopedia Wikipedia is perhaps the most interesting example of how large numbers of people can produce a "knowledge product" of high quality together. It is considered to be one of the most innovative collaborative enterprises at the beginning of the 21st century (Tapscott & Williams, 2008). As a knowledge production network, the encyclopedia can cope with much more information than traditional knowledge production networks in an offline setting. For example, in November 2015, the encyclopedia reached five million articles on English Wikipedia (Wikipedia, 2015).

Some researchers have even claimed that Wikipedia constitutes an example of a new type of *collective knowledge advancement* (CKA) that is made possible by the establishment of the Internet as a significant online setting for human interaction. For example, Castells (2010, p. xxviii) labels Wikipedia as an example of "mass self-communication", because it reaches a global audience through the Internet. This is a new type of communication since many persons can communicate with many others. The amount of information or knowledge that is produced is also enormous and incredibly diverse. In addition, the quality is remarkably high even though anyone can contribute to and change the articles (Giles, 2005). The success of Wikipedia has even raised questions as to whether a crowd of amateurs can outperform experts under the right conditions (Surowiecki, 2005). One reason is that the quality of content can be improved by scaling up the numbers of contributors, because this will reduce bias (Kittur & Kraut, 2008). As in anonymous peer review processes in the research community, these new networks also build on peer collaboration and evaluation as a part of the production of high-quality content (Benkler, 2006). In addition, the Wikipedia project challenges our perspective on knowledge, since it is very different from the printed encyclopedia, which manifests itself with a finite text. Contributions can not only be made anywhere at any time, but one can also freely choose the size of their contribution. The text license permits anyone to copy, modify, and reuse the Wikipedia text (Wikipedia, 2016). It is this new type of CKA in an online setting that constitutes the background for this thesis.

1.2 Knowledge-producing skills in the network society

1.2.1 Political interest in knowledge-producing skills in formal education

Because of the rise of the network society (Benkler, 2006; Castells, 2010), collaboration and creativity are skills that are becoming increasingly more important in schools all over the world. Both policymakers and educational researchers emphasize that these 21st-century skills will be essential in future society (e.g., Binkley et al., 2012; Griffin, Care, & McGaw, 2012; Pellegrino & Hilton, 2013; Trilling & Fadel, 2009). One example is the Assessment and Teaching of 21st Century Skills Project (ATC21S), which was established in 2009 with the University of Melbourne as an institutional leader (Griffin & Care, 2015; Griffin et al., 2012). In this project, assessment demonstrations were designed for two new 21st-century skills relevant for CKA— (1) *collaborative problem solving* and (2) *Learning in Digital Networks – Information Communications Technologies* (LDN-ICT) (Wilson & Scalise, 2015). While collaborative problem solving was included in the larger Program for International Student Assessment (PISA) assessment system starting in 2015, less work has been done with learning in digital networks. Both skills suggest that students should be encouraged to collaborate in a range of different groups in both online and offline settings, yet we know little about what kind of skills CKA in formal education will require. Previous research suggests that students need to learn how to participate in global online communities and that they also need to learn how to develop collective ideas in large-group collaboration in an offline setting. These two knowledge-producing skills will be described briefly here.

1.2.2 Students need to learn how to participate in global online communities

In one strand, researchers recommend that students should learn how to participate in new online communities. For example, Rudd, Sutch, and Facer (2006) suggest that schools need to move toward the "network logic" of the learning community. Learning in networks is no longer restricted to the boundaries of time and space. Students can easily connect with other people from all over the world. We need to rethink where learning can happen and who is involved in the learning process. Expertise and knowledge do not reside only in the teacher and within the walls of the educational institution. Students will need to learn how they can join and utilize online networks.

According to Jenkins (2009), we are still in an apprenticeship phase, where we have just begun to identify and assess the emerging set of social skills and cultural competencies that will be required in the network society. One common characteristic is that new media literacies move from a traditional focus on individual expression toward a stronger emphasis on community involvement and network skills. It is suggested that literacy should be understood as a social skill rather than an individual skill. Jenkins (2009, p. 33) also claims that collaboration and knowledge sharing in large-scale online communities should be regarded as the most *radical element of new literacies*. He claims that all students need to learn how to contribute to and participate in global online communities that go beyond the walls of the classroom. Although he does not use CKA as a term, he suggests that a new type of literacy will need to be developed to support this way of working in schools.

Jenkins (2009, p. 33) claims that these new global online environments are ideal for informal learning, because there are no restrictions concerning space, institutional bureaucracy, or adult authority. Collaboration happens across traditional differences, such as age, class, race, gender, and level of education. A variety of persons can contribute according to their specific skills, interests, and expertise. This creates many opportunities for peer-to-peer learning. For example, it is common in informal mentorship arrangements that more experienced members assist novices. In these communities, most members think that their contributions matter, and they also care about what others think about their work. According to Jenkins (2009) schools should also let children learn how to cooperate with others in these global online communities. This involves giving and receiving authentic feedback to/from outsiders who are members of these communities.

Jenkins (2009) even reinterprets the digital divide as being about a participation gap. The Internet has made artistic expression, civic engagement, and the sharing of creations much easier, but only those who have the education and the skills to use networked technologies will be able to enrich their lives in these ways. Those with less time, less money, and less knowledge about how they can navigate the online cultural system will instead rely on traditional media. There is a risk that this may lead to the creation of a new cultural elite and a new cultural underclass. The school is not doing enough to reduce this participation gap.

1.2.3 Students need to learn how to develop ideas together in large groups

According to several published reports about 21st-century skills, in the future it will become even more important to work in multidisciplinary teams in environments that are technology-rich and digitalized. Enterprises put more emphasis on decentralized decision making, information sharing, teamwork, and innovation. A professional person will need to communicate, share, and use new information to solve complex problems in response to new demands (Binkley et al., 2012; Griffin et al., 2012). Sustained knowledge advancement is considered essential for the development of prosperous societies and the solution of societal problems. Productive participation in knowledge-intensive work requires that individual professionals, their communities, and organizations continuously create new knowledge (Bereiter, 2002; Paavola & Hakkarainen, 2005, p. 535).

The Knowledge Building pedagogy developed by Scardamalia and Bereiter (2006 is one of the most prominent examples of a pedagogy which highlights this perspective. These researchers claim the Internet has for the first time made it possible for students to connect with civilization-wide knowledge building and to make their classroom work an authentic part of this process. Students should not only developing knowledge-building competencies, but also come to see themselves and their work as part of the civilization-wide effort to advance knowledge frontiers. In knowledge creating organizations people are not honored for what is in their minds but for the contributions they make to the organization's or the community's knowledge (Scardamalia & Bereiter, 2006). The fundamental task of education should be to help youth find a place in this knowledge society. This requires the "(…) same kind of work in the classroom as it is in the research laboratory" (Bereiter, 2002, p. 295). A knowledge-building environment needs to support collective risk-taking with ideas. This is why children need to be treated as junior members of the society of thinkers rather than as trainees (Scardamalia & Bereiter, 2006, 2014). While school practices and social media tend

to personalize ideas, student ideas should at some point become community property and open to collective revision and improvement by the whole community. Like in scientific research groups, it is important to develop theories or models that function as shared knowledge objects in the class in schools (Scardamalia & Bereiter, 2014).

According to the Knowledge Building pedagogy, educational technology should not only support productive interaction and feedback between people but also between ideas. This is why students are encouraged to work in teams that go beyond the traditional division of labor and make every member responsible for their joint effort. The idea is to turn over increasingly higher levels of agency to the students, which are normally undertaken by the teacher. This includes activities such as priority setting, evaluating progress, trouble-shooting, and ensuring inclusiveness. The students are, for example, challenged to evaluate the progress of problem-solving discourse, critically examine goals, and find ways around obstacles (Scardamalia & Bereiter, 2006, 2014). It is assumed that all learning and knowledge-production work builds on self-organizing processes. The design challenge is not to control these processes but to facilitate the emergence of higher-level outcomes. The goal is to let the students develop a better explanation or a more coherent understanding through a collective discourse (Scardamalia & Bereiter, 2006, 2014). An important innovation in the instructional design is to actually believe that students can become engaged as innovators in a research-intensive process. They represent a resource that is largely wasted and that can be brought into play through network technology. The goal is to give ideas a life of their own without using the technology to enforce centralized control.

The Knowledge Building pedagogy also highlights the importance of collective work and idea development in whole-class projects. One example is the use of “knowledge-building circles,” where students sit in a circle on the floor. The intention is to facilitate collaboration between the students in an offline setting. Students also share their inquiry-based notes, questions, and comments with all the other students in the class in an online environment called the Knowledge Forum. These notes are discussed over time and will be revised several times. The Knowledge Forum offers an archival record of the group´s knowledge, which is transparent and accessible for everyone in the class. In this way, the students are given access to the distributed expertise and thoughts of others in the school class (Scardamalia & Bereiter, 2006).

In their research, Scardamalia and Bereiter (2006) have found that the motivation is not primarily children’s interests but rather their desire to connect with what is most dynamic and meaningful in the surrounding society. The fundamental task of education should be to help students find a place in this knowledge-creating culture. The collective resources of the students can be utilized through new network technology. Students need to see themselves and their work as part of the civilization-wide effort to advance knowledge frontiers. Both transmission-orientated pedagogy and constructivist methods appear to be limited in scope (Scardamalia & Bereiter, 2006).

1.2.4 Two new core skills

The two previous sections (1.2.2 and 1.2.3) show that two new knowledge-producing skills are becoming increasingly important. First, it is assumed that students should be able to

develop collective knowledge through participation in global online environments. Although students can acquire new knowledge in these environments, Jenkins emphasizes that it is even more important that the students learn how to get access to knowledge in these environments. In this way, one can use networks to acquire new knowledge. This also requires that students dare to express their own opinions in public. As such, they must learn how to be active participants in different online environments. The fear is that the students who do not learn these participatory skills will become the losers in the future society. Second, students should learn how to develop knowledge through whole-class projects or large-group collaboration. For example, the Knowledge Building pedagogy challenges our normal conceptions of the upper limits of acceptable group sizes in formal education. This pedagogy emphasizes that large groups of students can work together as a research team to explore different ideas. Digital technology can be used to support this type of creative work. There is a need to further explore what characterizes these new types of skills.

1.3 The main research question

Both the new types of knowledge production on the Internet (1.1) and the need for new knowledge-producing skills (1.2) suggest that there is a need to invent pedagogical practices that to a larger degree can support collective knowledge advancement as a pedagogical practice. As a consequence, this research study will address the following research question:

How does collective knowledge advancement (CKA) as a pedagogical practice in teacher education emerge in the complex interplay between an offline setting and a global online setting?

The following sections will briefly describe the theoretical framework and explain the other key terms in the research question in more detail.

1.3.1 Studying CKA as an artifact-mediated pedagogical practice

In recent decades, we have witnessed a "sociocultural turn" regarding our understanding of the concept of learning. This shift has to a large degree been inspired by the work of Lev Vygotsky (1978). He claims that higher mental functioning such as language, writing, counting, drawing, and memory are all mediated by the use of tools and signs. Language is the primary psychological tool we use to understand the world. Cognitive processes first appear at the social level and then are internalized into individual thinking. Many scholars within the learning sciences build on this theoretical framework and highlight that learning must be understood as an interactive process based on participation in cultural practices. Learning is defined as a process of becoming a member of a community and acquiring the skills to communicate and act according to its socially negotiated norms (Lave & Wenger, 1991). Sfard (1998) distinguishes between an acquisition metaphor and a participation metaphor in relation to human learning. For example, in the study of creativity it has been suggested that we should move from the idea of individual genius to the study of the social and cultural conditions that inhibit or enable creativity (Sawyer, 2006). New theories of learning also highlight the qualities of group discourse and joint meaning making to a greater degree (Stahl, 2006). Another example is Edwards and Potter (1992), who have introduced a discursive approach to psychology. Discourse, like naturally occurring talk and text, should not be considered a "mirror" of the inner cognitive life of the mind. It should rather be understood as a phenomenon that is constructed and understood in the interaction itself. Knowledge does not reside inside the heads of individuals but in the practice itself (Flick, 1998; Gergen, 1985). Even memory is considered to be a social or collective process. It is co-constructed by individuals in their daily speech and actions within a community (Middleton & Edwards, 1990). Although these new theories differ from each other, they all reject the claim that learning is just something that happens inside the individual mind.

On the other hand, some of these new learning approaches have been criticized, because they do not explain how a group of people or communities create new knowledge (Paavola & Hakkarainen, 2005). A set of new approaches have therefore been employed to investigate collective knowledge advancement as a phenomenon. These studies are performed with the use of a large variety of different concepts that all describe more or less the same phenomenon. Some of the most prominent examples are knowledge building

(Scardamalia & Bereiter, 2006), expansive learning (Engeström, 2014) and knowledge creation (Paavola & Hakkarainen, 2005). While some of these theories continue to use the learning concept at a collective level (Engeström, 2014), others reject this linkage and define the collective level of knowledge advancement as something different from individual learning (Scardamalia & Bereiter, 2006). For example, Lund and Smørdal (2006) use collective cognition as a similar broad term that encompass innovative learning. This process emerges when two or more people reach insights that neither could have reached alone. The insight cannot be traced back to one particular individual's contribution, and it can be used to solve problems that are too complex or demanding for an individual. Collective cognition is not a static notion; rather, it should be considered as a dynamic emerging concept that highlights the process of a group coming-to-know. While some of these theories focus on small groups (Stahl, 2006), others highlight knowledge work in larger groups (Scardamalia & Bereiter, 2006) or activity systems (Engeström, 2014).

Although these theories also differ, they all emphasize that human creativity and knowledge production needs to be understood as a collaborative artifact-mediated practice. Several of these new approaches adhere to Vygotsky (1978) and highlight the position of the artifacts. Human action is regarded as mediated through artifacts that have been culturally and historically developed. Artifacts include both psychological tools and externally orientated technical tools. They have been shaped by previous interactions that influence or frame the present interaction and accumulation of cultural knowledge. The artifacts in the world and the individual subject constitute each other mutually in a dynamic way (Wertsch, 1991).

In the current study *collective knowledge advancement (CKA)* will be established as the main concept for describing this type of practice. It is difficult to select the most relevant concept, because this is a new research area with many new practices and few established academic concepts. Note that other concepts could have been taken into use as well. Within the field of learning sciences, there are similar concepts that describe knowledge production at a collective level. Some examples are collaborative learning (Hmelo-Silver, 2013), creativity (Sawyer, 2012), and collaborative knowledge creation (a trialogical approach to learning) (Moen, Mørch, & Paavola, 2012b).

The most important reason why CKA will be used as the main concept is because it is a general and broad concept that is not strongly affiliated with one specific pedagogical theory. At the same time, the concept shows that it is something different from individual cognition. According to Lund (2008), a concept like collective knowledge advancement (CKA) should not be studied as individual acquisition but as artifact-mediated collaborative participation. Learners in communities will utilize a range of different resources. This includes social resources (other participants, institutional affordances), material resources (PCs, networks, applications), and semiotic resources (signs, genres). Lund (2008) refers to cultural-historical activity theory (Engeström, 1987; Engeström, Miettinen, & Punamäki, 1999) as one such approach, which attempts to include the whole learning ecology as its unit of analysis (agent, object, tool, and community as well as its rules and division of labor). Other scholars study cognition as coordination between individuals, artifacts, and the environment (Hutchins, 1995; Salomon, 1993).

The more specific theory that will be used in the present study is cultural-historical activity theory (CHAT) (Engeström, 1987). The first reason is that this theory emphasizes the importance of several different types of artifacts. While most sociocultural theories of learning highlight the importance of artifacts, some emphasize physical artifacts in a material environment (Hutchins, 1995) and others emphasize conceptual artifacts (Bereiter, 2002; Scardamalia & Bereiter, 2006), while CHAT includes both physical and conceptual artifacts (Engeström, 2014). Second, while many theories emphasize interaction as orientated toward a shared object, the object itself is perceived differently. In the Knowledge Building pedagogy, the collective object is an idea that needs to be scrutinized and improved (Scardamalia & Bereiter, 2006), while in CHAT it is assumed that the whole practice in an activity system is orientated toward an object (Engeström, 2014). This analytical perspective will be pursued in this research study.

However, CHAT has been criticized for not fully capturing the new network society and the digitalization of society (Rückriem, 2009). The theory (Engeström, 1987) was originally developed before the age of the Internet. Most CHAT studies, including those related to teacher education, primarily focus on human interaction in an offline environment (Ellis, Edwards, & Smagorinsky, 2010). Although some recently published papers (Engeström, 2009a, 2009b; Engeström & Sannino, 2010) suggest that Internet-based peer production challenges scholars to rethink the shape of activity systems, the new concepts are just briefly described (e.g., runaway objects, knotworking, co-configuration, boundary crossing, expansive swarming, etc.) (Engeström, 2009a). It is still unclear how the theory can adapt to the new online setting. Although the thesis will not address this specific theoretical discussion any further, it will instead utilize some of the core concepts (contradictions and germ cell) in the theory in an attempt to better understand CKA in both an offline and online setting.

Note also that the term “advancement” assumes some kind of progress toward that which is better, but this is not necessarily the case when collaboration leads to change. It will therefore be important to explore characteristics that indicate the quality of progress in the knowledge process or in the knowledge product. CKA will be analyzed as an artifact-mediated phenomenon with the inclusion of both physical and conceptual artifacts. The theoretical framework assumes that CKA must be examined as a specific artifact-mediated phenomenon within a specific educational context.

1.3.2 Studying the interplay between an offline setting and a global online setting

This study will investigate how students jointly construct knowledge in a learning environment that requires participation in both an offline and an online setting. Because of the Internet, several prominent scholars claim that collaboration in online networks is even more important than before (Benkler, 2006; Castells, 2010). It is expected that learners in the future will normally collaborate in a face-to-face setting while at the same time collaborating in an online setting. This trend has become stronger with the increased access to online environments through many different mobile devices. This has been documented in the Speak Up project of Project Tomorrow from 2014, which included the views of 431,231 K–12 students representing over 8,000 schools from the United States as well as

other countries. The findings show that students are increasingly using different mobile devices, such as a laptops or tablets. This gives them personalized access to learning tools anywhere at any time in a blended learning environment. Many school districts provide students with mobile devices and improved Internet connectivity. Project Tomorrow discovered that 45% of the administrators interviewed find that blended learning environments hold great promise for student learning (Project Tomorrow, 2015). This "double presence" has become even stronger with the wide adoption and use of smartphones and other handheld technologies. Some research efforts have been initiated under labels such as mobile learning or ubiquitous learning (Hwang & Tsai, 2011) or blended learning (Garrison & Kanuka, 2004), but this field is still underdeveloped and under-theorized. Few theories have yet attempted to explain how we increasingly participate in both an online and offline setting at the same time.

Not surprisingly, there has been little time to adjust the theories within the learning sciences to this recent development. Many researchers highlight the importance of technology-supported collaboration such as in small groups (Stahl, 2006) or in larger groups such as the whole school class (Scardamalia & Bereiter, 2006), but they do not explicitly investigate the interplay between an online and an offline setting as two equal analytical components. Most CHAT studies also focus on human interaction in a face-to-face offline setting (Engeström, 2014). Obviously, we cannot avoid being in a physical or material environment, but we are increasingly also participating in online environments at the same time. Few of the dominating theories within the learning sciences seem to have incorporated this new polycontextual nature of human learning as part of the analysis. It is here suggested that an important goal in educational research is to better understand student learning in the complex interplay between an offline and an online setting.

However, the definition of an online setting needs to be further specified. The global networked technologies also challenge our fundamental ideas of the scope of human learning and collaboration in an online setting. Although some scholars discuss these new global online environments (Jenkins, 2009; Rheingold, 2002), there are few theories of learning that seek to explain human interaction as enacted in two parallel contexts with their own unique characteristics. For example, studies of online environments in the Knowledge Building pedagogy are usually restricted to class projects in a face-to-face setting and do not include student participation in global online networks (Scardamalia & Bereiter, 2006). A range of new interdisciplinary concepts have been introduced that describe large-scale cooperation on the Internet. They attempt to grasp these new trends related to collective knowledge advancement (e.g., collective intelligence (Malone et al., 2009); mass collaboration (Tapscott & Williams, 2008)). They all build on the same premise that in the in the age of the Internet, CKA will increasingly manifests itself in through participation in a global online environment. The current study of CKA as a pedagogical practice will therefore also include an analysis of participation in *an extended global online environment outside the formal educational setting* in addition to *the local online environment within the educational setting*.

1.3.3 Studying CKA as a pedagogical practice that includes participation in a global wiki environment as an online setting

This research question will be investigated by studying how students interact when they are assigned to produce authentic knowledge with the support of different wiki technology. The student work is published in an online environment which stretches far beyond the walls of the classroom (e.g., Wikibooks). These environments are important to study if we want to understand what characterizes how CKA as a pedagogical practice interplays with *a global online setting*.

Within the learning sciences, several networked technologies have been developed in an attempt to strengthen collaboration in formal education (e.g., Knowledge forum (Scardamalia & Bereiter, 2006) and 'Knowledge Practices Environment' (Batatia, Hakkarainen, & Mørch, 2012)). However, most of these technologies do not depend on participation in a global online environment. The main exception is the "wiki," which can be used both in a local online setting and a global online setting. The wiki, a Hawaiian term meaning quick, was first created in 1995 by Ward Cunningham as a tool to support text collaboration over the Internet. It is easy to add to, delete or change any part of the published text. When a page is changed, the new version will be immediately available on the web. All the different page versions are also archived, and it is possible to retrieve an old text version. In addition some wikis have a separate discussion page attached to each page that enables users to communicate about the content (Leuf & Cunningham, 2001). This makes it possible to undo vandal attacks on the open encyclopedia, and the discussion pages also mediate negotiations around the content of the articles. Over the years, many different types of wiki applications have been developed (e.g., MediaWiki, Wikispaces, PBwiki). For example, the online encyclopedia Wikipedia is built on the MediaWiki.

The wiki technology has been studied in relation to how it can support collective knowledge advancement (Cress & Kimmerle, 2008; Lund, 2008). For example, Lund and Smørdal (2006) emphasize that wikis can support an epistemological shift from individually acquired knowledge to collectively created knowledge. It is assumed that wikis can support knowledge creation and knowledge sharing in both an offline and an online setting. However, there are few detailed definitions of CKA as a pedagogical practice and most of this research investigates the use of a local wiki in a local classroom setting (Melissa Cole, 2009; Lund & Smørdal, 2006). There are only a few studies that explore student contributions in *global wiki environments* such as Wikipedia (Farzan & Kraut, 2013; Lampe, Obar, Ozkaya, Zube, & Velasquez, 2012; Roth, Davis, & Carver, 2013; Schulenburg, Davis, & Klein, 2011) or Wikibooks (Baltzersen, 2010; Ravid, Kalman, & Rafaeli, 2008). We still know little about how global online environments can be integrated within a formal educational setting.

1.3.4 Studying CKA as a pedagogical practice in the teacher education context as the offline setting

Moreover, CKA as a pedagogical practice will be studied in a teacher education context. The current study will therefore investigate how students in one specific course produce learning

resources in a wiki-supported learning environment. Teacher education institutions need to devote extra attention toward developing future skills, since they educate prospective teachers. For example, Herrington and Parker (2013) claim that it is even more important to employ emerging technologies in teacher education, because this institution is responsible for preparing future teachers for technology-rich classrooms. It is negligent to assume that teachers will learn pedagogical use of ICT on their own.

The current study has been conducted in a teacher education institution in Norway. Although there have been some large ICT-projects in this country within the last decade (Benan, 2003), several recent studies indicate that ICT has resulted in little pedagogical innovation in Norwegian teacher education (Gudmundsdottir, Loftsgarden, & Ottestad, 2014; Hetland & Solum, 2008; Wilhelmsen, Ørnes, Kristiansen, & Breivik, 2009), and the findings from Swedish teacher education are similar (Granberg, 2011). The research is also quite broad and directed toward ICT-training in general (Wilhelmsen et al., 2009; Ørnes, Wilhelmsen, Breivik, & Solstad, 2011). Hardly any of the Norwegian teacher education institutions seems to have developed a systematic pedagogical strategy related to the use of ICT. Most of the use still relies on contributions from enthusiasts (Tømte, 2013; Wilhelmsen et al., 2009; Ørnes et al., 2011). It has also been less focus on how ICT can support collaboration and creativity as important 21st-century skills.

From one perspective, the situation may seem alarming, because teacher education institutions are expected to be frontrunners in the exploration of new and innovative pedagogical practices. For example, although some of the wiki studies in the review are from the teacher education field (see Chapter 2), few researchers have investigated in detail how student teachers can use wikis to support collective that attempts to produce authentic learning resources. The current study will, therefore, explore how student teachers encounter wiki-supported learning environments, how they perceive the value of wikis, and how they utilize this technology to support collaboration in large groups.

The offline setting that has been selected as a research site is a teacher education institution that has been actively using ICT for many years. All students at the institution are required to pass an introductory course on basic ICT skills to graduate as teachers. This institution was, therefore, considered a good location to investigate new wiki-supported pedagogical practices among student teachers.

Note that the second part of the aforementioned course emphasizes pedagogical use of ICT but it is not obligatory. However, it was considered to be very relevant as the classroom research site. One important reason is that this course permits the exploration of innovative ICT-supported pedagogical practices, which makes it possible to design new and nontraditional assignments without meeting too much resistance from colleagues or students. Although the main objective of the course is to strengthen students' ability to employ ICT in classroom teaching in a broad way, it also opened up for the design of assignments that could support CKA.

Three wiki assignments were therefore designed that were assumed to support CKA as a pedagogical practice. The students also used three different wiki environments (Wikibooks, Wikispaces, and Wikipedia), with two of these (Wikibooks and Wikipedia) labeled as global

wiki environments. It is expected that the particular wiki artifact and its use in combination with other artifacts will significantly influence students' collective work. A wiki is not just a wiki, but a wiki-in-use, in both offline and online settings.

Furthermore, two of these three wiki assignments were designed as whole-class projects. Students were expected to submit their project work as wiki pages, but they were also encouraged to employ other digital tools during the work process (e.g., Google Docs). In two of the wiki assignments, students were also asked to build on and improve a text other students had worked with in previous years. In this way, the wiki assignments did not start from scratch but were part of a collective work extending over a longer time period than that of a single course.

Furthermore, one should note that the course, as a research site, is to some degree in the periphery of the ordinary teacher training program. One reason is that both preservice and in-service teachers follow the course. Because some already work as teachers, it will be incorrect to use the term "student teacher" to describe the whole student group. Instead, the term "student" will normally be used. Second, the course does not require that students do classroom teaching as a part of a practicum period. As such, the collective work in the course involves only adult learning as campus and not children´s learning in the classroom.

On one hand, because the research site only covers a small part of the training at campus, it is difficult to generalize the findings to be relevant for the whole teacher training program. In addition, one must be cautious about conceptualizing CKA as a pedagogical practice that also encompasses the primary and secondary school sector. On the other hand, the emphasis on campus-based teaching makes the findings relevant not only for the teacher education context but also for other courses or programs in tertiary education.[1] Therefore, the term "teacher" will normally be used in the present study. The exception is when the discussion is considered to be particularly relevant for the teacher education context. Then, the term "teacher educator" will be used instead.[2]

[1] See section 11.2, Contributions and limitations, page 362.
[2] For example, see section 10.4, The teacher educator as a team coach, page 341.

1.4 Overview of the contents

The aim of the present study is to contribute to the discussion of CKA as a pedagogical concept. By analyzing CKA as a concept-in-practice in a teacher education setting, the intent is to provide a deeper understanding of the complexity of this phenomenon. The empirical analysis will, therefore, focus on how students produce knowledge together in the interplay between an offline and an online setting.

The dissertation consists of 11 chapters. Part I consists of three chapters, which cover the theoretical perspectives and research method. Chapter 2 reviews tertiary students' coursework in global wiki environments, involving both studies of student participation in global wiki environments and wiki studies in the teacher education context. The purpose is to identify gaps in the research and formulate more specific sub-research questions, which are addressed in chapters 5, 6, and 7, rather than offer a complete overview of the field. Chapter 3 presents two concepts from cultural-historical activity theory (CHAT)—germ cell and contradictions—which will be applied as the theory of change. This theoretical framework will be used to explain how new concepts emerge in practice. Chapter 4 offers a detailed presentation of the research design, which includes a discussion of what characterizes the explorative case study (4.1), the research site (4.2), data collection (4.3), data analysis (4.4), the transcribing and reporting of data (4.5), and ethical considerations (4.6). The chapter also comprises a discussion on the qualities of the many different types of data that were collected in the present study. In addition, the analytical strategy is explained in detail, which involves how data triangulation and theoretical concepts have been utilized to analyze the data.

Part II consists of five chapters covering the empirical analysis. Chapters 5, 6, and 7 are similar in that they each address one of the three sub-research questions through empirical analysis. Chapter 6 is built around the first sub-question: *How does the value of student-produced collective work emerge in teacher education?* This question will be used to address the knowledge-production dimension. The study will investigate what kinds of collective knowledge students think can be of value in the teacher education context. Chapter 7 addresses the second sub-question: *How does "students' shared responsibility" emerge in teacher education?* The focus here is on how students manage their own collaboration and involves several issues related to the project management of wiki work. Chapter 8 discusses the third sub-question: *How does peer learning emerge in teacher education?* This empirical analysis involves the investigation of both peer feedback and peer editing.

In chapters 8 and 9, the analysis of the findings from chapters 5, 6, and 7 are brought together, utilizing two theoretical concepts (germ cell and contradictions). These concepts are used to address the main research question to explain how CKA emerges as a pedagogical practice in the teacher education setting. First, in Chapter 8, the conditions that inhibit CKA as a pedagogical practice are further summarized through the description of specific tensions. Contradictions, as a theoretical concept, is also applied to identify the fundamental inhibitory condition in a teacher education context. Second, in Chapter 9, the findings labeled as enabling conditions are compared in an attempt to identify the essential characteristics of CKA as a pedagogical practice. This germ cell of CKA is a singular entity that will exhibit the simplest possible definition of the phenomenon.

Part III consists of two chapters and covers a discussion of the findings. Chapter 10 discusses the implications of the findings. In accordance with the principle of ascending from abstract to concrete (see section 3.3), the germ cell must first be identified before continuing to develop the concept in new directions. As such, since the germ cell is described in Chapter 9, this makes it possible to discuss the relevance of five new "conceptual trails" (10.1. Transparent use of artifacts; 10.2. Nurturing critical feedback; 10.3. Learning by teaching; 10.4. The teacher educator as coach; and 10.5. Creating value beyond the learning period). Each section builds on the previous identification of the germ cell of CKA as a pedagogical practice, and discusses the concept in further detail. In the final remarks (Chapter 11), the findings are summarized in relation to the key research question, which addressed the interplay between offline and online settings. A few concrete design principles are also suggested, which could guide the further development of CKA as a pedagogical practice.

2 A review of tertiary students' course work in global wiki environments

2.1 Introduction

2.1.1 About the articles in the review

This section will explain what articles have been included in the review. As already mentioned in the introduction, the basic theoretical assumption in this dissertation is that collective knowledge advancement (CKA) as a pedagogical practice will always be mediated by artifacts. As such, wiki has been selected as one of the most interesting new networked technologies that can potentially support CKA in teacher education. In recent years, educational researchers have begun to explore whether wikis can be used to support CKA in formal education. Typically, the instructional models move from traditional knowledge-transmission to investigations of how students co-construct, share, and reshape knowledge in different wiki-supported learning communities (Bonk, Lee, Kim, & Lin, 2009a; Lund, 2008; Zheng, Niiya, & Warschauer, 2015). Although most researchers do not explicitly use "collective knowledge advancement" as a term, they focus on the value of collaborative learning in different ways.

However, although a global environment such as Wikipedia has become a huge success (Giles, 2005), most wikis have thus far failed to have a large scale impact on classroom teaching and the educational system. For example, a large study examined a representative sample drawn from a population of nearly 180,000 wikis in K–12 settings in U.S. The authors found that only one percent of the wiki usage was related to collaborative student presentations and workspaces (Reich, Murnane, & Willett, 2012),[3] and several explanations have been put forward. First, it is technically difficult to get an overview of student work, because the wiki was not designed for educational purposes (Lund & Smørdal, 2006). Second, if the wiki is not part of the assessment system, students lack motivation (Melissa Cole, 2009). It seems clear that wikis cannot support CKA in any simple technology-deterministic way. Several technical and pedagogical challenges need to be further investigated.

Furthermore, in accordance with the main research question—*How does CKA as a pedagogical practice in teacher education emerge in the complex interplay between an offline setting and a global online setting?*—it is here suggested that one needs to direct more attention toward student participation in global wiki environments. Few studies have explicitly addressed this issue even though it is quite obvious that the success of Wikipedia (Giles, 2005) is less about the wiki technology and more about the global online community. A major limitation in many wiki studies in formal education is that they only analyze student work as a part of a local course context, Usually, the students will start doing their work from scratch, and they will not try to improve others work (e.g., Cole, 2009).

[3] There are only a few other studies that indicate a potential learning effect related to the final exam scores (Stafford, Elgueta, & Cameron, 2014).

In relation to CKA in an online setting, participation in global wiki environments can be regarded as highly relevant, because such environments also extend traditional barriers in time and space in a formal education setting. It is expected that such online environments will become a more important part of formal learning in the future. The current review will therefore primarily use articles about student contributions in global wiki environments as part of a formal educational setting. In this way, the online setting will not be restricted to only the course setting but will also include an extended online environment that stretches beyond the "common" institutional boundaries of formal education.

Regarding the concrete selection of global wiki environments, it is Wikibooks and Wikipedia that have been selected as representative examples of global wiki environments in this review. They can be considered two of the most important global wiki environments. *Wikibooks* is a site where volunteers create a free library of educational textbooks, while Wikipedia is a site where anyone can help create an online encyclopedia. Neither of these environments belongs to any specific educational institution, and people from all over the world can make contributions. Both environments offer resources openly to anyone free of charge. Both Wikipedia and Wikibooks are built on the MediaWiki technology and are hosted by the Wikimedia foundation. Anyone can create, edit, modify, or reuse the wiki text. This is done in a browser with a wiki markup, which is a simplified alternative to HTML. It is also possible to view and retrieve earlier versions of the article. A special feature of MediaWiki is the unique discussion page attached to each wiki page. This page makes it possible to discuss the content in the article, which is considered to be an advantage on large open-content sites (Lund & Smørdal, 2006). The main difference is that while Wikipedia is used all over the world, there is in comparison very little activity on Wikibooks. However, there are still 2,880 book projects on the English wiki site.[i]

2.1.2 Searching for articles about student participation in global wiki environments

The first search area covered *student participation in global wiki environments*. A combination of three different strategies was used in this search. First, several different "search strings" were used to look for articles that investigated student contributions in Wikibooks and Wikipedia as part of a formal educational setting. Because there were only few such wiki studies, this search included articles from educational settings other than just the teacher education setting. The few articles that were retrieved were carefully read and the reference list was also checked to determine whether there were other relevant articles to include. In addition, relevant articles that had previously been read by the researcher were included in the review list. For example, the Wikipedia Public Policy Initiative was used as a search term, because this was a project the researcher was familiar with. Several different search terms were used that were expected to be relevant. The table below gives an overview of the different search strings that were used and the relevant articles that were found and included in the review list.

Table 2.1.a An overview of the articles in the review list that cover student participation in global wiki environments.

Search strings used in the search engine Google Scholar	**References relevant for the review list**	**Additional information**
- Search string [Wikibooks pedagogy] (Search period from 2008–2015)	Wikibooks: - (O'Shea, Allen, Onderdonk, & Allen, 2011) - (Karasavvidis, 2010b) - (Kidd, O'Shea, et al., 2009) - (Baltzersen, 2010) - (Kidd, Baker, et al., 2009) - (Kidd, O'Shea, Baker, Kaufman, & Allen, 2008)	- Four of these six articles have been published by one research group (Kidd, Baker, et al., 2009; Kidd et al., 2008; Kidd, O'Shea, et al., 2009; O'Shea et al., 2011). It was only the first page with hits in Google Scholar that retrieved the most relevant hits. - One article by (Lin & Kelsey, 2009a) was omitted, because the focus was on the production of a wiki resource, but this was not done on the wiki site Wikibooks. - Another article by (Lin & Kelsey, 2009b) was also omitted, because it was a book chapter, and it was not clear if this text had been peer-reviewed.[4] - A few articles showed up in some of the other searches below. They have only been mentioned in this top row.
- Search string [Education Wikibooks] (Search period from 2008–2015)	- Wikibooks: - (Ravid et al., 2008) - (Bonk et al., 2009a) - (Bonk, Lee, Kim, & Lin, 2009b) - (Wang, 2010) - (Karasavvidis, 2010a)	The book chapter Wiki writing: collaborative learning in the college classroom by Matt Barton (2008) was excluded, because it was not clear if this text had been peer-reviewed.
- Search string [Students Wikibooks] (Search period from 2008–2015)	Wikibooks: (Xiao & Lucking, 2008) (Ren, Dang, Zhang, Baker, & Allen, 2008)	Did not get access to the article by Ren (2008).
- Search string [Students Wikibooks] (Search period from 2013–2015)	Wikibooks: - (Wang, 2014) - (Kim, 2015)	
Articles located by reading the reference list in the articles from the first search round	Wikibooks: - Article by Dohn (2009) was located in reference list in article by (Karasavvidis, 2010a). - Article by Xiao et al. (2007) was located in reference list in article by O´Shea et al. (2011)	

[4] Only peer-reviewed articles have been included in the review.

- Search string [Wikipedia Public Policy Initiative]	Wikipedia: - (Roth et al., 2013) - (Carver, Davis, Kelley, Obar, & Davis, 2012) - (Lampe et al., 2012)	Paper by (Obar & Roth, 2011) was excluded, because it is a working paper and has not been peer-reviewed.
- Search string [Student contributions Wikipedia]	Wikipedia: - (Farzan & Kraut, 2013)	
Highly cited articles: Search string [wiki education] Search string [educational use of wikis]	 - (Melissa Cole, 2009) - (Lund & Smørdal, 2006)	Assumed to be "benchmark" articles with important findings in the research area. These articles were selected because they were among the most cited that were educationally relevant. (More than 100 citations). These students did not use Wikibooks or Wikipedia but local wikis at the educational institution.

The large majority of articles that have been included in the review were retrieved through the search engine Google Scholar. Although there were quite a lot of hits, most of them were not relevant. Some other search strings ([school+wikibooks], [learning+wikibooks], [pedagogy+wikipedia], [student+Wikipedia] and ["pedagogical use of Wikipedia"]) were also used but did not return any additional articles of interest. In total, there were very few relevant articles. A total of 24 relevant articles were located from this search area and have been included in the review. Note here that two highly cited wiki articles were also included in the review list. This was done under the assumption that these findings could potentially be important independent of the wiki environment used.

When comparing the studies in the review list, one should be aware that all the articles about the use of Wikibooks and Wikipedia are from tertiary education. This indicates that students' participation in global wiki environments is more common among adult students. There are also far fewer articles about student work in Wikipedia compared with Wikibooks (4 vs. 18 articles). Although there are quite a lot of research articles connected to Wikipedia, there are very few publications that address how students can contribute in Wikipedia as a part of a formal educational setting. One reason may be that this is a rare pedagogical practice. Nevertheless, in recent years there have been two major Wikipedia projects that involve these kinds of student contributions in tertiary education. In 2010, the Wikimedia Foundation piloted the Public Policy Initiative together with the faculty from 24 universities. The goal of this education program was to improve the Wikipedia content in articles related to United States public policy. Students in 33 classes were involved in the production of Wikipedia articles (Roth et al., 2013). Another project, The Association for Psychological Science (APS), established the APS initiative to improve Wikipedia articles about scientific psychology. The APS president encouraged psychologists to make three types of contributions. They could edit Wikipedia articles in their area of expertise, provide feedback on the quality of existing Wikipedia articles, or create Wikipedia assignments if they also worked as teachers (Farzan & Kraut, 2013). These studies focus exclusively on the wiki as a

Wikipedia environment. The study by Roth et al. (2013) will also be much used, since it consists of rich qualitative data.

2.1.3 Searching for articles about students' use of wikis in teacher education

The second search area covered *students´ use of wikis in the teacher education context*. The aim here was to locate more context-related issues related to wiki work in the teacher education setting. Studies with detailed qualitative reports would be given extra attention. However, a specific search in Google Scholar after articles that focus on wiki use in teacher education gave only a few relevant hits. Most of the relevant articles from the teacher education context were instead found when conducting other wiki searches. The table below describes which articles have been included in the review list.

Table 2.1.b An overview of the articles in the review list that cover students' use of wikis in teacher education.

Search strategies	**References relevant for the review list**
Search string [wikis teacher education]	(Biasutti & Heba, 2012; Wheeler & Wheeler, 2009; Wheeler, Yeomans, & Wheeler, 2008)
Articles found in the first search round (student participation in global wiki environments) and also with teacher education as a research site.	(Karasavvidis, 2010a; O'Shea et al., 2011; Xiao et al., 2007)
Articles from the teacher education context but that were found accidently when using search terms not directly linked to the teacher education context.	(Ertmer et al., 2011; Hadjerrouit, 2014; Kessler, 2009; Kessler & Bikowski, 2010; Kim, 2015; Li, 2015; Naismith, Lee, & Pilkington, 2011; Ng, 2014; O'Shea, Baker, Allen, Curry-Corcoran, & Allen, 2007; Vratulis & Dobson, 2008). (Arnold, Ducate, & Kost, 2012)[5]

In total, 15 articles have been included. Fourteen of these involve student teachers' use of wikis. Three of these articles are the same that were found in the first search round (Karasavvidis, 2010a; O'Shea et al., 2011; Xiao et al., 2007). These studies are special, because they involve both a teacher education context and a global wiki environment. However, in general it was difficult to find wiki articles from the teacher education context. One reason is that most of these studies do not direct any significant analytical attention toward the context they are a part of. It is typical to give only a brief description of teacher education as a research site. This is illustrated by the fact that these articles that have used teacher education as a research site do not use context-relevant terms in the title, such as "student teachers," "teacher education," or something similar, nor is the context mentioned in the abstract. This makes it difficult to find these articles through search engines. Although some of the studies combine several different kinds of data (Ertmer et al., 2011; Ng, 2014), there are few thick descriptions.

[5] The article by Arnold et al. (2012) was located by checking who had cited article by Kessler (Kessler, 2009; Kessler & Bikowski, 2010) after it was published on Google Scholar. The study is not from the teacher education context but targets university language learners. It was still regarded as relevant to include in the review list.

Moreover, several of the Wikibook studies aim to develop collective learning resources that can be of value for all teachers (Baltzersen, 2010; Karasavvidis, 2010a; Naismith et al., 2011; O'Shea et al., 2011; O'Shea et al., 2007). Some of these studies also let new students continue to develop the resources over a period of several years (Baltzersen, 2010; O'Shea et al., 2011). For example, the project described by O´Shea et al. (2011) started in 2006 and has continued every semester since. Each semester, the teachers decided to keep the best content so that new students could be inspired by this work. However, new classes primarily wrote new articles independent from the previous work (O'Shea et al., 2011).

Most of the studies are also case studies of both small and large classes. One example of a small class is the study by Karasavvidis (2010a), who let 27 students work on a Wikibook in an undergraduate course about the Internet in education. The aim of the course was to introduce common Internet technologies and a pedagogy that could support the use of this new technology. A couple other studies involve wiki work in larger student groups (Ertmer et al., 2011; O'Shea et al., 2011; Vratulis & Dobson, 2008). For example, Ertmer et al. (2011) studied the contributions from 346 preservice teachers. In another study, all the first year student teachers (800 in total) were required to contribute in a wiki (Vratulis & Dobson, 2008). In a third study, Xiao et al. (2007) measured 260 students' perceptions and participation levels in the use of Wikibooks. In a fourth study, over 200 student teachers developed a Wikibook about the Social and Cultural Foundations of Education, which is an obligatory course for preservice teachers. However, no studies show that the wiki has been implemented full-scale in more than one subject in a teacher training program.

Furthermore, many of these studies have been conducted in educational technology courses (Baltzersen, 2010; Ertmer et al., 2011; Hadjerrouit, 2014; Karasavvidis, 2010a; Li, 2015; Naismith et al., 2011). The use of wikis is therefore often related to the acquisition of individual technology skills. However, there are a few wiki studies that focus on the development of more subject-specific skills like language learning (Kessler, 2009; Kessler & Bikowski, 2010) or the knowledge of the foundations of education (O'Shea et al., 2011; Xiao et al., 2007). Some studies also emphasize how wikis can support the development of individual writing skills and critical thinking skills (Wheeler & Wheeler, 2009; Wheeler et al., 2008).

However, none of the studies address the importance of the teacher education setting. Both (Naismith et al., 2011) and (Karasavvidis, 2010a) find significant tensions between wiki-mediated collaboration and institutionalized assessment practices, but these issues are not discussed in much detail, nor are they addressed as unique for the teacher education context. Instead, the findings are usually generalized to be relevant for the whole of tertiary education. However, Karasavvidis (2010a) recommends that we need to examine wiki practices within the specific learning ecology to fully utilize the pedagogical potential of the wiki technology. This is what the current study will attempt to do by analyzing how CKA emerges as a pedagogical practice in teacher education.

2.1.4 Overview of the content in the review

In the following sections the selected articles from the two lists of review will be combined and used to describe some “problems spaces” that characterize this research area. The review is organized according to five such problem spaces: (2.1) The quality of the collective text, (2.3) Individual learning, (2.4) Peer editing, (2.5) Feedback-driven processes, and (2.6) The fairness of the collective work. The different findings in these studies will be systematically compared with each other within each problem space. This comparison will be used to identify gaps in previous research. In the last part of the review (2.7), the gaps in previous research and the problem spaces will be used as a conceptual framework to formulate three more specific sub-research questions. These sub-questions will be used to direct the further empirical investigation of CKA as a pedagogical practice in the current research study.

2.2 The quality of student-produced collective texts

The studies in this review show that there are several different reasons why students in tertiary education produce texts in wikis. Wikibooks vary in both size and content. Some groups of students have created collective learning resources, such as a shared glossary or dictionary (Hughes & Narayan, 2009; Warschauer & Grimes, 2007), while others have produced more comprehensive textbooks (Ravid et al., 2008; Xiao et al., 2007). In the following section, the benefits and limitations of the quality of these student-produced texts are reviewed.

2.2.1 Potential benefits

Some of the studies in the review indicate that the size of the collective text increases when the number of authors increases. In one study conducted by Ravid et al. (2008), 1,200 students in 20 classes from three separate universities improved an outdated college-level textbook that was converted into a wiki. Each student had to improve a small part of the textbook. The size of the book more than doubled when 339 new articles were added to the initial 225 articles. This increase in the amount of text produced was also found in a study by Farzan and Kraut (2013). They compared the Wikipedia contributions from small groups of undergraduate students with individual work done by PhD psychologists. Because the students were motivated by grades, they contributed on average 3.4 times more words than the PhDs. These studies indicate that students can help scale up the size of a learning resource, but it is less certain whether the quality of the text will improve.

However, one benefit is that it is easier to regularly update an online textbook if one can utilize the contributions form a large number of persons. Several researchers highlight that in several academic areas it is a constant challenge to provide students with an updated textbook. The reason is that new knowledge is produced at such a rapid pace (Karasavvidis, 2010a; O'Shea et al., 2011; Ravid et al., 2008; Xiao et al., 2007). For example, in the study conducted by Ravid et al. (2008), students were supposed to develop a new textbook about Information Systems, which is an area where textbooks become outdated rapidly. The textbooks are also very expensive, and publishers may not even want to publish them because the target group is so small. In this incident, there were only two available textbooks, and they were both from the 1990s. However, the author of one of these books decided to convert the outdated book into a wiki format. He then invited the students to improve his book (Ravid et al., 2008). This project appears to have been a success. It is a collective contribution where the teacher creates the foundation through the open publishing of an old textbook and then lets the students continue to improve on this work. What is less clear is whether new classes are still continuing to update this textbook or if this was a "one-time stint."

Other researchers argue that collective work can better utilize the diversity of human expertise. For example, Ravid et al. (2008) highlight that each student can make a contribution within his or her area of expertise. Some students may have in-depth knowledge about a specific subject matter, while others have proficient writing skills. The researchers assume that the huge diversity of student competence can potentially create a synergy, which, over time, leads to the development of better and more varied textbooks. In

general, an increase in the number of authors may potentially bring in more information and more perspectives and provide greater richness to a textbook. For example, it becomes easier to publish textbooks that focus on marginalized perspectives that are often excluded from mainstream publications. Usually, in a printed textbook, a small number of authors will be able to present only a limited number of perspectives (Ravid et al., 2008).

Several researchers also highlight the value of producing free textbooks. These textbooks are available to students with limited financial resources who struggle to afford regular textbooks (Ravid et al., 2008; Xiao et al., 2007). A second advantage is that the textbooks can strengthen an academic discipline. In the study conducted by Ravid et al. (2008), students produced a textbook in Hebrew, which is a far smaller language area than English. The textbook helped strengthen the academic discipline, because there were few updated textbooks about the topic. A third advantage is that the collective text can help popularize scientific knowledge so that it reaches the broader society. Although the students' individual learning outcomes in these kinds of projects may vary, it is here highlighted what others can learn from the students' collective text product. For example, 30% of the page hits in this specific Wikibook project were from users outside of Israel who had not participated in the course (Ravid et al., 2008).

Most of the Wikipedia studies also emphasize the value of students educating the general public. For example, in the study by Farzan and Kraut (2013) students wrote different psychology articles on Wikipedia. The teachers assumed that even though the students were not experts in the field, they acquired relevant and updated subject knowledge through their course work. Students often have better access to academic libraries and online journals than the general public. If the students receive proper guidance from expert faculty members, the researchers assumed that even undergraduate students could produce articles of high quality. Professors could then spend less time educating the general public about scientific issues. Student contributions to Wikipedia should therefore be regarded as part of the general outreach mission that universities have (Farzan & Kraut, 2013). Several of these examples show that the quality of the collective text depends on collaboration between the teachers and the students.

The studies in the review give no clear answer as to whether the student-produced collective text is better than an individual text written by an expert. There are only a few studies that attempt to measure the quality of the student-produced collective text in a systematic way. In the Wikipedia APS initiative, text contributions from undergraduate students had the same survival rate on Wikipedia as the individual contributions from PhD students. This result indicates that students with limited background knowledge can contribute with high-quality content to Wikipedia (Farzan & Kraut, 2013). Concerning quality in a Wikibook project, Xiao et al. (2007) found that students preferred the Wikibook instead of a traditional textbook. A total of 78% rated the Wikibook as better than other textbooks in the course, while 22% rated it as worse. However, the student preferences were not only based on the Wikibook's quality or credibility but also on the fact that the students themselves were the authors. The students had an influence on what was being learned, and they found it more useful to write and read short, 1,000-word articles rather than lengthy chapters in a traditional textbook (Xiao et al., 2007). These studies suggest that student-produced

collective work can be of value, but it will perhaps be something different from the expert-produced textbooks.

2.2.2 Limitations in quality

On the negative side, several of the Wikibook studies also show that undergraduate students are concerned about the quality of the texts (Karasavvidis, 2010a; O'Shea et al., 2011; Xiao et al., 2007). For example, Xiao et al. (2007) found that several students were unsure about the academic quality of the textbook, because it was not written by experts. They worried that their lack of background knowledge would have a negative impact on the quality of the textbook. Although most students were satisfied with the quality of the content, several of them felt that the quality did not equal that of a traditional textbook. The quality was noticeably lower in some of the articles, and the students complained that some of their peers did not put enough energy into the work (Xiao et al., 2007).

Karasavvidis (2010a) has similar findings. In a course in educational technology, the students in class had to create their own wiki textbook. Because of the lack of updated textbooks on topics like Internet services and social networks, the teacher wanted the student-produced textbook to be the definitive course reader for the final exam. However, the students were very concerned about possible errors or inaccuracies in the books that might influence their grades negatively. Students expected to read authoritative texts written by leading scholars, and they did not want to use the student-authored book as a source of information before the final exam. Some students admitted that they were not sure about the quality of their own work, because they had little knowledge about the textbook topics. They therefore assumed that it was likely that they had produced incorrect information in the book. The majority of students strongly insisted that the exam questions should not be derived from the whole Wikibook the class had made together. Instead, they preferred an individualized assessment system based on their own work (Karasavvidis, 2010a).

In addition, a few studies in the review report that students used copy-and-paste strategies when they did the wiki work (Dohn, 2009; Karasavvidis, 2010a). Karasavvidis (2010a) finds that several students adopted this strategy, which resulted in plagiarism and reduced the overall quality of the textbook. Some of these contributions were incoherent and incomprehensible. There were also problems with plagiarism in one of the Wikipedia studies. In the Wikipedia Public Policy Initiative, a few students got significant parts of their work deleted. Some of the students were very worried, because they were accused of plagiarism, and they had to collaborate with both online ambassadors and Wikipedians to improve their work. Most of the students in the Wikipedia project rewrote the text and improved their citations (Roth et al., 2013).

However, as mentioned by Dohn (2009), there is no easy answer concerning the issue of copying text. In her study, she noted that one student had published text that had been copied from others but that this text had a Creative Commons license. Since the goal was to produce an open learning resource, this act was legal and illustrated a new way of reusing existing information. However, in relation to the legal regulations in the assessment system, this was an act of cheating.

Another challenge is that several of the Wikibook studies show a lack of synthesizing efforts in the collective text-production process. First, Kessler and Bikowski (2010) found that students seldom attempted to synthesize the collective text in Wikibooks. They added new information (25 times), deleted information (25 times), and clarified/elaborated on information (23 times) quite often. However, they performed a synthesis only six times, and only four new hyperlinks were created. These synthesizing efforts occurred primarily during the first phase of the project when the students deleted and rebuilt the wiki. Most of the other wiki work was related to the clarification of information. The lack of synthesizing also resulted in the final wiki's failure to achieve a cohesive text product. Likewise, Hadjerrouit (2014) found that the student groups revised each other's work substantially only a few times. Most of the time they added new text, or they formatted the existing text (Hadjerrouit, 2014). Second, Kessler and Bikowski (2010) found that many of the ideas given during the first phase survived and ended up as part of the final version. This is similar to the "first-mover" advantage, which shows that the initial text of a wiki page tends to survive longer and tends to be modified less than later contributions to the same page (Viégas, Wattenberg, & Dave, 2004). The researchers suggest that advanced collaboration requires the strong involvement of the teacher. In addition, students need to have access to an online environment where they can easily discuss different questions. This was not possible to do in the wiki environment (Kessler & Bikowski, 2010).

Furthermore, some of the studies indicate that the wiki projects are not adapted well enough to students' interests. For example, Zheng et al. (2015) suggest that the topic in the assignment needs to be better aligned with students' interests. They found that the students struggled to write about personal learning environments as a topic, because they had little prior knowledge of this topic. The concept was difficult to grasp, and there were few available sources. This made the work more difficult (Zheng et al., 2015). Another challenge is that the students must adapt to a new writing genre in some wiki environments. For example, in the APS project students struggled with their writing of Wikipedia articles, because they could not state their own opinion or discuss the topic (Farzan & Kraut, 2013).

2.2.3 Summary

Although few of the studies in the review explicitly examine the quality of the collective text, a summary of the relevant studies gives some indication of the potential benefits. These are summarized in the table below.

Table 2.2.a An overview of the findings in the review that examine the benefits of the quality of student-produced collective text.

Benefits	**Findings in the review**
1. Groups of students produce more text than individual experts.	Some indication (Farzan & Kraut, 2013; Ravid et al., 2008)
2. Students can update learning resources.	Moderate confirmation (Karasavvidis, 2010a; O'Shea et al., 2011; Ravid et al., 2008; Xiao et al., 2007)

3. It is important that students produce free learning resources.	Some indication (Ravid et al., 2008; Xiao et al., 2007)
4. Students can bring in a stronger diversity of expertise.	Some indication (Ravid et al., 2008)
5. Students can popularize scientific knowledge.	Moderate confirmation (Farzan & Kraut, 2013; Ravid et al., 2008; Xiao et al., 2007)

First, there is some indication that groups of students can produce more text than individual experts. By scaling up the number of student contributors, it is possible to produce richer and newer content than one expert author could have done. *Second*, there is also moderate confirmation that a large number of students can more easily keep an online textbook updated. However, we know little about what happens with the collective texts after the projects have finished. *Third*, there is some indication that free textbooks have a strong outreach potential, but there is still no guarantee that the book will be used.

Fourth, there is some indication that by increasing the number of student contributors one can utilize a diversity and richness of perspectives. This requires that the assignments be adjusted to student interests. Another challenge is that updated textbooks require the continuous contributions from new students every year. Although there is a clear indication that student contributions can be used to increase the size of a textbook (e.g., 1,200 students involved), it is not clear if this helps provide the reader with a better overview or a more readable introduction to different topics. However, a large student group can be used to cover new or marginalized areas where few or no textbooks have been produced before. In some academic areas open textbooks will be the only solution, because a traditional publisher will likely not print the book because the target group is too small. These open textbooks can potentially improve accessibility to human knowledge.

Fifth, there is moderate confirmation that students can popularize scientific knowledge. Wikipedia studies show that students can produce articles that are relevant for the broader public. It is not necessary to be an expert in the field. There is also one example of students producing shorter articles in Wikibooks, which function more as summaries of the expert-written textbooks. One study indicates that students experience this as positive, with the production of many short articles that give an overview of different academic topics. However, students are unsure about the quality in some of the articles. Very few of these studies have tried to measure the actual value or quality of these student-written textbooks. It is therefore very much still unclear if student work in wikis can improve the quality of textbooks. Some of the studies indicate that the quality depends on collaboration between the students and teachers or between students and external reviewers (Wikipedians). It is more likely that students can popularize knowledge in an efficient way with proper guidance from qualified teachers

On a more negative side, there are some studies showing that the quality of the student-authored collective work is limited. These are summarized in the following table.

Table 2.2.b An overview of the findings in the review that examine the limitations in the quality of student-produced collective text.

Limitations	**Findings in the review**
1. Lack of background knowledge among students has a negative influence on the quality of the text.	Strong confirmation (Zheng et al., 2015) (Farzan & Kraut, 2013; Karasavvidis, 2010a; O'Shea et al., 2011; Xiao et al., 2007)
2. Accusations of plagiarism	Moderate confirmation (Dohn, 2009; Karasavvidis, 2010a; Roth et al., 2013)
3. Lack of synthesizing work	Some indication (Hadjerrouit, 2014; Kessler & Bikowski, 2010)

Overall, there are too few studies in the review to draw any strong conclusions, but some of the key points will still be summarized. *First*, several studies strongly confirm that the students lack of background knowledge has a negative influence on the quality of the text. The wiki projects can be adjusted well enough to student interests and areas where they already have knowledge. However, although the Wikipedia studies suggest that the quality of the contributions is quite good, many Wikibook studies show that students are concerned about the quality of the textbooks. One reason is that some students do worse work than others, and this work is also included in the collective text. Publications on Wikipedia will usually go through some kind of external review process by outsiders independent of what happens in the course. On Wikibooks, the peer review process will likely need to be organized by the teacher on Wikibooks.

Second, there is a moderate confirmation that students get in trouble on issues related to plagiarism. Some students use copy-and-paste strategies only, and they lack knowledge on how to cite resources in the correct way. This is also evident in the Wikipedia studies where there are outsiders who review the student work. One study shows that Wikipedians have simply deleted text because of the poor work that has been done regarding this issue. There is no guarantee that student-produced collective texts will automatically end up being better.

Third, some studies show that the synthesizing work is lacking. Students do not critically review each other's work if this is not organized by the teacher. As a result, some articles end up as compilations of individual contributions. This problem appears to be larger in Wikibooks, where there are a lack peer review processes if they are not organized as a part of the course.

2.3 Individual learning

2.3.1 Effect on exam results

There are only a few studies examining whether students' collective work in global wiki environments like Wikibooks or Wikipedia have a positive effect on final exam grades. In one study by Kidd et al. (2009) students in an Educational Foundations course wrote their own textbook using Wikibooks. This study examined the effectiveness of the text-production process by examining academic outcomes over two semesters. Students who used a traditional textbook were compared with those who wrote their own Wikibook in the course. The findings show that the students who used the student-written Wikibook scored as well as the students who read a traditional textbook on a core competency examination. However, these results cannot be interpreted as a direct measure of the quality of the textbook, but the researchers raise the question as to whether students can expand our traditional conceptions of experts being the best textbook authors. In another Wikibook study, by Ravid et al. (2008), a positive effect related to the final exam grades appeared in two of four classes with students. This suggests that the conditions in the whole learning environment are more important. In general, there were also only a few students who did most of the work. While 450 students did the collective wiki work within a timespan of less than one day, there were only 18 students who were active more than one semester.

2.3.2 The sharing of the workload

Many of the Wikibook studies also show that it is common that only a few students do most of the work. Even when general participation is relatively high, it is often dominated by a small proportion of contributors (Carr, Morrison, Cox, & Deacon, 2007; Ertmer et al., 2011; Ravid et al., 2008). Even when it is mandatory that all students make contributions, there are significant differences in the size of the contributions (Kessler & Bikowski, 2010; Kim, 2015; Zheng et al., 2015). For example, Kessler and Bikowski (2010) found that during a course 55% of the students made only one contribution each. This accounted for 1% of the total work in the wiki. On the other hand, a small group of students contributed many times. They claimed ownership of the wiki and engaged in more collaboration. The rest of the students simply fulfilled the course requirements (Kessler & Bikowski, 2010). In another study, Kim (2015) found that one exceptionally motivated student had performed over two-thirds of the peer editing in a group that had received no instructional assistance. However, in another group that had received more instruction and wiki training, the contributions between the students were distributed more evenly. This indicates that teacher guidance may be important if students have little knowledge of wikis (Kim, 2015). Another reason is that most students do the work right before the final deadline. Because the wiki is an asynchronous tool, it can be used most effectively if the students distribute their workload throughout the entire course (Carr et al., 2007).

In addition some studies show that free riding and social loafing is a problem (Arnold et al., 2012; Kessler & Bikowski, 2010; Wheeler et al., 2008). One exception is a study by Arnold et al. (2012), who found this problem to be non-existent, because students were organized to collaborate in dyads. These researchers suggest that distant and anonymous relations make free riding more tempting.

2.3.3 Individual wiki skills

Several studies show that a significant number of students found it difficult to use the wiki and would have preferred more technical support (Choy & Ng, 2007; O'Shea et al., 2011) (Hadjerrouit, 2014; Roth et al., 2013; Zheng et al., 2015). For example, in a study by Zheng et al. (2015), fewer than half the students felt that the wiki was easy to use, while the other half found it difficult. It was most common to ask other peers for help. Likewise, Hadjerrouit (2014) found that several students in an educational technology course were not comfortable with using wikis. Although they knew some of the functionality, they needed more time to become familiar with the technology. More initial technical training would have been helpful. Even students with an IT background reported that they would have liked some initial wiki training (Choy & Ng, 2007; Melissa Cole, 2009). However, a possible disadvantage is that extra wiki training would steal time from other learning activities (Farzan & Kraut, 2013).

In several studies, students have also complained about the interface not being user-friendly enough (e.g., Mediawiki) (Hadjerrouit, 2014; O'Shea et al., 2011). In the Wikipedia Public Policy Initiative, students felt that the citation interface was very time-consuming compared with using a word editor (Roth et al., 2013). Similarly, Hughes and Narayan (2009) found that students using wikis with WYSIWYG editors experience fewer technical difficulties, because the mark-up language is not necessary for formatting (Zheng et al., 2015). Some wikis, like the PBwiki, also have a more user-friendly interface (Zorko, 2009).

Furthermore, Hadjerrouit (2014) suggests that the wiki needs to be used together with other Web 2.0 technologies. The discussion page in the wiki is not sufficient for promoting reflections on collaborative writing. For example, Zheng et al. (2015) found that students frequently used other technologies that could better support both online and offline communication. Skype, Google Talk, email, and Facebook were used to plan and discuss the wiki work. However, there was little online communication across the smaller student groups, because the students still preferred face-to-face communication (Zheng et al., 2015).

2.3.4 Autonomous learning

On a more positive side, some wiki studies highlight the notion that students can potentially become more active and autonomous learners. Some studies underscore the acquisition of individual language skills through autonomous learning (Kessler, 2009; Kessler & Bikowski, 2010). Other studies emphasize that the wiki can strengthen critical and analytical thinking skills, metacognitive skills, authentic learning, information literacy, and the abilities to value multiple perspectives and synthesize different types of information (O'Shea et al., 2011; Xiao et al., 2007). For example, Xiao et al. (2007) report that all students were very active because they were creating their own content. One student said: "Reading, rating, and editing my classmates' articles made me evaluate and think critically about every article I read. I would never have been able to do this without the Wikibook article project" (Xiao et al., 2007, p. 17). This wiki project stimulated the students' critical thinking skills. In a survey, more than half the students agreed that higher-level learning skills had improved more through the Wikibooks project compared with using a traditional textbook. Several students emphasized the importance of letting several students write about the same topic. Another student

noted, "It advanced my learning potential, because I had to read several people's papers on one topic, and this expanded my knowledge and broadened my point of view" (Xiao et al., 2007, p. 17). Reading different articles about the same topic is perceived as valuable, because it brings in new perspectives to the work. Lund and Smørdal (2006) also found that students enjoyed the wiki work, because they could so easily compare and share information. Some students highlighted the value of giving and receiving help, which strengthened the team spirit, while others enjoyed the qualities of an aggregated collective work that included many different perspectives.

2.3.5 Audience motivation

Furthermore, several studies show that students become more engaged when they feel that their work is part of a wider online community. For example, Xiao et al. (2007) report that student interviewees frequently responded that the Wikibooks process motivated them to work harder than in other classes. Since many people read their work, they wanted it to be of good quality. Some students also noted that they learned more when they wrote about the topic instead of just memorizing or reading about it. In Wikipedia, Roth et al. (2013) finds that contributing to a potentially huge global audience was the students' prime motivation after grades. Many highlight the pleasure of knowing that others outside the class could benefit from their work. In another Wikipedia study, by Farzan and Kraut (2013), the high degree of visibility strengthened the students' engagement in the task. Students reported that they really wanted to do good work when they knew that many people would read and use their work. A substantial amount of qualitative evidence in the study shows that students put more effort into the Wikipedia assignment compared with a traditional academic paper. In addition, the students strengthened their critical thinking skills by engaging with others in the global wiki environment. Similarly, Kim (2015) found that the students who produced a Wikibook worked more thoroughly, because they were aware that many people around the world could read their chapters and acknowledge them as authors: ''This [Wikibook] is an official Internet website. So, everybody can see what my project is, and that made me focus on grammar and the contents'' (Participant K) (Kim, 2015, p. 25). At the same time, the visibility of the collective work also created fear and stress among some of the students (Roth et al., 2013).

2.3.6 Socially responsible students

In some studies, the wiki work is more directed toward making connections with the global wiki environment and not only with other students in the course. These contributions intend to empower students and stimulate them to become more active societal contributors (e.g., Roth et al., 2013). Some of the studies indicate that students experience a much stronger sense of pride related to this work compared with doing an ordinary assignment (Baltzersen, 2010; Roth et al., 2013). The students highlight the strong sense of accomplishment and the feeling of having made a contribution to an important community. Many students enjoyed the idea that their work could also be useful for others (Roth et al., 2013). One student

commented, “I really like the fact that the work done for this class won’t just get thrown away at the end like most homework” (Roth et al., 2013, para. 28).[6]

According to Ravid, Kalman, and Rafaeli (2008), it is important to empower students. Open, free textbooks are part of the new culture of user-generated mass-collaboration. These textbooks can potentially disrupt the traditional power structures in relation to the production of curricular material. Any student or teacher can in principle become a textbook author. They can decide what content to include and what language to use. The student project designed by Ravid et al. (2008) aimed to make the students realize that they could make contributions to human knowledge even though they are not experts. Several other studies also show that students develop a more positive attitude toward contributing in global wiki environments (Baltzersen, 2010; Roth et al., 2013).

Another example is the survey of students’ attitudes, conducted by Roth et al. (2013), in the Wikipedia Public Policy Initiative. Students reported that they are motivated by, in order from strongest to weakest: a contribution toward a useful public resource, an interest in learning a new technology, the opportunity to share work with a global audience, an interest in the creation of knowledge, and collaboration with an online community. Both this survey and additional qualitative data from instructors and students show that student research and writing skills improved in the same way as with a traditional research paper. In addition the students were more engaged in the work, because friends and family members could look at their work, and it could be useful for others. They enjoyed the fact that their work was accessible to a wider audience. For example, one student stated:

> This project was awesome. I feel like we have all made a tangible, solid contribution to human knowledge as opposed to just our own knowledge. When you Google [the subject], my page is the first result. If that’s not a sign of a semester well-spent, I don’t know what is (Roth et al., 2013, para. 32).

This student was very happy about his accomplishments and contributions to human knowledge. Several other students also showed strong positive feelings and emphasize the value of sharing their work with others outside the class in a meaningful way.

Nevertheless, few students have contributed to global wiki environments after their projects ended. As many as 85% of the students who participated in the Wikipedia Public Policy Initiative claimed that they wanted to continue to make contributions after the course. However, the teachers observed close to zero new contributions to Wikipedia from the student usernames over a period of a half year afterwards (Roth et al., 2013). This concurs with the study by Lampe et al. (2012) who found that only 25 of 615 students edited Wikipedia after their project was over. This finding suggests that few students significantly change their online behavior after they have participated in this kind of project. Some students also feel that the personal value of the text is still the most important aspect. One student states: “Most people don’t read about the subject I wrote about, and it doesn’t matter how many people read it. But what matters is that the material is really important to me. This was more important than having a global audience” (Roth et al., 2013, para. 29).

[6] N.B. All quotations from Roth et al. (2013) do not refer to page numbers because there are no page numbers in the online article. The quotation will instead refer to a paragraph number (para.).

2.3.7 Summary

The review shows that the wiki studies emphasize different aspects of individual learning. The table below summarizes the findings.

Table 2.3.a An overview of how student-authored wiki projects influence different aspects of learning.

Aspect of individual learning	**Findings in the review**
1. Effect on individual exam grades (learning outcome)	Some indication of small positive effect (Kidd, O'Shea, et al., 2009; Ravid et al., 2008)
2. The sharing of the workload: - Most students in class do little work (lack of individual learning) - The presence of "free riders" (lack of individual learning)	 - Strong confirmation (Carr et al., 2007; Ertmer et al., 2011; Kessler & Bikowski, 2010; Kim, 2015; Ravid et al., 2008; Zheng et al., 2015) - Moderate confirmation (Arnold et al., 2012; Kessler & Bikowski, 2010; Wheeler et al., 2008)
3. Lack of individual wiki skills	Strong confirmation (Choy & Ng, 2007; O'Shea et al., 2011) (Melissa Cole, 2009; Hadjerrouit, 2014; Roth et al., 2013; Zheng et al., 2015) (Farzan & Kraut, 2013)
4. More active and autonomous learning (different types)	Moderate confirmation (Kessler, 2009; Kessler & Bikowski, 2010; Lund & Smørdal, 2006; O'Shea et al., 2011; Xiao et al., 2007)
5. Stronger audience motivation	Moderate confirmation (Farzan & Kraut, 2013; Roth et al., 2013; Xiao et al., 2007) (Kim, 2015)
6. Socially responsible students	Moderate confirmation (Baltzersen, 2010; Lampe et al., 2012; Ravid et al., 2008; Roth et al., 2013)

There are too few studies to draw any obvious conclusion about the effects on exam results. Some of the studies indicate that there is no negative effect. However, the review strongly confirms that most students do little work in wiki projects. Only a few students make substantial contributions. When many students do little work, the individual learning will inevitably be low. There is also moderate confirmation that the presence of "free riders" is a problem. However, this appears to be related to the size of the group, since one study shows that this is not a problem when students are assigned to work in dyads. Furthermore, the review strongly confirms that the students struggle because of a lack technical wiki skills. This will limits the degree of contributions and has a negative influence on the wiki project.

On the more positive side, several of the studies in the review suggest that the students acquire advanced individual skills. Students who actively participated in the wiki projects became more autonomous learners. Writing to learn is considered to be better than just reading about a topic. In addition, the students can strengthen their critical skills and will learn something by reading their peers' work. However, it is unclear to what degree this

actually happened in the studies. The downside is that since many studies also show that students do little work, this will obviously inhibit the degree of individual learning.

One advantage with the transparency of the wiki environments is that it increases student motivation. There is moderate confirmation that students become more motivated when they are publishing work that a larger audience can access. Particularly students who have made contributions in Wikipedia experience strong audience motivation. The downside is that there is some indication that this can also increase the students' anxiety.

Furthermore, the studies in the review moderately confirm that wiki work strengthens students' identification with being a cosmopolitan citizen. The students report that they not only feel that their work is related to getting a grade but that it is about making a contribution to the global knowledge society. This pride related to sharing their own work with others is stronger when contributions are made in Wikipedia compared with Wikibooks. Although the studies indicate some level of improved attitude, it is unclear to what degree students actually continue to make contributions after the course is over. The few studies that have examined this issue indicate that this usually does not happen.

2.4 Peer editing

A fundamental idea behind wiki work is that it relies on collective authorship rather than individual authorship. Several studies in the review also show that the collective work is done through the direct editing of the same wiki text. The following section will describe different types of peer editing and review the potential benefits and limitations.

2.4.1 Peer editing between students in the same class

In several studies, students found it difficult to edit each other's text. In most of these studies they prefer to concentrate their efforts on their own individual work. They avoid changing or editing others' work, because they feel this to be inappropriate (Dohn, 2009; Elgort, Smith, & Toland, 2008; Karasavvidis, 2010a; Kim, 2015; Lin & Kelsey, 2009a; Lund & Smørdal, 2006; Naismith et al., 2011). For example, in one study by Karasavvidis (2010a), students reported that they worry about possible negative reactions from their peers. In another study by Kim (2015), students tended to avoid peer editing if it was a voluntary activity. All students who were interviewed felt uncomfortable with peer editing, because they were afraid they could hurt somebody's feelings. In a reflection paper one student wrote ''I found myself feeling very uncomfortable and invasive editing my classmates' work, which may be due to the fact that the authors and I know each other. To me, these authors 'owned' the ideas presented in their assigned entry space'' (Kim, 2015, p. 25). Note that the student feels that it actually is a "problem" that the students know each other, because this makes it more emotionally difficult to edit others' work. The student knows who has done the work, but they are not close enough that they feel comfortable criticizing each other. Dohn (2009) even found that students who were required to do peer editing made "bargains" with each other. The first author of an entry would deliberately make mistakes or leave something out so that it would be easier for others to correct the first version. This also relieved the discomfort many students experienced when they had to revise other students' work in class. One of the concerns was that correct content would be removed. Other studies that have analyzed the wiki text also point in the same direction. For example, in one study by Zheng et al. (2015), 53% of the students reported that they read other students' wiki pages, but only 3% had actually edited their texts.

Furthermore, students in several studies reported that they do not like it when their own text is edited by others (Bonk et al., 2009a; Lund & Smørdal, 2006; Roth et al., 2013; Zorko, 2009). In a study by Lund and Smørdal (2006), most students were concerned about inexpert editing. This worry was also related to the loss of control over one's own contributions. To a large degree, the practice of individual ownership continued (Lund & Smørdal, 2006). Another reason why students feel that peer editing as difficult is because they often publish work they consider to be finished. For example, in a wiki study by Zorko (2009), most groups published finished text versions. One group reported that they explicitly disliked publishing unfinished work. They wanted their work to be perfect. Arnold et al. (2012) suggest that it is important that teachers create a space for discussions between students where they can exchange ideas and plan major revisions before executing them. This reduces the risk of offending a group member.

2.4.2 Peer editing outside of class

Some studies also show that students engage less in peer editing in an online setting compared with an offline setting (Karasavvidis, 2010a; Zheng et al., 2015). In an international student project across four institutions, Zheng et al. (2015) found that the students preferred to collaborate with peers from the same institution. One reason is lack of being acquainted. For example, one student stated: "I didn't even know who [the international students] were. I just looked at their wiki page. I didn't dare to edit it at all" (Zheng et al., 2015, p. 366). The instructional design was therefore modified so that the students had to create content together across institutions. Groups were divided based on their interests, and this seemed to increase their motivation (Zheng et al., 2015).

2.4.3 Meaning-related revisions

Several studies also show that students do few meaning-related revisions in their peer editing (Arnold et al., 2012; Kim, 2015; Lund & Smørdal, 2006; Wang, 2014). Arnold et al. (2012) found that students primarily made meaning-related revisions on their own text (72% in their own text, 28% in others' text). Formal revisions were more balanced between the author's own text (51%) and another student's text (49%). Likewise, Kim (2015) found that the amount of students' peer editing activity gives no guarantee of the quality. Students primarily corrected grammatical errors in other peers' work. Kessler (2009) also found that students make more form-focused revisions than content revisions in language learning. Similarly, Lund and Smørdal (2006) found that most students were reluctant to change others' work. This was done more on a language level than a content level. This coincides with a Wikibook study by Wang (2014). Here, students had to present their work to the class every week. A group of three to five students presented their Wikibook chapter about a linguistic topic in a 20-minute peer teaching session. Then the rest of the class gave constructive comments. However, this peer feedback was only partially beneficial, because few of the comments focused on the content. Instead, they emphasized spelling mistakes and formatting issues related to the pictures, the links, the tables, etc. (Wang, 2014).

Peer editing is also related to the length of the project's time period. In a study by Lund and Smørdal (2006), the project was extended from two weeks to a whole term, because several learners reported that they needed more time to improve other classmates' work. The design now aimed to produce added value beyond the sum of its individual contributions, which cannot be reduced to its separate parts. More contributions were now given outside of the lesson time, and the end product was more cohesive, but the learners still gave each other few critical comments. The authors recommend that future wiki studies should focus on instructional designs where tasks and assignments are irreducible to individual problem solving.

2.4.4 Collaborative skills

Moreover, several researchers have found that the students lacked collaborative skills in the wiki work (Arnold et al., 2012; Hadjerrouit, 2014; Karasavvidis, 2010a; Zheng et al., 2015). This may be one reason why the students struggled with peer editing. For example,

Karasavvidis (2010a) suggests that initial training should not only focus on the technology but also on core activities like collaborative writing, editing, and discussing. One important reason is that most students resist editing other's work even though they know how to use the wiki. They lack the necessary collaborative skills. Small-scale writing workshops could address issues related to collaborative writing and peer feedback. It might then be easier for students to accept the basic idea behind collective text-production processes (Karasavvidis, 2010a). Arnold et al. (2012) suggest that students should, in advance, discuss issues such as whether it is acceptable to delete others' work or add new content to each other's work. Lin and Kelsey (2009b) found that students did not begin to write together before they had completed several exercises that made them familiar with the wiki tool and where they could agree on their author roles. Zheng et al. (2015) also found that students lack skills related to collaborative writing, active listening, constructive feedback, and task management. To strengthen these skills, a small ice-breaker activity was designed where students had to continue to write on each other's notes. The instructor also provided explicit guidelines on how to cite references in addition to providing examples of previous student work. This strengthened the students' confidence and motivation (Zheng et al., 2015). Another reason why it is important to provide training on collaborative skills is because students are usually mainly occupied with getting as good of grades as possible (Arnold et al., 2012; Karasavvidis, 2010a). Karasavvidis (2010a) suggests that this training should span more than one semester.

2.4.5 Time-extended peer editing

It is worth noting that several studies show that students find it much easier to edit and revise work done before the course period. For example, in one study, all the 800 first-year student teachers were required to reflect upon different topics related to the professional standards established by the provincial College of Teachers. Rather than doing this individually, the classes (with up to 36 students) were divided into groups that focused on one or two of these topics. Students had to discuss these topics and publish their texts in a wiki environment that all the students had access to. Later in the term, the groups worked with another standard. Then they had to build upon and revise text that had already been published by another group of students (Vratulis & Dobson, 2008).

In another study, by Baltzersen (2010), the students did not edit the work of their peers in the same class but were instead assigned to improve the work that anonymous students had done the previous year. This required that they compare and contrast new information with the existing wiki content to improve the textbook. Most students enjoyed this time-extended peer editing and did not experience it as emotionally difficult. In addition, the students emphasized that they did not finish the work but rather had made significant improvements. In this way, the value of developing a collective text over an extended time period is acknowledged.

In the Wikipedia projects, the idea of ownership over one's work is challenged in an even more fundamental way. One student in the Wikipedia Public Policy Initiative says: "It's funny that you said 'our articles' ... because once we put them up, they're not really ours; they're like the whole Wikipedia community's" (Roth et al., 2013, para. 44). This student feels that the individual ownership of the text is lost. Another student talks about giving up control:

"Roughly 90% of Berkeley participants have said they feel the ownership of their work is at stake, and this is why they are going to monitor their published work on Wikipedia" (Roth et al., 2013, para. 44). These statements indicate that in the Wikipedia environment, students must, to a greater degree, accept that they cannot "own" the text in the same way as usual. Although they find this difficult, they have to adjust to the community norms, which here are very different from those of formal education, which is built around individual ownership and the individual grading of students. Interestingly, there are also examples of students who embrace these new writing norms: "It's almost a fun experiment to see how the world reacts to something you create and what parts get edited and what don't" (Roth et al., 2013, para. 30). This student is looking forward to receiving feedback and seeing how the text continues to evolve. These statements indicate that a minority of students support the idea that their work can be changed.

2.4.6 Summary

The review shows that the wiki studies emphasize different types of peer editing. The table below summarizes the findings.

Table 2.4.a An overview of how students experience different types of peer editing in wikis.

Types of peer editing	**Findings from the review**
1. Peer editing between students in the same class: - Difficult to edit others' work in class - Students do not like it when their own text is edited by others.	 - Strong confirmation (Elgort et al., 2008; Lin & Kelsey, 2009a; Lund & Smørdal, 2006; Naismith et al., 2011; Zheng et al., 2015) (Karasavvidis, 2010a) (Kim, 2015) (Dohn, 2009) - Moderate confirmation (Bonk et al., 2009a; Lund & Smørdal, 2006; Zorko, 2009)
2. The peer editing of others work outside of class is difficult.	Some indication (Arnold et al., 2012; Karasavvidis, 2010a; Zheng et al., 2015)
3. Students make few meaning-related revisions.	Strong confirmation (Arnold et al., 2012; Kessler, 2009; Kim, 2015; Lund & Smørdal, 2006; Wang, 2014)
4. Students lack collaborative skills	Strong confirmation (Hadjerrouit, 2014) (Karasavvidis, 2010a) Arnold et al. (2012) Lin and Kelsey (2009b) (Zheng et al., 2015) (slå sammen referansene så de blir satt opp på samme måte I tabeellen).
5. Time-extended peer editing is easier and more acceptable.	Some indication (Vratulis & Dobson, 2008) Baltzersen (2010; Roth et al., 2013)

First, the studies in the review strongly confirm that peer editing between students in the same class is experienced as difficult. The students struggle when they have to edit the same collective text in the class in an offline setting. They find it very hard to edit and improve on each other's work, because it is considered inappropriate. One reason is that the students

know each other to some degree, but the relationship is still not close enough to overcome this awkwardness. Likewise, the students state that they do not like it when their own text is edited by others. Most students prefer to have control over their own work. *Second*, there is some indication that students find it difficult to peer edit others' work outside of class. One reason is that the wiki does not stimulate online peer discussions of texts. *Third*, the studies strongly confirm that students primarily edit minor issues on others' work and that there are few meaning-related revisions related to the content itself. *Fourth*, it is strongly confirmed that students lack collaborative skills. They need more explicit training in how to peer edit each other's texts. *Fifth*, there is some indication that time-extended peer editing is much easier to do. Some students are curious about what will happen with their work when someone else changes it. Students show less resistance toward this kind of collaborative work, because they do not have to be in direct interaction with the previous authors of the work. Some students also enjoy the thrill of knowing that someone else might continue to build on their work in the future.

2.5 Feedback-driven processes

Several studies in the review show that students' wiki work is integrated with different types of feedback processes. This includes feedback from peers and teachers in the offline setting but also from outsiders in an online setting. In the following section, the different types of feedback-driven processes will be described in more detail.

2.5.1 Formal peer feedback

Some of the wiki studies highlight the use of formal peer feedback. These feedback-driven processes are used to support the production of a wiki resource that becomes both an integrated part of the course material (syllabus) and the final summative assessment. In one example, more than 200 preservice teachers produced a Wikibook about the Social and Cultural Foundations of Education in a course on teacher education. Each student could select a topic of interest, but a maximum of three students could write about the same topic. Students were required to write a 1,000-word article, but they also had to read and rate other student contributions. A simple three-point rating system (good, average, and poor) was used, and the most highly rated articles were eventually included in the final textbook, which was organized into 15 chapters (O'Shea et al., 2011; Xiao et al., 2007). In the final course assessment, the students were equally accountable for their own student-authored textbook as for the lecture content. The production of the Wikibook articles also comprised 30% of the course grade for each student. In addition, there were seven online quizzes, one midterm, and a final examination in the course. Half the questions on each course assessment came from the student-produced Wikibook, and the other half came from the lecture material. It is likely that the students used the Wikibook more frequently, because it was necessary to obtain a good grade (Xiao et al., 2007). In a follow-up study by O'Shea et al. (2011), the rating scale was redesigned to include four variables (importance, interest, credibility, and writing), which were rated on a five-point scale. In another study, by Wang (2014), student ratings were also used as a part of a summative peer assessment, but the reported disadvantage was that students tended to give higher marks to their peers.

However, few of these wiki studies investigate the influence of peer feedback on the student´s individual learning outcome. One exception is a Wikibook study by Xiao and Lucking (2008), where each student had to write one article (1,000 words) from 66 topics that the teacher had formulated in advance. In addition, the students had to participate in two rounds of peer assessment exercises. While the student article assignment was worth 30% of the total course grade, the peer-feedback assignment counted for five percent. Contrary to the previously mentioned studies, the students here received initial training on how to give feedback on a sample article. This included the use of detailed criteria, quantitative rating scales, and qualitative feedback. Half the students were assigned to provide qualitative feedback on their peers' articles on the Wikibook "discussion page" according to three criteria: (a) at least two points about the strength of the article, (b) at least two suggestions on how to improve the article, and (c) at least 150 words of qualitative feedback. The other half, the comparison group, did not give any qualitative feedback and gave only quantitative peer ratings scored on information relevance, information density, information credibility, and clarity/fluency of writing. After the feedback process, the students revised their articles and submitted the final articles. Students in both groups then

used the rating-only peer assessment method to assess their peers' articles. Each student article then received between 20 and 43 ratings. The peer assessment was anonymous and asynchronous. The results showed that students in the experimental group demonstrated greater improvement in their writing than those in the comparison group. They were also more satisfied with the peer assessment method (Xiao & Lucking, 2008). This finding indicates that qualitative peer feedback is more important than quantitative peer feedback for improving students' individual work.

Moreover, some studies point to challenges concerning instructional design. For example, in a study by Wang (2014), students felt that giving feedback to peers is time-consuming even though the learning value may be high. In this specific course, the students had to write comments to each other every week. The students read the first few chapters more carefully than the later chapters, because the workload increased toward the end of the course (Wang, 2014). Likewise, Kim (2015) found that the lack of time at the end of the semester reduced student motivation to give peer feedback. There have also been technical challenges related to the administration of peer feedback in the wiki. As a consequence, one study by Farzan and Kraut (2013) showed that in one project a new wiki portal was developed to make it easier to support peer reviews administrated by the students and the teachers in the class. This made it possible to specify the number of reviews per student and assign specific reviews to students or let the students organize things on their own. The review form could provide both a quantitative score and qualitative comments. A survey of the use of the wiki portal shows that about half the students had reviewed their peers' work (73 of 127). This indicates that many teachers prefer to organize peer feedback processes if the wiki offers this feature (Farzan & Kraut, 2013). However, there are too few wiki studies to draw any conclusions on the value of peer feedback. Notice that all the studies discussed focus on organized or formal peer feedback, while none investigate the influence of informal peer feedback processes in the classroom.

2.5.2 Outsider feedback

A few of the Wikipedia studies show that students receive academic feedback from outsiders in the online setting. Roth et al. (2013) found that some of the students really enjoyed receiving recognition from others outside the classroom. It is viewed as motivating to get feedback from others who are interested in the same topic. In general, the students who received feedback put more effort into the work and developed a stronger connection with the Wikipedia community. The amount of feedback from outsiders was not measured systematically, but one student claimed that most student articles were modified by four or five random people. However, while some students received a lot of feedback from the Wikipedians, several students were also disappointed, because they did not receive any feedback.

The students also had mixed feelings regarding outsider feedback. Some Wikipedians simply revised the content without asking for permission. Some students found this hard to accept, because the feeling of psychological ownership of one's own text was still there. Several students had feelings of possessiveness toward their articles, and they did not like the fact that they lost control over the text (Roth et al., 2013). Some students even experienced confusing revisions and harsh critiques (Roth et al., 2013). Likewise, Farzan and Kraut (2013)

found that in some cases the students became very upset when their work was nominated for deletion. Students experienced this as demotivating, since the Wikipedia editors were not experts in the field. The main problem was usually that the students struggled to adapt to the norms of the encyclopedia as a genre. The typical conflict was about the credibility of different sources. While the students used original research papers as a source, the Wikipedia community instead preferred articles based on reliable secondary sources. However, within some topics, one could use only peer-reviewed journal articles, because it was not possible to find any review articles or textbooks. Some of the comments from the Wikipedians were also superficial and not very constructive. In general, the students reported they received more and better feedback from their teachers than from peers or outsiders (Farzan & Kraut, 2013).

2.5.3 Feedback from the teacher

Several of the studies indicate that the teacher needs to take on a new role, but it is unclear what, exactly, this implies (Lund & Smørdal, 2006; O'Shea et al., 2011). On one hand, there are wiki researchers who highlight the importance of letting students share the responsibility in "teacherless" environments (Arnold et al., 2012; Kessler, 2009). For example, Kessler (2009) reports about a course where the wiki assignment was given by the teacher, but then the students were left to do the rest of the work on their own. The goal was to create a wiki that summarized what the students had learned in class. The teacher did not intervene during the project work in an attempt to let the students be more responsible for their own collective work (Kessler, 2009). In a similar study by Arnold et al. (2012), most students reported that they enjoyed doing wiki work with less teacher intervention compared with regular group work. Lund and Smørdal (2006) found that the teacher had the role of being a more knowledgeable peer. For example, sometimes the teacher would remind the whole class about the tasks by displaying the wiki work on a projector. However, the students were to a large degree left on their own. The teacher also struggled with supporting online activities, because it was technically difficult to get an overview of the work in the wiki. Although some new wiki features were developed during the project, they were used only occasionally.

On the other hand, some studies suggest that the teacher needs to actively support the development of a vibrant community of student learners (Elgort et al., 2008; Kim, 2015; Zorko, 2009). Zorko (2009) highlights the importance of immediate feedback and that the teacher be able to quickly answer students' questions, because the feedback from the teacher encouraged the students to perform better. Kim (2015) claims that teachers need to carefully plan the course design. Too much scaffolding might inhibit students' voluntary participation, while too little support might create too many technical difficulties related to the use of the wiki. A similar challenge is mentioned by Dohn (2009), who posits that students in tertiary education prefer to get answers from the teacher rather than discussing their work with peers. When the teacher responds, the discussion will usually end, because these comments are considered to be "expert knowledge." As a result, teacher involvement usually inhibited openness, student responsibility, and the dynamics of the knowledge production process.

Alternatively, if the students were left to themselves in their work, the teacher would be criticized for not doing his or her job because of the lack of involvement. The students would perhaps not receive accurate feedback, and they would struggle more during the final exams (Dohn, 2009). Likewise, in another study, by Wang (2014), students disliked the fact that the student-produced content was of lower quality than what the teacher could have presented. It is therefore possible to claim that there is a fundamental tension present between letting students share responsibility for the collective work and letting the teacher answer student requests (Dohn, 2009).

Karasavvidis (2010a) suggests that one solution can be to regulate the student work more tightly by providing an explicit set of rules regarding participation, etiquette, and topics and by explicitly discussing these rules with the students. In addition, there have been attempts to develop a complete wiki environment that could better support teachers' work (Farzan & Kraut, 2013; Roth et al., 2013). For example, in one Wikipedia project, several supportive resources were developed, which included teaching assistants, supervision of work, and Wikipedia campus ambassadors (Roth et al., 2013). An interesting aspect of the APS project was that an online portal was designed to make it easier for teachers and students to use Wikipedia in class projects. The portal provided information about relevant Wikipedia articles that needed to be improved. There were also tutorials and other help pages there as well as information about the activities of other members. In addition, teachers could use the portal to automatically track all student activity on Wikipedia. This made it easier for faculty staff to provide feedback to students and get a quantitative summary and overview of their activities. This included the number of edits, time spent editing, and the number of words they added or deleted. The portal also provided a list of pages each student had edited, the number of edits for each page, and the number of words added and deleted for each page. In addition, one could obtain a list of all the students who had worked on the same article and view the additions and deletions that had been made by each individual student (Farzan & Kraut, 2013).

2.5.4 Summary

The review shows that the wiki studies emphasize different aspects of feedback. The table below summarizes the findings.

Table 2.5.a An overview of how students experience types of feedback as a part of the wiki work.

Types of feedback	**Findings from the review**
1. The quality of formal peer feedback	Moderate confirmation that it depends on the quality of the instructional design (O'Shea et al., 2011; Xiao et al., 2007; Xiao & Lucking, 2008)Wang (2014)Kim (2015)
2. The quality of outsider feedback	Some indication that it creates mixed experiences (Farzan & Kraut, 2013; Roth et al., 2013)

3. Feedback from the teacher: - The teacher needs better supportive resources.	- Some indication (Farzan & Kraut, 2013; Karasavvidis, 2010a; Roth et al., 2013)
- The teacher gives a minimal amount of feedback.	- Some indication Kessler (2009) Arnold et al. (2012) (Lund & Smørdal, 2006)
- The teacher needs to actively support the collective work.	- Some indication Elgort et al. (2008) Kim (2015) (Dohn, 2009)

First, the review shows that several studies have investigated peer feedback in relation to wiki work. This usually involves formalized feedback processes that are organized by the teacher as a mandatory part of the course. There are examples of courses where peer feedback is used to improve the quality of the Wikibook and where it is integrated into the assessment system. The feedback can be either qualitative or quantitative, and it can also be done anonymously. However, few of the studies have examined whether the quality of the collective work actually improves. One study indicates that qualitative peer feedback has a positive impact if students receive training in advance. In sum, these studies give moderate confirmation that the quality of the peer feedback is dependent on the instructional design. This includes not only the type of peer assessment but also the degree of training in advance and the level of students' background knowledge.

Second, the quality of the outsider feedback varies. There is some indication that most students enjoy the recognition they get from these outsiders. On the positive side, constructive critique can help the students improve their work. The disadvantage is that there is no guarantee one will actually receive any feedback at all. In addition, the critiques are sometimes too harsh and/or irrelevant. In the Wikipedia environment, the students must also adopt their writing to encyclopedic norms, which are different from the requirements in a scientific paper.

Third, the different studies in the review show that the degree of teacher support and feedback varies. There is some indication that a fair amount of studies are based on instructional designs that leave all decisions to the students. Part of the challenge is that most wiki applications lack features that can provide teachers with an overview of students' online work. The wiki was not originally built for educational purposes. In addition there is some indication that the teacher should more actively support the students' collective work. However, it is not clear how much the teacher should intervene in the students' work in both the offline and online settings. Some studies show that a strong degree of teacher intervention inhibits student responsibility.

2.6 The fairness of collective work

Several of the studies in the review address different issues regarding the fairness of collective work. The following section presents how the students, in various ways, experienced the collective work as unfair.

2.6.1 Group grading

The design of the assessment system in a course is an important issue, since most students primarily do what they think is required to get good grades (Melissa Cole, 2009; Ebner, Kickmeier-Rust, & Holzinger, 2008). Some wiki researchers have therefore suggested that group grades can better support collective work (Carr et al., 2007; Hadjerrouit, 2014). The studies in the review show that group grades usually constitute a small percentage of the total grade. In one study, the group grade counted as five percent (Carr et al., 2007), while it counted as 10% (Baltzersen, 2010) of the total grade in another study. However, several studies report that students feel that group grades lead to unfairness and that they interfere with the well-established culture of individual assessment and competition between the students (Carr et al., 2007; Hadjerrouit, 2014; Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014).

Although most students and teachers tutors believe it is insufficient to assess students individually when they do collective work, at the same time students experience it as unfair if their individual effort is not given enough credit (Naismith et al., 2011). Several studies show that students dislike being held accountable for others' work (Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014). Group grades also become problematic when a few contributors do most of the work (Hadjerrouit, 2014). Some address this challenge by letting the individual contribution in the Wikibook count for as much as 60% of the total grade. This was done to reduce the problem of free riders (Karasavvidis, 2010a). Naismith, Lee, and Pilkington (2011) found that most students prefer a combined assessment of both individual and group performance, but there was one group of students who did not like any kind of group grade. Their main concern was how individual contributions would be assessed in the group work. Other studies show that students worry about whether the tracking of the individual contributions in the collective work is accurate enough (Karasavvidis, 2010a; Stafford et al., 2014).

Another challenge was addressed by one student group who worried about anti-plagiarism rules. Each student chose to do their own individual independent task, because the assessment procedures required that students declare that they had done the work on their own (Naismith et al., 2011). Dohn (2009) also found that because individual documentation was required, the students interest in supporting each other in the co-construction of the collective text was inhibited.

2.6.2 Dividing the tasks

Several studies also show that students experience the collaborative learning process as less fair. One major challenge is that students do not feel that the tasks are divided in a fair way.

In one study by Karasavvidis (2010a), there were conflicts between the students, because they could only choose from a limited number of predefined tasks. The teacher had lectured about some of the topics that were relevant for the tasks. As a consequence, the students considered these tasks to be easier, because the information was already available. An analysis of the wiki log file showed that students rushed to make contributions on these topics after each lecture. As one student put it, "this meant that they had 'done their part' and need not do anything else" (Karasavvidis, 2010a: 391). The rest of the class had to work with other topics that were perceived as more difficult, because they required more extensive searching and reading of sources. Likewise, Dohn (2009) observed that some students (either alone or in groups) in her courses "rushed to take" the tasks that were considered to be more popular or attractive. Others were left frustrated, because they had to do what they perceived as the more difficult tasks. Some even feared that they might fail the course because of how the tasks were divided. In one wiki study by Wang (2014), this challenge was solved by letting student groups draw lots to decide what kind of task each member would undertake. This reduced the problem of dividing the tasks according to the principle of "first-come-first-served." One student said: "There's no argument when we use a fair method—the lucky draw" (Wang, 2014). These studies show that complex project work will inevitably make students perceive the tasks as more or less valuable. If the distribution of tasks is perceived as unfair, this will probably create conflicts throughout the project period.

2.6.3 The assessment criteria

Some studies also show that students perceive the assessment criteria to be less clear when they are less standardized. In one case, a group of students gave a well-prepared oral presentation to the class. They assumed that this was "their" wiki topic. They were therefore very dismayed when they discovered that another student had "stolen" their wiki topic and even used their presentation as an inspiration. The group felt that they "had done all the work" and that the other student had just been "free riding" on their efforts. However, Dohn (2009) claims that the student had just followed the ideas behind the new open licenses (e.g., Creative Commons), and reused the material from the oral presentation by transforming it into a wiki page. In another study, by Karasavvidis (2010a), the students did not know the assessment criteria and tacitly assumed that publishing a large amount of text would be an indicator of hard work and result in a better grade. However, this strategy just reduced the overall quality of the textbook. Furthermore, while most of the studies assess student work done from scratch, there are also examples of wiki tasks that build on existing work. For example, in a Wikibook assignment, one student suggested that it was easier to continue the work of an article if the original quality was low:

> It was a totally new experience working with and editing Wikibooks. It was unfamiliar to correct something that others had written ... It was very obvious that those who had written before us had a big "text production" requirement, because there was too much information in the text, but it made our job easier ... It will be exciting to see what happens with our texts in the future. (Baltzersen, 2010, p. 803)

This student suggests that it is easier to improve a text of low quality compared with a text of high quality. If there is a large variation between the texts that the students begin to work

with, this increases the complexity of the assessment work compared with a standardized assessment where everybody starts from scratch.

Dohn (2009) claims that free riding is legitimate within a Web 2.0 environment, because everyone is encouraged to reuse material that others have made. However, within the context of formal education, most students want to get "credit" for their contributions and are reluctant to share "their" knowledge with the class if there are those who may free ride. These students do not want to share if they do not get as much in return as they produce. To solve this problem, Dohn (2009) let all the students in the class make a minimum contribution. However, Dohn still observed that some students were annoyed about the lack of effort by their peers. Furthermore, she states that these attitudes may jeopardize any attempt to implement Web 2.0 practices in education.

2.6.4 Summary

Several of the wiki studies report that students experience the wiki work as unfair. The table below summarizes the findings.

Table 2.6.a An overview of how different issues of unfairness are related to the students' wiki work.

Issues related to experienced unfairness	**Findings in the review**
1. Students think group grades are unfair.	Strong confirmation (Carr et al., 2007; Hadjerrouit, 2014; Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014)
2. Division of tasks can easily become unfair.	Some indication (Dohn, 2009; Karasavvidis, 2010a; Wang, 2014)
3. The assessment criteria become less clear.	Some indication (Karasavvidis, 2010a) (Baltzersen, 2010) (Dohn, 2009)

First, in several studies group grades were implemented in in an attempt to support the wiki work. There is some indication that these grades counted only as a small percentage of the total grade. Nevertheless, several of the studies strongly confirm that students experience the use of group grades as being unfair. One reason is that they are unsure about how their individual contributions will be assessed when it is also a part of group work that receives a group grade. One solution here is to simply give the students individual wiki assignments. However, although this may increase the fairness, it may easily reduce students' collaborative efforts.

Second, the review gives some indication that the division of tasks is perceived as less fair, because the workload between the students is different. Some studies also show that even the division of tasks is viewed as unfair if it is not organized by the teacher (e.g., lucky draw).

Third, some studies also show that students lack knowledge about the assessment criteria relevant for the collective work. Some students are annoyed about the unequal workload in

the collective work. When students do different tasks, it becomes much more important to specify the assessment criteria so that students are sure that they have an equal opportunity to achieve a good grade. Because students have access to digital information, new issues also emerge concerning how students should be allowed to reuse others' work.

2.7 The three sub-research questions

The review shows that tertiary students' course work in global wiki environments can be described within five different problem spaces. Even though the studies build on various instructional designs and course objectives, it has been possible to summarize the studies within a coherent conceptual framework. First, one should note that most of the studies are from a blended learning environment where students interact with both their peers and teachers face-to-face regularly. While most studies direct the majority of the analytical attention toward the student work in this local offline setting, there are also a few studies that analyze student participation in the larger global wiki environments in the online setting. However, these studies do not analyze the interplay between student participation in the local offline setting and the global online setting. Nevertheless, the complete review has aimed to show how the interplay between an offline and an online setting can be related to five different research areas, or "problem spaces." These problem spaces will here be used as an "analytical guide" to guide the formulation of the three more specific sub-research questions in the current study (Yin, 2009).

Table 2.7.a An overview of the connection between the sub-research questions and the five research areas, or "problem spaces," in the review.

Sub-research questions	**Problem spaces**
1. How does the value of student-produced collective work emerge in teacher education?	*Problem space I:* The quality of the collective text (Authentic value of text in an online setting). *Problem space II:* Individual learning (The specific acquirement of new individual skills like citizenship skills, critical skills**,** and digital competence). *Problem space V:* The fairness of the collective work (Grading).
2. How does "students**'** shared responsibility" emerge in teacher education?	*Problem space IV:* Feedback-driven processes (Teacher feedback online and offline). *Problem space V:* The fairness of the collective work (Division of tasks).
3. How does peer learning emerge in teacher education?	*Problem space III:* Peer editing (Formal peer editing, informal peer editing, extended peer editing). *Problem space IV:* Feedback-driven processes (Peer **f**eedback, outsider feedback).

The three sub-research questions in the table above will direct the further empirical investigation in the current research study. Each of the questions builds on research areas located in the review. They address different aspects of student work related to both an offline and an online setting. However, one should be aware that few of the studies from teacher education have analyzed the influence from the context. The sub-questions are therefore less influenced by the unique contextual constraints in the teacher education context. Nevertheless, the importance of the teacher education setting will still be addressed as a part of the empirical analysis. In the following section, the rationale behind the formulation of the three sub-research questions will be explained in further detail.

2.7.1 How does the value of student-produced collective work emerge in teacher education?

The first sub-research question—*How does the value of student-produced collective work emerge in teacher education?*—addresses the knowledge product. The current study will investigate what kind of knowledge students can make together that can be of value in the teacher education context. According to the review, *problem space I* underscored the notion that the potential value of student work needs to be assessed in relation to its specific genre, target group, and context. There are examples of students producing learning resources, textbooks, and encyclopedia articles in the global wiki environment. However, it is unclear if this work is valuable for others. In one study (e.g., Ravid et al., 2008), it is suggested that when the number of student contributors is scaled up, students can produce richer, more varied and updated resources compared with a traditional textbook with one expert author. The weakness here is that the researchers have not done any substantial evaluation of the quality of the collective work. The exception is a Wikipedia study where students were tasked with popularizing assigned to popularize scientific knowledge. It is here suggested that the quality of the contributions from a large number of volunteers is on par with what experts were able to produce (e.g., Farzan & Kraut, 2013). However, several of the Wikibook studies point in a more negative direction, because the students were found to be critical in regard to the quality of their own work. They felt that they did not have enough background knowledge. A few studies also reported about the uncritical use of copy-and-paste strategies. The mixed results indicate that there is a need for more research that investigates the quality of contributions from students as "non-experts."

Further, we do not know whether some ways of organizing the wiki work are more effective than others. The current study will therefore seek to further investigate this issue by letting students create different types of wiki learning resources. This involves the use of both Wikibooks and Wikipedia, which will be used for different purposes. None of the studies in the review have compared students' use of different wiki environments. There have also been few attempts to describe what type of wiki text can be of value to others. The current study will include this dimension in the analysis of the collective text-production process in the teacher education context. This will not only include an assessment of the value after the project work is over but also of its use after the project has ended.

Moreover, *problem space II* shows that the notion of valuable knowledge creation is unavoidably connected to individual learning. There are too few studies to assess whether or

not the quality of the individual learning process or the exam results improves. Nevertheless, many of the studies point to a decrease in the level of individual learning. The most common problem is that a few students do most of the work, while the rest only do some work. This results not only in a reduction of the quality of the collective work but in a situation where many students will not learn much, either. This is a significant challenge, because all educational systems expect that all students acquire a certain minimum of individual learning.

From another perspective, some studies also address which individual skills are required to create something of value (*problem space II*). Most of these studies suggest that the quality is reliant on the acquirement of a range of different skills, such as individual technical skills, team skills, improved learning strategies, and problem-solving skills. For example, students learn to be more critical toward collective texts when they are involved in peer assessment and peer feedback processes. They become aware of what other students are doing, and this has a positive impact on student learning. However, most of these studies emphasize that the students do not have these skills in advance but rather that this is something they learn during the wiki work. Some studies also suggest that students do not develop these skills. For example, there are several studies reporting that students wanted more training on how to use the wiki. On the more positive side, the Wikipedia studies highlight the students' sense of pride and joy related to the work. As such, the present study will further investigate what individual knowledge production skills are needed to succeed with wiki work in teacher education.

2.7.2 How does "students' shared responsibility" emerge in teacher education?

The second sub-question—*How does "students' shared responsibility" emerge in teacher education?*—addresses how students manage their own collaboration. The current study will therefore examine how students interact when they attempt to share responsibility. Regarding this issue, *problem space V* refers to studies showing that students found shared responsibility to be difficult, because it created unfairness in several different ways. Many students tended to do little work, and there was also a problem with free riders in several studies. Some studies also showed that students found the process of dividing the tasks to be unfair, because some got to do the more interesting tasks. Several studies also show that when group grades are used, students view these as unfair. It becomes more difficult to assess individual contributions when students do different tasks as part of a larger collective work. As such, these potential challenges related to students' shared responsibility will be further investigated in the current study. This requires that the students be given group grades for the wiki work in this study.

Another important issue is related to the role of the teacher. While most of the studies in the review show that the teacher is still present, it is unclear what kind of role the teacher should have. The studies give no clear indication of what kind and how much teacher feedback is ideal in wiki-mediated environments. Some studies point to the teacher being in the background, while others indicate that the teacher struggles to get an overview of the collective work in the online setting. The present research study will address this issue by letting students manage their work on their own with little intervention from the teacher. Interactions between students and between the students and the teacher will both be

addressed. Although some of the studies suggest that there is pedagogical potential in wiki-mediated group work, we still know very little about how to design successful instructional models.

2.7.3 How does peer learning emerge in teacher education?

The third sub-question—*How does peer learning emerge in teacher education?*—addresses collaboration between students both inside and outside the course setting. The current study will investigate what type of formal and informal collaborative processes are involved in students' wiki work (Boud, Cohen, & Sampson, 2014). In line with the review, the current study will investigate both peer editing and peer feedback as two important aspects of peer learning.

First, *problem space III* suggests that peer editing is a significant challenge in wiki work. In many studies, students are assigned to co-construct knowledge through direct improvements to the same collective text. However, most Wikibook studies show that students find it difficult to edit or modify each other's work. One of the problems is that the students feel inhibited because they do not know each other well enough. Another reason is that students are unsure if their edits will improve the quality of the text. As a consequence, the final wiki product usually ends up as a compilation of individual contributions and small-group contributions. This immediate peer editing between students in class in an offline setting is also perceived as much more difficult to do compared with time-extended peer editing, where students build on the work done in previous classes. In addition, the Wikipedia studies show that outsiders may edit students' work. However, no conceptual clarification exists of the different types of editing that are in use. One type of peer editing is more formal and organized by the teacher, while other types of peer editing are less formal. The current study will therefore attempt to systematically examine these different types of peer editing.

Second, the review shows that students can receive feedback from several different persons in the learning environment (*problem space IV*). This includes feedback not only from peers and teachers but also from outsiders in global wiki environments. Although the Wikipedia studies show that some of this critique can be experienced as harsh, most students enjoy getting comments that are meant to be helpful. The current study will therefore include any feedback the students receive from outsiders in the online setting. Furthermore, the review shows that most of the studies in the review analyze more formally organized peer feedback processes. There is a lack of studies describing the more *informal peer feedback* that takes place during the ongoing group work. It is also assumed that this type of interaction can be of importance for the quality of the wiki work. The present study will therefore investigate the different types of feedback that support wiki work.

3 Studying a concept in practice

3.1 Cultural-historical activity theory

In accordance with the main the research question (*How does collective knowledge advancement (CKA) as a pedagogical practice in teacher education emerge in the complex interplay between an offline setting and a global online setting?)*, it is important to employ a theoretical perspective that can support the investigation of CKA as a complex concept-in-practice. Moreover, to explore CKA this way, it is necessary to use a theory of change. Cultural-historical activity theory (CHAT) will here be used as a theoretical framework to serve this purpose. CHAT builds on Vygotsky (1997) and assumes that complex concepts are often created in the complex interplay between everyday (bottom-up) and scientific (top-down) concepts. CKA will therefore need to be examined not only as a theoretical concept but also as a part of the spontaneous use of everyday concepts in a specific pedagogical practice.

Furthermore, CHAT presumes that CKA as a pedagogical practice must be examined as a phenomenon that will always be mediated by how learners use artifacts. According to Engeström (2011), CHAT has evolved through three phases. The first generation of activity theory, based on Vygotsky's work, focused on mediated action. The notion of mediation refers to the idea that artifacts are embedded in all human practical activity. Both semiotic and material artifacts mediate learning in the activity between the subject and the object. It is therefore necessary to understand how individuals orientate themselves toward their objects with the help of tools. In addition, one needs to understand the historically developed purpose of the tool, which also influences how the tool is used.

Furthermore, Vygotsky (1997) considered the principle of double stimulation to be the foundational mechanism by which volitional action emerges. It allows humans to intentionally break out of a conflicting situation, solve a problem, or change its circumstances. The first stimulus is defined as the problem itself or the conflict of motives the subject faces. The second stimulus is picked up to solve the problem (first stimulus). It will also first need to be identified to be taken into use. It can, for example, be an external artifact that is turned into a meaningful sign. This sign will help the subject redefine and gain control over the situation. A new understanding of the initial circumstances or problems is then created. The stimulus can here be regarded as not only a general instrument but also as an instrumental solution to a problem or conflict. However, there may be a considerable delay between the formation of the second stimulus and its actual employment. The true test of the efficacy of the stimulus is whether it will be used again when the conflict reappears (Engeström & Sannino, 2014; Engeström, Sannino, & Virkkunen, 2014; Sannino, 2011).

In Vygotsky's original experiments, some of the second stimuli were prepared by the researcher, while in other experiments the participants spontaneously applied their own auxiliary stimulus as symbols. For example, counting to three can be used as a strategy to solve the conflict between wanting to sleep and wanting to wake up. Counting is here invented as an external auxiliary stimulus to help the person control his behavior by waking

up (Engeström & Sannino, 2014; Engeström et al., 2014). The key issue is that the mind is always mediated by physical objects and abstract symbols. This includes language, numbers, and signs. The tools mediate our experience and understanding of phenomena. Learning, therefore, needs to be analyzed as a process where people act and think with tools in a social and cultural context that exists for a particular purpose (DeVane & Squire, 2012).

In the second generation of activity theory, Engeström (1987) directs attention toward the larger collective activity system through the work by Leont'ev (1978, 1981). While double stimulation was originally considered to be a cognitive technique, Engeström extends the use of this concept by focusing on collective actions as second stimuli. He claims the second stimulus will seldom be automatically taken into use, but it will usually be rejected or reshaped. Because of human agency, participants will invent their own devices. Personal conflicts or motives are now also regarded as representations of contradictions in the larger activity system (Engeström & Sannino, 2014; Engeström et al., 2014). Humans make sense of themselves by directing attention toward different objects. Objects are connected to processes where something material is transformed, because one follows a specific motive. In the classic example by Leont'ev, obtaining food and clothing are the objects of the activity of hunting (Engeström, 2011). In the third generation of activity theory, the focus is on the interactions between two or more activity systems, where, minimally, two activity systems have a partially shared object (Engeström, 2011).

However, since the main focus in this research study is to examine a concept (CKA), the theoretical framework has been narrowed down to the introduction of two more specific concepts in the theory that are considered to be especially relevant. These two concepts, the notion of the germ cell and the notion of contradictions, are here regarded as theoretical concepts that can help in analyzing the dynamic aspect of CKA as a concept-in-practice. Although the use of this specific theoretical framework is not very common among CHAT researchers, there are a few examples of studies that have utilized these two theoretical concepts in greater detail (e.g., Engeström, Nummijoki, & Sannino, 2012). One should also be aware that this theoretical account does not give a general overview of CHAT. It could have been relevant to include elements from the fourth generation of activity theory (Engeström, 2009a, 2009b) but the content in these articles indicate that these perspectives are still rather underdeveloped in the research community. Instead, two core concepts in the theory will be presented in more detail. They will later be used to analyze CKA as a concept-in-practice. One should note here that this theoretical framework directs how we understand change or, more precisely, human transformation. This chapter is built around an introduction to the introduction of the following two assumptions:

- A new concept will emerge through contradictions.
- The germ cell of a new concept needs to be identified.

3.2 A new concept will emerge through contradictions

3.2.1 Analyzing the inherent contradictions in the object

In CHAT, *contradictions* play an important role, because they are regarded as sources for change and development. The existing activity system will consist of a collective formation directed toward an object and motive. However, it may often be hard for the individuals in the activity system to define the object, because it is inherently contradictory. Practitioners and researchers will always encounter a problematic object embedded in life activities. It is therefore usually ambiguous, fragmented, and contested. As a consequence, activity systems will never be free of inner contradictions or disturbances. However, a contradiction is not necessarily the same as a problem or conflict; it is rather historically accumulating structural tensions within and between activity systems. These contradictions are essential drivers of change, as the systems constantly try to solve them (Engeström, 2011). Some CHAT researchers even claim that the focus on contradictions represents one of the major analytical strengths of the whole theory (DeVane & Squire, 2012).

Furthermore, while most theories of learning expect a change in the subject, CHAT is connected to what is referred to as a theory of expansive learning, which highlights change in the collective activity. Learning by expanding is a form of learning that produces new objects, concepts, and forms of practice. It includes both the transformation of practice and new concept formation. When the object changes, this inevitably also affects the other components in the activity system. In expansive learning, learners construct a new object for their collective activity, which is implemented as a concept-in-practice. The social practices that emerge will never be entirely "new"; rather they will be hybrid combinations of "old" and "new" goals, actions, and tools for action (Engeström & Sannino, 2010).

Because expansive learning also builds upon collective transformations, it presupposes that contradictions are addressed and resolved within and across activity systems (Engeström, 1987, Engeström 2014). Even though a contradiction, disruption, or manifestation of dissent can be the starting point of expansive learning, this learning does not happen by itself. Although contradictions in an activity system are necessary, it is not a given that they will provide enough "fuel" to create expansive learning. The contradictions can rather be regarded as historically evolving tensions that can potentially be resolved. This is also the reason different types of intervention studies have been designed to help move expansive learning forward (Engeström & Sannino, 2010). Expansive learning takes place because historically evolving contradictions in activity systems lead to disturbances, conflicts, and double binds that trigger new kinds of actions among the actors. In formative interventions, the researcher will support this process by conducting both (1) a historical analysis of the activity system and (2) an empirical analysis of the contradictions in the ongoing activity (Engeström, Rantavuori, & Kerosuo, 2013).

It is common to analyze the contradictions that emerge as part of the historical development of the system. It is possible to move between the long historical time perspective of object-oriented activity systems and the relatively short time perspective of goal-oriented actions. These contradictions will also need to be resolved for expansive learning to occur. It is assumed that a successful intervention will need to build on the energy from these

contradictions to potentially transform the activity system. This is why contradictions are especially important in phases of transitions. If the intervention focuses only on the transformation of actions, it may be effective in the short run, but it is unlikely that it will endure in the long run (Engeström, 2011; Engeström & Sannino, 2010; Sannino, 2011). It is usually easier to locate the contradictions in the activity system when there is an ongoing attempt to move from new actions to new activities (Sannino, 2011).

One should also be aware that transformations in the collective activity can happen in several different ways. First, important practices that have previously become vague, confused, or lost can be recovered. Second, cross-appropriation refers to tools, practices, or ideas taken over from other activities or social worlds. A third form is reconfiguration, in which a marginal aspect of the activity becomes dominant, and the entire pattern is transformed (Penuel, 2014). However, change is not synonymous with progress. The result can also be disintegration and regression (Engeström & Sannino, 2010). According to Engeström and Sannino (2010), the occurrence of a full-fledged expansive learning cycle is not common. To achieve this, it will often be necessary to perform a series of deliberate interventions (e.g., Change Laboratory). However, one should be aware that expansive learning will be more of a historical reality than an outcome of a designed policy or intervention (Engeström et al., 2013).

In relation to concept development like that with CKA, it is important to analyze the inherent contradictions in an object, because this opens up the possibility of both constructing new concepts and expanding existing concepts. However, the basic assumption is that an object cannot be defined in advance; rather it must be understood as it is used in practice as a part of an activity system (Engeström, 2011).

3.2.2 Contradictions will emerge at four different levels

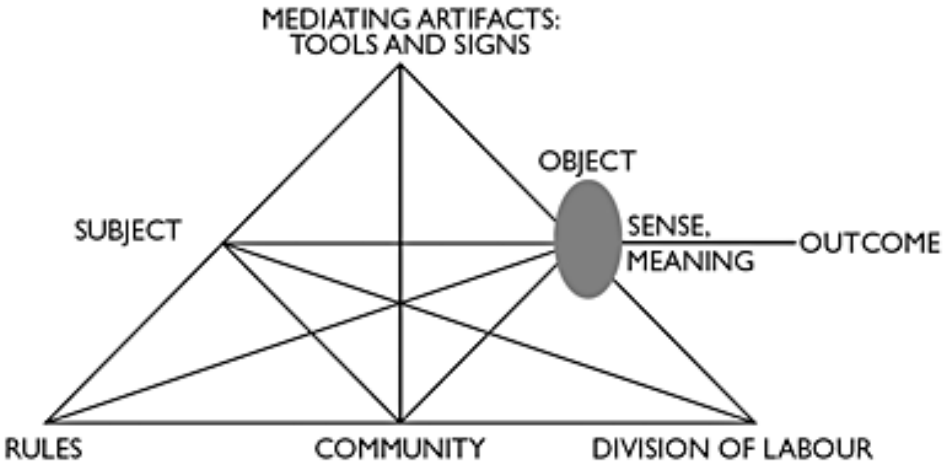
According to Engeström (1987), there are four levels of contradictions in the network of human activity systems: primary, secondary, tertiary, and quaternary. The *primary contradiction* refers to the double nature that exists within each component in the activity system. The component will have both an intrinsic value and at the same time be a commodity in a market-based socioeconomic system. This contradiction reveals the fundamental contradiction between the use value and exchange value in capitalist political economies. For example, the use value of a pen is related to how well it works, while the exchange value indicates that one can buy or sell it. This contradiction exists in all commodities in society and will be constantly reshaped into new forms. Another example is that doctors will provide treatment to heal patients, but this will also be done so they can earn money. Medicaments and drugs are useful for healing, but they are also commodities sold for profit. In this example, a primary contradiction may emerge between doing as much as possible to heal a patient versus attempting to maximize one's personal income. Even if contradictions at other levels are solved, this primary contradiction will always be present. This is why commodity can be regarded as the germ cell of capitalism (Foot & Groleau, 2011; Sannino, 2011).[7]

[7] The term primary contradictions is used to analyze the data in section 8.6.6, That teachers have to become knowledge producers is viewed as unfair, page 296.

One can question whether most CHAT studies focus too little on this primary contradiction. For example, Engeström and Sannino (2010) refer to James Avis (2009), who criticized the lack of political focus in studies of expansive learning. He claims that most studies discuss only secondary contradictions and tend to reinforce traditional practice, because they focus on "peripheral contradictions" and "adaptive change." The main concern is the improvement of local work practices, but this analysis is not connected to the larger societal structures. The revolutionary implications of the theory are ignored and instead reduced to a management technique. As a consequence, the studies are primarily of value in the local context. When Engeström and Sannino (2010) address this critique, they suggest that large-scale political confrontation is not necessary in studies of expansive learning. They also claim that some studies have investigated primary contradictions in an activity system. As an example, they highlight an intervention study with the area managers of Helsinki Home Care Services in 2008–2009, in which the participants identified privatization and the logic of profit as the main threat. The primary contradiction between use value and exchange value manifested itself in the attempt to save money. The commoditization of care resulted in the abandonment of elderly people to the mercy of the market (Nummijoki & Engeström, 2010).

Secondary contradictions are contradictions that appear between the different constituent components in the activity system. In the second generation of activity theory, Engeström (1987) developed a graphic representation of this activity system. It can be regarded as an extension of Vygotsky's work through the reading of Leont'ev.

Figure 3.2-a A model of the structure of a human activity system (Engeström, 1987, p. 78).



This model gives an overview of how one can analyze specific relations between its structural components, but the triangle constitutes a whole unit of analysis. It is the inner contradictions between the components in the activity system that initiate change or transformation. New forms of activity will emerge as solutions to these contradiction in the existing activity system. These innovations from below will emerge as "invisible breakthroughs." A universal phenomenon will always first manifest itself as an individual, particular, specific phenomenon in its initial phase. For example, a new and better way of dividing the labor will first emerge as a certain deviation from previously accepted and codified norms. This new form will later be taken over by others. Secondary contradictions

will appear when a new element enters into the activity system from the outside. One example is when conflicts emerge between the increasingly ambivalent and complex symptoms of patients and the traditional biomedical diagnostic instruments. Patients' problems will perhaps require an integrated social, psychological, and biomedical approach that may not yet exist (Engeström, 1987; Foot & Groleau, 2011).[8]

The starting point will usually consist of intense attempts to articulate the experienced problem space. The given problems are often transformed into a poorly understood contradictory object. One example can be that a group of people, like patients at a hospital, are described in a negative way. This kind of categorization, or empirical abstraction, served to "stabilize the knowledge." If offers a simple pseudo-explanation for a complex and bewildering problem. Another common reaction is that persons in this situation experience a fear of the unknown, because they lose control and overview of the "big picture." In these cases, it becomes important to identify and articulate the contradictions that exist (Engeström, 2011).

A *tertiary contradiction* appears when a more culturally advanced object and motive are introduced into the activity system. This type of contradiction exists independently from secondary contradictions and happens when a disturbance is created in the existing object. For example, if practitioners of a medical clinic adopt a new way of working that builds on holistic and integrated medicine, the practitioners who support the old model will reject the new model. The new tool creates a mismatch with the rules in the existing activity system. However, the motive for introducing a new object to an activity system will often be an attempt to solve secondary contradictions. The new object triggers a developmental phase, which can potentially redefine and reconfigure the whole activity system (Engeström, 1987; Foot & Groleau, 2011). Foot and Groleau (2011) claim that power relations become central when a new object is introduced. They claim that such relations are decisive for whether or not the central activity will change, although Engeström does not put as much emphasis on this issue.[9]

Quaternary contradictions appear between the central activity and its neighbor activities. Quaternary contradictions emerge in the interaction between the entity of the dominant activity and the entity-producing neighboring activity. One example is if a primary care doctor, who uses a new holistic approach, refers a patient to a hospital that uses a traditional biomedical model. Conflicts and misunderstandings will then easily arise between these two activity systems (Foot & Groleau, 2011).

[8] The term *secondary contradictions* is used to analyze the data in section 8.6, Unfairness as the fundamental inhibitor of CKA as a pedagogical practice, page 293.
[9] The term *tertiary contradictions* is used to analyze the data in section 8.6.6, That teachers have to become knowledge producers is viewed as unfair, page 296.

3.3 The germ cell of a new concept needs to be identified

3.3.1 The principle of ascending from the abstract to the concrete

In this research study, the theoretical idea of *a germ cell* will be used in an attempt to increase our understanding of CKA as a concept in teacher education. The theoretical idea of a germ cell builds on the "unit of analysis," which was a central concept of Vygotsky's methodology (Vygotsky, 1987). The mode of analysis can be compared with the chemical analysis of water. When water is decomposed into hydrogen and oxygen as two separate atoms, the water ceases to exist. It is the union of hydrogen (H) and oxygen (O) that creates water (H_2O). For example, if we want to understand the properties of water that extinguish fire, it becomes highly problematic if we study only the elements separated from each other. This is because hydrogen burns and oxygen sustains combustion. It is only the synthesis of its parts (H_2O) that opens up for understanding the properties of water that can extinguish fire (Vygotsky, 1987, p. 45). The point is that both hydrogen and oxygen exhibit radically different properties from H_2O, which is a molecule. The elements are of a different nature than the whole from which they are derived.

According to Vygotsky (1987, p. 46), the further development of theories of thinking and speech need to adhere to this type of analysis. It relies on the partitioning of the complex whole into units. In contrast to the term "element," the term "unit" possesses all the basic characteristics of the whole. To explain the characteristics of water, one should not investigate the chemical formula but rather H_2O as a molecule and its molecular movements. It is about combining two seemingly opposite elements (hydrogen and oxygen) into one distinct entity. The new synthesis of the elements will consist of new distinct properties. Another example is the living cell, which is the real unit of biological analysis, because it preserves the basic characteristics of life that are inherent in the living organism (Vygotsky, 1987, p. 46).[10]

In accordance with this theoretical perspective, the unit of analysis is here regarded as a distinct empirically given phenomenon. The unit can here be used as a methodological concept to resolve a problem. It provides an "entry point" for scientific work, but at the same time it requires that psychological activity must be studied in all its complexity, not as isolated components. The unit first becomes meaningful when it refers to a complex process that manifests itself through a vast number of different combinations and interactions. For example, although each water molecule contains the same two atoms of hydrogen and one atom of oxygen, it can be transformed into many different forms (e.g., ice, steam). Moreover, the unit is also closely related to the idea of the existence of a germ cell, which assumes that there are inherent contradictions in basic concepts (Blunden, 2015b).

As such, one could claim that the germ cell is a simple and finite relation that provides the key to understanding the whole complex process under investigation. It is a singular entity that exhibits the essential or simplest possible characteristics of the whole process. It can be

[10] In the present study, the two seemingly opposite elements are identified as "help on request" and "help without request." Together they constitute the "molecule of CKA as a pedagogical practice." See section 9.1, Identifying the germ cell, page 299.

anything we observe, such as a specific type of interaction, a concept, or an artifact. This germ cell also contains the seeds of what can stimulate the development of a new and more complex practice, but it should not be understood as a rule or a principle hidden from perception that governs the process from outside. Every new concept that is created will therefore always begin from everyday perceptions, but the analytical process cannot be complete before the germ cell has been identified. Before this happens, there exists nothing more than a description of the most prominent and consistent characteristics of the process (Blunden, 2015a).

Initially, the notion of the germ cell was brought into activity theory tradition by Vasily Davydov (1990), and it has been further developed by Yjrö Engeström (Blunden, 2015a). The idea of a germ cell is here also closely connected to *the principle of ascending from the abstract to the concrete.* This principle builds on dialectical thinking originally developed by Hegel and Marx. Davydov (1990), who was inspired by the philosopher Ilyenkov (1982), turned this principle into an interventionist method for school improvement.

According to Sannino (2011), the principle of ascending from the abstract to the concrete has four main characteristics that evolve through different steps: (1) practical transformation, change, and experimentation with (in) a problematic situation; (2) the identification and modeling of a germ cell behind the problematic situation (initial abstraction); (3) testing the germ cell in its different material manifestations and possible variations; and (4) projecting a theoretically mastered solution onto the initial problematic situation. This methodology is different from empirical abstraction, which based on comparisons and categorization, captures arbitrary, interconnected properties.[11] Instead, practical transformation, change, and experimentation are viewed as the fundamental actions of theoretical generalization. Here the term "theoretical" refers to a mode of knowing that reproduces the development or movement of systemic objects through different steps (Sannino, 2011) (Engeström et al., 2013) (Engeström et al., 2012). These steps are here explained in further detail.

3.3.2 Step 1. Practical experimentation in a problematic situation

The first step *is practical transformation, change, and experimentation with (in) a problematic situation*. Concepts in practice will often emerge as complex, multi-layered, and incomplete. An attempt to move an expansive concept into practice will usually involve conflicts, confrontation, and negotiations. The main reason is that different stakeholders will produce partial versions of the same concept. To locate the germ cell, it is necessary to both experiment with and analyze problematic or chaotic situations. This involves performing a careful analysis of dysfunctions and anomalies in the data. It is often this type of analysis that makes it possible to discover the characteristics of the germ cell (Sannino, 2011).

Sannino (2011) here refers to Davydov (2008), who claims that the most interesting phenomena may not be empirically generalizable, because they are emergent. The early

[11] The empirical analysis in Chapter 5, 6, and 7 build on empirical abstraction or generalization. Although the findings from these chapters are later used to identify the germ cell in Chapter 9, these chapters capture primarily arbitrary, interconnected properties.

symptoms will just barely be observable. This approach is very different from traditional empirical generalization, which aims to find the most representative examples of broader categories in the data. It is here assumed that practices which on the surface look different may have the same genetic origins. In this first step, it is therefore necessary to conduct enough experimentation to be able to identify the initial "germ cell" abstraction. Moreover, in expansive concept formation, it is important to trace and analyze the whole process, starting with the early unstable attempts of experimentation up until the stabilization steps, such as naming and modeling (Sannino, 2011).

3.3.3 Step 2. Identification of the germ cell behind the problematic situation

The second step is *the identification and modeling of the germ cell behind the problematic situation*. This step requires that the problematic situation be transformed through the identification of an initial "germ cell" abstraction. In dialectical-theoretical thinking, this abstraction represents *the smallest and simplest genetically primary unit of the whole functionally interconnected system being studied* (Sannino, 2011). The germ cell builds on the assumption that all thinking and learning represents an attempt to abstract meaning from an initial diffuse sensory-concrete entity. The starting point is the world as it presents itself to us. The learner will then need to interpret a particular situation or aspect of reality in a meaningful way. In this way, the abstract here refers to something partial, which is the construction of a germ cell (Engeström et al., 2012; Engeström et al., 2013; Sannino, 2011). One example of a germ cell is the steam engine, which originally looked very different from the steam engines that later were used in ships and locomotives. The reason is that the first invention of steam power described a very simple relation that was then modeled and later developed into many new variations (Sannino, 2011).

However, a germ cell can also be identified as specific types of embodied interaction. Usually the formation of a new theoretical concept is regarded as a textual and language-bound process. However, within this perspective it is assumed that every concept conceals a particular action with objects. Concepts will therefore be something more than just a verbal definition. They will be foundationally bound to our bodies, movements, and physical actions (Engeström et al., 2012; Hutchins, 2010; Shapiro, 2010). For example, Engeström et al. (2012) describes a project where one such germ cell was related to nurses' and clients' practical efforts to integrate physical mobility exercises into the routines of home care services. In this setting, standing up from a chair (or sit-to-stand) was identified as the best candidate to serve as the germ cell. In home care encounters, this bodily movement requires that one must get up to reach the upright position in order to move. This develops one's own muscular strength and coordination and is foundational in any other kind of physical movement. It was therefore interpreted as the smallest and simplest initial unit of a complex totality.

Moreover, the germ cell will also carry in itself *the foundational contradiction of the complex whole*. Although the identification of a germ cell may be more superficial as an empirical classification, it represents an important intermediate analytical step. However, this is not enough to transform practice in any fundamental way before the inner contradictions in the germ cell are resolved. This requires that the logic of the objects' development needs to be reproduced both theoretically and as a historical formation (Engeström, 2011; Engeström et

al., 2012; Engeström & Sannino, 2010; Sannino, 2011). In the project by Engeström et al. (2012), where standing up from a chair was identified as a germ cell, it was also necessary to describe the inner contradictions in the cell. On one hand, if a person stands up without grabbing a piece of furniture for support, this will strengthen the muscles. However, the natural temptation, especially for a frail person, is to use the edge of a table or the armrests of the chair as support when getting up. This makes it easier and safer to stand up from the chair, but it creates more dependency and does not strengthen the muscles in the same way. There is a contradiction here between the motives of safety and autonomy, which is experienced as a critical conflict between the fear of falling and the need to move. While the safety motive leads the person to use the furniture, it has the disadvantage that it makes the person more dependent on external support. On the other hand, the autonomy motive will build on using the muscles to a greater degree, but it is still harder and riskier. This contradiction cannot be eliminated. Safety and autonomy both repel and require one another. However, one can transcend the contradiction by expanding one's mobility beyond standing up from a chair (Engeström et al., 2012).

It is this contradiction in the germ cell that is regarded as the most demanding to describe.[12] In this example one should also note that this germ cell is ubiquitous. Standing up from a chair is so commonplace that it is often taken for granted and goes unnoticed. Hence, it is easy to neglect the importance of these types of embodied interaction (Engeström et al., 2012).

3.3.4 Step 3. Testing the germ cell

The third step is *the testing of the germ cell in its different material manifestations and possible variations*. When the germ cell as an initial idea is clearly understood, it can be enriched and transformed into a complex new system with multiple, constantly developing and expanding manifestations. This initial simple relationship can potentially turn into a new expanded object, which can become the actual driving force of expansive learning. New patterns of object-orientated activity may emerge, but this requires that the germ cell be materialized in such a way that the new forms of activity become stabilized. The cell must therefore be put into use through the construction of a range of concrete applications and tasks. It must be applied and implemented as different practical manifestations to move toward a concrete new whole (Engeström, 2011; Engeström et al., 2012; Engeström et al., 2013; Engeström & Sannino, 2010).

Several of the epistemic actions in expansive learning are relevant for this step. The third epistemic action in expansive learning refers to the modeling of the germ cell in some publicly observable and transmittable medium. This requires the construction of an explicit, simplified model that offers a solution to the problematic situation. The fourth epistemic action involves an examination of the model. It is necessary to test the model of the germ cell to fully grasp its potentials and limitations. It is only after the germ cell has been described as a model in its initial form that it is possible to develop more complex models and different practical manifestations (Engeström & Sannino, 2014).

[12] The contradiction in the germ cell is described in section 9.4 The basic conflict of motive, page 310.

In the project by Engeström et al. (2012), the description of the germ cell was used as the basis for the next step, which required the analysis of the collective formation of a new concept of mobility. The germ cell was now expanded into new bodily movements and sensations supported by simple pictorial artifacts. However, it took time to integrate these exercise actions into the daily routines of persons. A new commitment is also needed if collective concept formation is to happen. By doing research on encounters between nurses and 30 elderly clients, a new concept of mobility began to emerge. In their analysis of the home care visit, segments from six *"conceptual" trails* of expanding (ascending) from the abstract toward the concrete were identified.[13] For example, the researchers found little evidence of the value of continuing to use of the visual exercise booklet that was originally introduced. It became relatively unimportant compared with the bodily action schemas and associated physical artifacts (chairs, tables, stairs, utensils, mirrors). It showed that the body itself was crucial but also were the artifacts in the environment. Another finding was that although the new germ cell (sit-to-stand) had been identified, the consequences of the design of a new practice did not entail a quick fix. These took time and seldom manifested themselves as radical breakthroughs (Engeström et al., 2012). Instead of focusing on the development of one grand design, one should instead cultivate tentative solutions developed through experimentation. These solutions should first be designed locally, and, if they are successful, they can be generalized and spread to new areas. The designs will also always have unintended consequences and evolve in unexpected ways (Engeström et al., 2014; Sannino, 2011).

3.3.5 Step 4. Suggesting a solution to the initial problematic situation

The fourth step *is projecting a theoretically mastered solution onto the initial problematic situation*. The dialectical nature of theoretical knowledge originates from practical experimentation, and, in step 4, it culminates in the establishment of new forms of practice or a theoretically mastered solution. The final step of "ascending from the abstract to the concrete" is about reconstructing the concrete reality as a whole (Engeström et al., 2014; Sannino, 2011). Sannino (2011) exemplifies how this can happen by referring to Luria, who studied classification tasks in Uzbekistan. Local illiterates initially organized different objects, such as a tree, a saw, and an axe, into the same category because of the functional connection between the items. When a scientific classification system was introduced, the saw and the axe were categorized as tools, while the tree was categorized as a plant. When the subjects began acting according to this scientific classification system, they were stimulated to establish connections between phenomena they had never previously assumed were relevant for each other. In this way, the people's use of a new classification made it possible to produce new solutions to problems.

This example illustrates how concrete reality can be reconstituted. The difference now is that this new system exhibits the essential features of the original unit or the germ cell. The scientific classification system can as a theoretical framework be enriched and transformed into various, constantly evolving manifestations. It is possible to work proactively on a situation before it becomes a crisis (Engeström et al., 2014; Sannino, 2011).

[13] The notion of "conceptual trails" will be used to discuss the findings in Chapter 10.

Likewise, concepts will also evolve through such cycles of stabilization and destabilization. When a new concept is introduced, it is first externalized. However, it will need to be internalized in the system before the use becomes stable. It is not before this happens that the concept can be adopted by other activity systems. If a concept is appropriated as a new object, the patterns in the activity system will also begin to change. However, this first requires the identification of the germ cell or the simple initial relation (Engeström, 2011). Expansive concepts can also be future-oriented in the sense that they point to visions of future development and change. These visions will be loaded with affects, hopes, fears, values, and collective intentions. Such concepts are not yet part of a new system, but they point to the possibility of designing a new system (Engeström, 2007a; Engeström, Pasanen, Toiviainen, & Haavisto, 2005). In the project by Engeström et al. (2012), this is illustrated by the description of trails that build on the germ cell and point to new solutions in the routines of home care services.[14]

[14] In the present study CKA will be analyzed as a pedagogical practice that is potentially expansive. See section 4.5.6, Phase 5 – Expanding CKA as a pedagogical practice, page 117.

4 Research design

4.1 Introduction

In this chapter, the complete research design will be described. The research design shows how all the major parts of the research project are connected and how they address the research questions. It describes the set of methods and procedures that are used to collect and analyze the data in current research study. This involves a detailed outline of how CKA will be investigated as a pedagogical practice in teacher education. The complete research design will be further addressed through the following six components:

1. The exploratory case study
2. The research site
3. Data collection
4. Data analysis
5. Transcribing and reporting the data
6. Ethical considerations

These components describe the logical structure of the inquiry or how CKA as a pedagogical practice will be studied. The components describe the plan for successfully carrying out the study. They describe how the present study has been designed in a particular way to increase the chances of collecting the information needed to answer a particular question. As such, it is important to avoid analyzing data that are irrelevant for the initial research questions. This is why the research design includes a description of the study's research question, its unit(s) of analysis, which questions to study, which data are relevant, which data to collect, and the criteria for interpreting the findings (data analysis) (Yin, 2009, p. 26-27).

Furthermore, the research design can be defined as a *case study approach*. Yin (2009, p. 18) claims that a case study approach should rely on multiple sources of evidence, with data needing to converge in a triangulating fashion. This is because the phenomenon and context are not always distinguishable in real-life situations. One should also establish or develop theoretical propositions that can guide the data collection and data analysis (Yin, 2009, p. 18). Likewise, the current study follows the same line of inquiry by collecting different types of data, by triangulating the data, and by using a detailed review to frame the research questions. In addition a conceptual framework, which builds on cultural-historical activity theory (CHAT), will be used to better understand CKA as a *concept-in-practice* (data analysis).

4.2 The explorative case study

In accordance with the main research question, the primary aim of this case study is to increase our understanding of CKA as a pedagogical practice in teacher education. In the first chapter, a preliminary definition of CKA has been described. Since CKA is a new concept, it is still unclear what this concept will look like when it is enacted as a pedagogical practice in the context of teacher education.

Note that the main research question in the current study is also formulated as a "How-question" (*How does collective knowledge advancement (CKA) as a pedagogical practice in teacher education emerge in the complex interplay between an offline setting and a global online setting?*). According to Yin (2009, p. 10), the use of a case study approach is an especially relevant way of answering research questions that address the "How-dimension". This is why the research strategy here builds on an explorative case study in an attempt to further investigate CKA as a phenomenon (Marshall & Rossman, 2011, p. 69; Yin, 2009, p. 28). The key characteristics of this explorative case study are described in the following section.

4.2.1 Using the review to frame the sub-research questions

In the current study, the literature review in the second chapter served the purpose of bringing together several different wiki studies that could help formulate the more specific sub-research questions. These sub-questions build directly on the problem spaces that were identified in the review. They provide an analytical framework that can guide the further analysis into three different research areas (Chapter 5—The value of student-produced collective work, Chapter 6—Students' shared responsibility, and Chapter 7—Peer learning). All these sub-research questions are assumed to address important aspects of CKA as a pedagogical practice in the teacher education context. In this way, the questions constitute a tentative theoretical framework that can guide the examination of CKA.

According to Yin (2009, pp. 35-37), theory development is an essential part of the design phase of a case study. This is what makes this method different from ethnography, which to a greater degree avoids specifying any theoretical propositions at the outset of an inquiry. Theory development is even important in exploratory case studies where the existing knowledge base is poor. Furthermore, Yin (2009, p. 120) suggests that it is the review that can be used to develop sharper and more insightful research questions about the topic. Likewise, Marshall and Rossman (2011, pp. 71,73,78) claim that it is important to utilize a more extensive and creative review of the literature in explorative studies. The main research question will usually be general enough to permit exploration, but at the same time the specific sub-research questions are necessary to narrow down or delimit the area of investigation. The review can help formulate a more precise problem statement and specify research areas that have not yet been adequately explored. In this way, the review will also critique previous research.

Likewise, the review in the current study is used to narrow down the area of investigation. The sub-research questions emphasize some selected research areas. Although they are still

quite general, they help organize the complex and rich data material. They describe what Yin (2009, p. 127) labels as the delimitation lines in the current study.

On the other hand, using the review to formulate the sub-research questions can also be regarded as a paradox, because few of these studies examine concepts affiliated with CKA. One should here note that it is the comparison of the wiki-mediated pedagogical practices in the studies that has been important. The review synthesized the findings from many different practices where tertiary students had used wikis in the teacher education context and in global wiki environments. These pedagogical practices are assumed to be somewhat similar to what CKA as a pedagogical practice can be. It is therefore not an abstract theory but rather the similarities between pedagogical practices that led to the formulation of the sub-research questions. The major categories, or "problem spaces," that were developed represent common features typical across the different studies. It is primarily these categories that were used as a conceptual framework to specify the sub-research questions.

Likewise, Marshall and Rossman (2011, pp. 84-85) suggest that the review can help organize the empirical analysis. The categories can be regarded as tentative tools that support the first phase of the data analysis and the initial attempts to systematize the data (Yin, 2009, p. 29). The review also revealed some of the complexity of the area under investigation. This included a multitude of different challenges associated with tertiary students' course work in global wiki environments. The review also gave an overview of the gaps in previous research. As such, the findings in the empirical analysis will also be compared with relevant findings from studies in the review chapter.

4.2.2 Exploring a new concept

In the current study, CKA will be studied as a concept that manifests itself as a pedagogical practice in the teacher education context. In this way, the case study approach in this study shares some similarities with formative intervention research. According to Engeström (2011), one of the aims with formative intervention research is to generate new concepts that can be used as conceptual frameworks in the design of locally appropriate solutions in different settings. According to the theoretical framework (see Chapter 3), this requires the identification of the germ cell of CKA.[15]

In a recent paper, Engeström and Sannino (2014) propose that formative intervention research can be divided into four areas: First, this includes studies of manifestations of contradictions (e.g., Engeström & Sannino, 2011). At critical stages of transition where new actions transform into new activities, collectives become aware of the contradictions in their present activities and manage to connect them with new activities (Sannino, 2011). Second, studies of expansive learning actions and learning cycles are important (e.g., Engeström et al., 2013). Formative intervention research is a key methodology for studying these longer learning cycles, which are uncommon in most organizations (Engeström & Sannino, 2010). A third area includes the studies of expressions of transformative agency, which focus on the object of the intervention. The formative intervention researcher supports the participants

[15] See the details of how the germ cell will be identified in section 4.5.5, Phase 4 – Using two CHAT-concepts to analyze the data, page 113.

in their efforts to co-construct the developmental process (e.g., Haapasaari, Engeström, & Kerosuo, 2014). Studies of concept formation is a fourth major research area (e.g., Engeström et al., 2012).

Accordingly, the current case study is similar to the fourth research area, because CKA is assumed to be a potentially expansive concept in the context of teacher education. Moreover, concept formation is necessary to facilitate changes in existing pedagogical practice. In adherence with the first major research area, it will also be assumed that the new actions that are produced will manifest themselves through contradictions between the existing activities and the new activities. Furthermore, through a systematic analysis and the identification of the characteristics of the germ cell of CKA, it is not only possible to describe the essence of the concept, but one can also explore its transformative potential through different conceptual trails that in the future might lead to expansive learning. The notion of the germ cell and contradictions will be used to frame the theoretical discussion of the different inhibitory and enabling conditions introduced in the empirical analysis.[16]

4.2.3 The unit of analysis (the three wiki cases)

To better understand how students can advance collective knowledge as a part of a pedagogical practice in teacher education, it is necessary to create an instructional design that is built on a tentative and preliminary definition of CKA. Regarding this issue, a key challenge in the current research study is related to how CKA can be transformed into a valid instructional design within the context of teacher education. Although a tentative description of CKA was offered in the first chapter, there exists no accepted definition that most researchers agree upon.

However, as described in Chapter 3, the theoretical assumption is that CKA must be analyzed as a phenomenon mediated by artifacts. This requires an analysis of how artifacts influence the collective work in both an online and an offline setting. The concept needs to be examined and constructed through the analysis of a specific artifact-mediated practice. The wiki was selected as one such technology that can support new types of collective work.[17] As a consequence, CKA will be explored through the analysis of student group work with wiki assignments in teacher education. As such, the definition of the unit of analysis (Yin, 2009, p. 29) is *student group work with wiki assignments*. The unit, or case, will therefore contain both a technology and a collaborative component.

Furthermore, in the current study, three different wiki assignments will be examined. These assignments can be regarded as separate cases that in different ways try to support students in collaborating together in new ways in teacher education. Since it is not entirely clear what characterizes this pedagogical practice, it is considered to be an advantage to design cases that are somewhat different from each other. It is here assumed that there is not necessarily

[16] Read more about these two theoretical concepts in section 4.5.5, Phase 4 – Using two CHAT-concepts to analyze the data, page 113.

[17] See also section 1.3.3, Studying CKA as a pedagogical practice that includes participation in a global wiki environment as an online setting, page 11, for more information about the rationale behind the selection of the wiki technology.

one successful practice but rather several that may look quite different from each other on the surface. At the same time, the wiki assignment will consist of only one element in a complex social setting. By letting students use the wiki in different ways, one can also obtain more information about how the wiki functions together with various other artifacts and interaction patterns. Moreover, there is no guarantee that the wiki assignment will support new pedagogical practices. Part of the challenge here is that we do not know exactly what CKA as a pedagogical practice will look like.[18] The germ cell of CKA will first need to be identified as a part of the empirical analysis.[19] Three different wiki assignments were therefore designed, with the aim of making it more likely to be able to identify important enabling conditions. These wiki assignments, which are closely connected to the three cases in the study, are described in the table below.

Table 4.2.a A comparison between the three cases according to some key dimensions.

	Case 1 (Student group work with the first wiki assignment)	**Case 2 (Student group work with the second wiki assignment)**	**Case 3 (Student group work with the third wiki assignment)**
Time period given to do the work	1 week (1 workshop session)	1 week (1 workshop session)	1 week (1 workshop session)
The size of the group	Two quite large groups (8 and 9 students).	Whole class (approx. 20 students)	Whole class (approx. 20 students)
Wiki environment/Wiki technology	Wikibooks MediaWiki (Obligatory to use)	- Wikispaces (Students could choose between MediaWiki or Wikispaces during the project work). - Wikipedia	Wikibooks MediaWiki (Obligatory to use)
Starting from scratch?	No (Improving an existing wiki page that contains a list of several video resources with short descriptions of content).	Yes (Primarily starting from scratch. The teacher had made an example of how one could make the wiki page).	No (Improving an existing wiki page that contains a substantial amount of readable unimodal text [text only] with some hyperlinks).
Is the number of wiki pages predefined?	Predefined (Improvement of one wiki page).	To some degree predefined (The class had to produce a Wikipedia article in addition to using Wikispaces).	Predefined (Improvement of one wiki page).
School subject	Music and Science	Interdisciplinary topic (“Rock carvings”).	Pedagogical use of wikis

[18] Read more about this in section 1.2.4, Two new core skills, page 5.
[19] Read more about the germ cell in section 4.5.5, Phase 4 – Using two CHAT-concepts to analyze the data, page 113.

Students' background knowledge about the specific topics in the assignments	Some degree (Substantial individual differences—from little to good knowledge).	None	Some degree (Primarily practical knowledge from the work with the first and second assignment).
Expected relevance for later professional work	Relevant (not all the students will teach music)	Relevant	Relevant
Availability of work after publication	Open	Open	Open
Primary target group	Teachers (learning resource)	Students (learning resource)	Student teachers (academic article)

4.2.3.1 The first wiki case

The first case in the current study refers to student group work with the first wiki assignment in the above table. The students were allotted approximately one week to do the first wiki assignment. It was presented on Thursday March 1st 2012. Then the students were encouraged to meet the next week to synthesize their collective work. The objective in the first wiki assignment was to let students develop a few comprehensive video resource pages in the subjects of music and science. This involved the improvement of four preselected wiki pages on the Wikibooks site. In music, the two wiki pages were about musical instruments and dance. In science, the video resources were about human senses and the human body. All the topics were directly relevant for different objectives in the national curriculum. The selected topics were also assumed to be of interest independent of the school subjects the students were teaching. Most students would have some basic knowledge about these topics.

These wiki pages already contained a list of external links to video resources that were relevant for a variety of curriculum objectives at both the primary and secondary school levels. These wiki pages were also selected because the initial amounts of existing video resources were approximately the same. This would give the students a similar starting point.

The students were expected to review the existing video resources. The student work was part of a larger wiki textbook project in science and music where previous students in the course had already done some work with the wiki pages. Students in the same course have worked on a specific book every year since 2007 (from 2007 until 2012). This wiki textbook covers a range of different school subjects. It includes descriptions of external links to resource pages and also a large number of articles. In this way the wiki assignment was different from a regular assignment, because the students were not required to start the work from scratch.

Music was also selected as a subject because it was assumed that most students have some basic knowledge about and interest in this area. Another reason is that a few music teachers from the region were also making contributions to the Wikibook within this school subject.

These “outsiders” were not formally affiliated with the teacher training program but use the wiki resource in their daily professional work. A third reason is that printed textbooks in music would inevitably be of limited value. A Wikibook with video resources can constitute an important supplement.

Most of the video links in the wiki page would usually consist of a description of the content and an assessment of the quality of the video. The students were encouraged to primarily edit the text but also find a couple of new external video links. It was important to use most of the time improving the page, as this was to make sure that it was of high quality. The quality of the collective learning resources was built around the idea of letting a large number of contributors continuously edit and assess a limited number of videos. Instead of just filling a web page with a lot of new videos, students were encouraged to discuss which videos were the most relevant to use. It was equally important to review the videos that had already been published. The assignment would therefore introduce the students to the importance of making sure that resources are updated continuously.

The learning resources had school teachers as the primary target group. The work was done with the aim of being of value for other teachers who were already working in schools. For example, a few music teachers from the region had already made some contributions to the music textbook. These teachers wanted to develop their own digital learning resources, because the paper-based textbooks in the schools were to a large degree outdated. Multimodal resources were considered an especially important supplement in music as a school subject. The production of video resource pages was considered to be extra important, because the availability of videos on the Internet has increased a great deal in recent years. In this way, the Wikibook textbooks could be an alternative to printed textbooks, which do not have any video resources. It was important to let students reflect on the potential value of using video resources in their own classroom teaching.

It usually also takes a lot of time for one person to find relevant video resources. Although this work is not necessarily difficult, teachers will not have the time to do this work on their own. A collective strategy would save everybody time. If everybody did a small portion of the work, the collective product might still end up being of good quality, and the burden of the work would not be so heavy for one single person. It was here important that the students gained experience with continuing to improve the work of previous students. In contrast, the obligatory assignment in the teacher training program had usually been to have students create their own personal web pages.

Furthermore, to test out the idea of working in somewhat larger groups than normal, students were encouraged to form groups with more than six students. One of the goals with having the students improve only four wiki pages was to “force” them to work more closely together. In previous years, students had often preferred doing the work individually on separate wiki pages. As a consequence, the class decided to split into two large groups (with 8 and 9 students) and two small groups (3 and 5 students). All the students, except a smaller group who was abroad, got to choose which of the predefined topics they wanted to work with. The two larger groups with eight and nine students participated in the research project, and the two smaller groups did not. The two larger groups worked with a wiki page about musical instruments and the human body. They met with each other in a workshop

setting once toward the end of the deadline (Tuesday March 6th and Thursday March 8th). The "workshop data" were collected when these groups met at the workshop session.[20]

Note that the students were also given quite detailed written instructions on what to do in this assignment. They were required to fix the original wiki in several different ways. First, this involved a revision of the content descriptions to the external video links. If the video was long, the most relevant time points should be specified. Second, each video should include a short review of its pedagogical relevance. Students could refer to the age of the target group and explain briefly why the video is interesting. Some of the videos also lacked content descriptions and reviews. Other videos contained several reviews that needed to be merged together. Third, there were few specifications of the number of new video contributions. Instead, the students were encouraged to cover topics for which there were few videos. The guidelines recommended a maximum of two video resources per topic. This was in accordance with the principle of offering a few videos of high quality instead of a lot of videos of mixed quality, which one usually finds at other websites. If the student found too many video resources on the same topic, they could also remove videos of low quality. Fourth, the students were encouraged to organize the page into functional subsections with relevant headings.

4.2.3.2 The second wiki case

The second case in the current study refers to student group work with the second wiki assignment (Table 4.2.3.a). The students had approximately one week to do this assignment (from Tuesday March 13th to Tuesday March 20th). The objective in the second assignment was to develop a comprehensive learning resource for children about rock carvings. The students were supposed to do this work as a whole-class project. The main target group was students in upper elementary school (grade levels 5–7) but also students at the lower elementary and secondary levels. The requirement was that the wiki resource could be used by the students on their own without needing any assistance from a teacher. This is why the content, language, and layout needed to be child-friendly. If teachers wanted to, they could of course also use the learning resource in their classroom teaching.

The guidelines encouraged the students to include a range of different resources, such as text resources, video resources, student-authored resources, photo galleries, screencasts, and tests and quizzes. With the exception of two mandatory subtasks, there were few minimum requirements. The first mandatory task required that the students write a short Wikipedia article about rock carvings in the region (400–1,000 words). The main target group was other adults, but children could also use the article for more advanced readings about the topic. The students were also given links to two relevant Wikipedia articles with a similar topic that could be used as sources of inspiration. In addition, the guidelines reminded the students that they had to use references in the correct way: "(…) It is also important that you cite your sources in the proper way. Remember that your text should be written within the genre of an encyclopedia" (Guidelines from the course web page).[ii] The second mandatory task was that the students had to write a summary of their work on this assignment (approximately 500 words). The students were encouraged to use a wiki and Google Docs to

[20] See section 4.4.3, The workshop data (video and screen capture data), page 96.

write this reflection document. At this time it was assumed that the students would publish their final work on Wikibooks, but they ended up doing their work on Wikispaces instead.

As suggested in the first wiki assignment, the students were encouraged not to add a lot of text, images, and videos. It was more important to find a few examples of high quality. For example, if they found three similar videos about rock carvings, they should publish only best of the three: “As a rule of thumb, it is better to create some resources of high quality instead of publishing a lot of text and links of mixed quality” (guidelines from the course web page). In this way, the wiki resource would be different from other sites, which usually contain a compilation of videos of mixed quality. The students were also encouraged to focus on peer feedback and peer editing, which is more time-consuming: “For example, it is better if five persons review one paragraph to ensure that it is of high quality compared with letting every student write a paragraph that nobody reviews critically” (Guidelines from the course web page). The guidelines explain that text will usually need to be revised and reviewed before it achieves a high level of quality. Here the students were encouraged not to make a lot of contributions but instead aim to maximize the quality of a limited amount of content. Although the assignment period was short, the guidelines still encouraged the students to visit the local rock carving sites and take photos or make a video. In addition, the students were advised to contact libraries or museums.

The students also received specific advice on how to organize their collaboration. Although the students were free to organize themselves as they wished, some of the guidelines indicated a preference for dividing the tasks into small group work:

> Do you want to organize yourself in smaller groups that work with different tasks (for example author team, video resource team), or do you want to organize a team according to other criteria? Should the same person work with several different areas? Or should one instead work more freely with the wiki resource? Or should specific groups work with specific areas? Maybe a combination would be a good idea. There is no correct answer. (Guidelines from the course web page)

Although the guidelines state that there is no correct answer, they still point to the organization of work in “smaller groups.” Google Docs, Wikispaces, and Facebook are also mentioned as examples of tools they could use to support the ongoing project work. In a later paragraph, Google Docs is also recommended as a specific tool that can support project management:

> First you should agree upon a plan for how you want to respond to the assignment. When this is done, you can specify subtasks for the different students in the class. It is recommended that you create a Google document that all the students can use. Then you can divide the tasks synchronously during the meeting. (Guidelines from the course web page)

Note that the guidelines here even suggest that the students divide their tasks online. In addition, the guidelines recommend that the students explicitly address free rider problems and other typical threats to good group work:

> It will be a challenge to include everybody in the group work. Some may talk too much or make too many decisions, while others might do nothing. A typical challenge in group collaboration is the free rider issue. The group must take collective responsibility to create a good balance. Maybe the group should make an agreement or make some rules that include obligations for everybody. Then you can formulate how you want to divide yourselves into smaller working groups and how you want to choose a topic to work with. Everyone should have separate tasks. So it might be that somebody is responsible for coordinating the work instead of collecting the material. (Guidelines from the course web page)

Note here that the guidelines even suggest that the task of managing the collective work should be regarded as a separate task. This implies that one person should be responsible for this work and not the whole group. In general, the guidelines in this wiki assignment are quite prescriptive, with detailed recommendations on how to do the work.

4.2.3.3 The third wiki case

The third case in the current study refers to student group work with the third wiki assignment in the table. The students were given approximately one week to do the third wiki assignment (from Tuesday March 20th to Thursday March 29th). The aim with this assignment was to improve a wiki page about the "pedagogical use of wikis." It was meant to be a comprehensive resource that could support teachers who wanted to use wikis in their classroom teaching. Both the teacher and previous students in the course had previously done work on the page. It consisted mainly of traditional text with some images. There were also several external links to other web pages. From another point of view, this wiki work also intended to challenge the students to spend more time reflecting about their experiences with the first two wiki assignments.

The students also had to do this third wiki assignment as a whole-class project. Because the students had to edit only one wiki page, it was assumed that this would "force" the students to work even more closely together. It would limit their possibilities to divide the work into many small parts.

In the guidelines, it was explained that this would make it easier for students to help each other. The students were therefore explicitly not allowed to split up the quite long wiki article into several shorter separate wiki pages. The intention was to avoid a situation where the students would just divide the work into very small tasks without doing any synthesizing. Instead, the guidelines suggested that the students should optimize the text quality by letting someone do some writing, while the other could edit as the work unfolds through several stages of collaborative writing. The students were also encouraged to review how the wiki page was organized. However, the students were not given a lot of instructions on how to tackle the assignment. They could choose freely what kind of content they wanted to include. A few examples were mentioned, such as lesson plans with wikis, wiki user guides (screencasts), articles about the pedagogical use of wikis, or videos on how to use wikis in an educational setting, but this was meant to be a source of inspiration only.[iii] In addition, the final work had to be published on Wikibooks, but the students could freely choose which collaborative tools they wanted to use during the project work.

Furthermore, there was no specification in regard to the minimum or maximum requirements of the collective work. It was more important to ensure that the original text was accurate and of high quality instead of using time producing new text. However, the students had to write a short summary (approximately 500 words) on the wiki discussion page about how they had gone about the work.

4.2.4 The relevance of the cases for the sub-research questions

Each of these three wiki assignments can be regarded as separate cases that illustrate how students can produce collective knowledge together in a pedagogical practice in teacher education. All the cases are relevant for the three more specific sub-research questions that were formulated in the review (Chapter 0). The connection between the research questions and the wiki assignments are here described in more detail.

First, since the three wiki assignments challenge the students to make something of value to others, they all address the first sub-research question:

1. How does the value of student-produced collective work emerge in teacher education?

In the current study, the students not only met face-to-face in an offline setting, but they also published their work in global wiki environments like Wikibooks (first and third wiki assignments) and Wikipedia (second wiki assignment). In these environments, the student work can potentially be of authentic value for others outside the formal educational setting. *First*, the wiki products make it possible for others to reuse the student work. In the first and third wiki assignments, the students published their work on Wikibooks. This is an open textbook environment where anyone can make their own textbooks. Because the students' work is published with a Creative Commons license, anyone can freely reuse the open text without needing to ask for permission. In contrast, the reuse of a copyright-protected publication would have required permission by the original author.

Second, the wiki resources offered different types of multimodality. For example all the wiki assignments included links to video resources in different school subjects. They were considered to be an important supplement to the printed textbooks. For example, in the first and second wiki assignments, the students were encouraged to find links to new video resources. Although this work is not necessarily very difficult, one cannot expect that teachers will be interested in doing all of this work on their own, because it is time-consuming. The obvious advantage with a collective effort is that everybody saves time. If everybody does a small portion of work, the collective product might still end up being quite good and the individual burden of the work will not be so heavy. In the first wiki assignment, these efforts were primarily directed toward the evaluation of the quality of the existing video resources. For example, in the first wiki assignment, the student continued to improve different resource pages about music and science. The assignment gave the students experience with how digital text resources need to be revised and continuously updated.

Third, all the wiki assignments were openly accessible for others. By being published in online environments, it is likely that the work will be read. However, Wikibooks is far from

being as popular as Wikipedia, and there are no guarantees that the work will be read and used by others. Students were therefore required to also write a Wikipedia article about rock carvings in the second wiki assignment. This was done in an attempt to expose students to outsiders in the online setting and ensure that their work would be distributed to the general public.

Fourth, all the wiki assignments intended to strengthen the students in continuing to produce open resources as a part of their future professional work. This included letting the students reflect on the potential value of using both wiki and video resources in their own classroom teaching.

Furthermore, the three wiki assignments address the second sub-research question:

2. How does "students' shared responsibility" emerge in teacher education?

In accordance with this sub-research question, the students were challenged to manage a lot of the project work on their own in all the three wiki assignments. *First*, although the students received some instructions on how to do the assignments, the teacher's plan was to stay in the background during the project work. The term "mission" was used to strengthen the experience of this being something students had to solve by themselves. This idea was also similar to the emphasis on letting students develop collective ideas in a research team.[21] In the offline setting, it was important to break with the teacher-centered IRE-communication structure that usually dominates classroom teaching. According to Cazden (2001), the dominant structure of classroom talk can be described as a series of speech events through a sequence of acts, namely an initiation act (I), a response act (R), and an evaluation act (E). It is the teacher who initiates the question, a student responds, and then the teacher evaluates the response (Cazden, 2001). In the current study, the teacher would instead try to move into the background in the classroom as an offline setting. This would signal to the students that the teacher was not supposed to be the primary source of knowledge. The idea was rather to test students' ability to work together in "large, self-organized groups" with as little teacher intervention as possible.[22] Although the teacher had created the wiki assignments in advance, the students were expected to plan, organize, and finish the project work on their own. The only exception was a teaching assistant, who helped the students with different technical issues during the first workshop sessions.

Second, it was important to encourage the students to work closely together. A disadvantage with wiki work is that students usually end up working isolated from each other on separate wiki pages. As a result, there is little collaboration and many fragmented contributions that do not build on each other.[23] To avoid this, the first and third wiki assignments were redesigned so that a large group of students had to improve only one single wiki page. In the first wiki assignment, the students were to improve only four wiki resource pages. By narrowing down the range of topics, the plan was that this would facilitate close collaboration between the students. In the third wiki assignment, the whole class had to

[21] Read more in section 1.2.3, Students need to learn how to develop ideas together in large groups, page 4.
[22] Read more in section 1.2.3, Students need to learn how to develop ideas together in large groups, page 4.
[23] Read more in section 2.4.6, Summary, page 38.

improve just one wiki page. As a consequence, students could not freely choose their own wiki topic in these assignments.

Moreover, all the wiki assignments address the third sub-research question:

3. How does peer learning emerge in teacher education?

In accordance with the third sub-research question, it was important to let students collaborate together in new ways. *First*, the students were introduced to the potential power of working together in larger groups as a way of increasing the quality of the collective work.[24] In the offline setting, students were organized in groups that were larger than what they were used to. Two of the wiki assignments were therefore designed as whole-class-projects. The goal was to utilize this group size to create wiki resources of high quality. This was to be done by utilizing the individual expertise in these large groups instead of just focusing on the students' individual learning needs. As a new type of knowledge-producing skill, it was considered important to challenge students to produce and work with collective ideas.[25] However, in the first assignment, students had to collaborate in groups that were just slightly larger than the normal maximum size (with groups of 8 and 9 students). This group size was also important since it was assumed to give the students a "benchmark experience" on the influence of group size compared with working in whole-class projects. Although many assignments are done individually in teacher education, it is quite common to let the students solve assignments in smaller groups ("basic groups with four to five students"). At the local teacher education institution, it was normal that students worked in groups of four to five students. One reason was that previous research (the PLUTO-project) in Norwegian teacher education had found that collaboration between students in smaller groups (maximum 6 students) was important for student learning (Benan, 2003). These student groups are together both on campus and during the practicum period. The difference in the current study was that the students were challenged to collaborate in groups that were larger than normal.

Second, in an attempt to strengthen peer learning, the students were free to organize the peer feedback as they wished. Although several studies in the review recommend formalized peer assessment[26], it was considered to be more important to let the students decide how they wanted to give each other feedback and edit on each other's work.

Third, the students were expected to meet at least once on campus in relation to each assignment. Since a part of the project work was to be done in a face-to-face setting on campus, it was expected that the students would need to discuss different issues. The school table set up in the classroom on campus was therefore rearranged in an attempt to better support a closer "face-to-face" collaboration between the student teachers. Four different school table arrangements were tested in the five workshop sessions. All of them let students sit physically closer than normal to each other so it would easier for them to talk to each other. As such, the arrangements were significantly dissimilar from the traditional "bus

[24] Read more about this issue in section 1.2.3, Students need to learn how to develop ideas together in large groups, page 4.
[25] Read more about this issue in section 1.2.4, Two new core skills, page 5.
[26] Read more about this issue in section 2.5.1, Formal peer feedback, page 40.

row," which is set up as a "default arrangement" in most classrooms at the institution. The arrangement intended to communicate that student-student interaction was more important than student-teacher interaction.[27]

Fourth, it was also important that the students experience new types of peer learning in the online setting. One goal with the wiki assignments was to expose students to the power of being a part of a collective work that includes a large number of contributors in different ways. It is therefore important that students review the existing work that other students have already published. Instead of letting the students start from scratch and make a wiki page with only new links to videos, it is more important that students connect with previous students by continuing with their work. In both the first and third wiki assignments, the students were exposed to the potential power in collective work that goes on over years. By letting students write a Wikipedia article, they are also exposed to a more vibrant global wiki environment. It is possible that they could receive feedback from outsiders. This could potentially enculturate students into becoming members of the global knowledge-creating communities.[28]

[27] See more in section 4.3.2, The workshop setting on campus, page 80.
[28] Read more about this issue in section 1.2.2, Students need to learn how to participate in global online communities, page 3.

4.3 The research site

In the current study, it is also important to give a thick description of the teacher education context. According to Lincoln and Guba (1985), it is by giving a detailed description of a phenomenon that one can evaluate the extent to which the conclusions drawn are transferable to other times, settings, situations, and people. In this way, a thick description can be regarded as one way of achieving external validity. As described in Chapter 2, CKA is to be examined as a context-specific phenomenon that emerges among students in a historically constituted practice in a specific teacher education institution. Regarding this issue, the current study builds on the ideal of exploring a real-life context. As such, the empirical study investigates three different cases that are interlinked with each other, because it is the same group of students who do all three wiki assignments in the same course. It is therefore necessary to also describe the characteristics of the course where the wiki work is done. Accordingly, Yin (2009, p. 18) defines a case study as an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context. This is important when the boundaries between phenomenon and context are not clearly evident.

This chapter will therefore provide more detailed information on the research site. This includes a detailed description of both the course and the students in the teacher education context. The description of the course builds on written documents about the course. The information about the students is based on a small survey conducted at the beginning of the course.

4.3.1 The course

A course about educational technology was selected as the research site. Every spring term the teacher education institution offers this course as a part-time study (ECTS 15 credits). It is organized with two evening sessions every week that last from five to eight p.m. Preservice teachers can take the course as part of the initial teacher training program at the bachelor level, but there are also in-service teachers from primary and secondary schools who participate. Usually between 20 and 30 students take the course every year. To gain admission, students had to pass the introductory part of the course, which primarily offers individual training on different software skills. This introductory part of the course was also interconnected with the obligatory teacher training program at the institution, since students had to complete the assignments in the course to be certified as teachers.

The main objective of the course about educational technology is to develop students' digital competence and strengthen their ability to use information and communications technology (ICT) in classroom teaching. There is more focus on pedagogy compared with the introductory course. In several of the evening sessions, teachers from different schools in the region are invited to lecture about how to use ICT in innovative ways. Although the students are required to read literature from the syllabus, some of the classroom teaching is also orientated toward giving a “hands-on” introduction on how to use the latest digital technology in school. Even though there are a substantial number of traditional lectures in the course, most of the course activities centered on the different assignments the students were required to do. The classroom sessions are usually based on face-to-face meetings on

campus in a traditional classroom. However, the online course environment is built around open applications like blogs, Google Docs, wikis, and YouTube. They are used as alternative applications instead of the traditional learning management system where the access is more restricted. Most of the student work is also published openly after the students have finished their assignments.

One important reason why this course was selected as the site of inquiry was because the course objectives support the experimentation of new pedagogical practice. It was expected that the students who participated in this course would be more open to new and unusual learning activities compared with other courses in the teacher training program. Several of the assignments highlight the testing of new technologies and new instructional designs. The assignments in the course have been revised many times over the years. As the course is not a mandatory part of the teacher training, it is not a big issue designing assignments that might fail.

When the current study was conducted, two teacher educators were responsible for the course together, but they had split the responsibility for the assignments. One of the teachers was responsible for the first and third assignments, while the other teacher was responsible for the second assignment. Since there were so few teacher educators involved in the course, it was also easier to design new and very different assignments without the risk of being stopped by more conservative colleagues.

In the course design in 2012, the students were required to do three different obligatory assignments. In the first assignment, each student had to make a digital story about a topic relevant for a school subject. In the second assignment, a group of two to five students did an international project that required online collaboration with students abroad. It is the third assignment that is under investigation and that requires that students collaborate with each other using wiki technology. Furthermore, this wiki assignment was split into three smaller wiki assignments. This research study is primarily orientated toward these three wiki "sub-assignments." In addition, the students had to write five individual blog posts about course-relevant topics. One of these posts had to be about the wiki work, but the students could write this post together in groups.

The three major assignments in the course (1. Digital story, 2. International collaboration, and 3. Wikis) counted in total for 30% of the final grade, while the final individual oral exam counted for 70% of the grade. In all the three wiki assignments, the student groups would receive a group grade for their work. In the first wiki assignment, the students received different grades depending on which of the four groups they were a part of. However, in the second and third wiki assignments, all the students in the whole class would receive the same grade. While it is not uncommon to give group grades to smaller groups of students, it is rare in whole-class projects. The students would then individually receive a "wiki grade," which was estimated as the average of the three group grades from the three wiki assignments. However, this "wiki grade" has only a minor impact on the final total grade. First, the "wiki grade" counts for only one-third of the total portfolio work in the course. In addition the total portfolio counts for only 30% of the final grade, while the final oral exam counts for 70%. As such, the wiki assignment counts for about 10% of the final grade. Each of the three wiki sub-assignments counted for only approximately 3% of the total grade. One

could therefore claim that the assessment system still relied heavily on the students' individual performance. However, the first part of the final oral would center on students' reflections on their work with the different assignments in the course.

4.3.2 The workshop setting on campus

In *the first wiki assignment,* two groups of eight and nine students met once face-to-face on campus to do the project work. The students were positioned around a rectangular-shaped school table formation. The two images below show the table formation used in the classroom in this first wiki assignment.

Figure 4.3-a The table arrangement in the first wiki assignment.

Image I—An overview of the whole classroom (Date: March 6th, 2012).

Image II—Students sitting around the table in the first wiki assignment (Date: March 6th, 2012).

Image I gives an overview of the whole classroom where the students worked on the first wiki assignment. The table arrangement was the same for both the science and the music groups in the first wiki assignment. The encircled area in the image shows the position of the table arrangment where the students sat during most of the workshop session. The table is positioned in the middle of the classroom. Tools that that can support plenary reflection, such as the whiteboard and the computer (which gives access to the projector) are placed quite far away from the table alongside the wall to the right in the image. Image II shows the group of students who worked with the music assignment sitting around the table. This image zooms in on the encircled area above.

In *the second wiki assignment,* the whole student group met two times on campus in different classrooms. The images below show the classrooms they used.

Figure 4.3-b The table arrangement in the second wiki assignment.

Image I—Classroom used in first workshop related to the second wiki assignment (Date: March 13th, 2012).

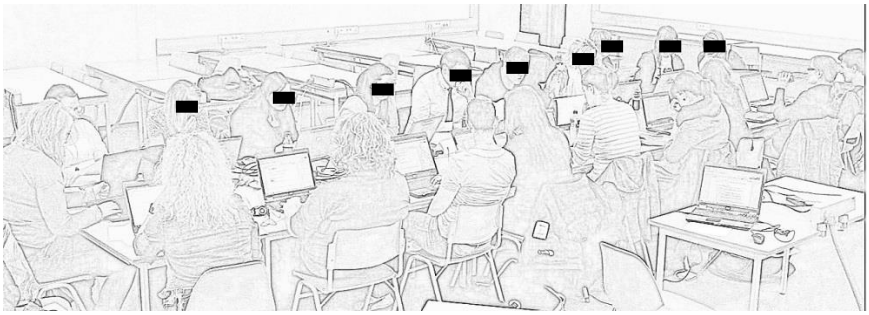


Image II—First workshop related to the second wiki assignment (Date: March 13th, 2012).

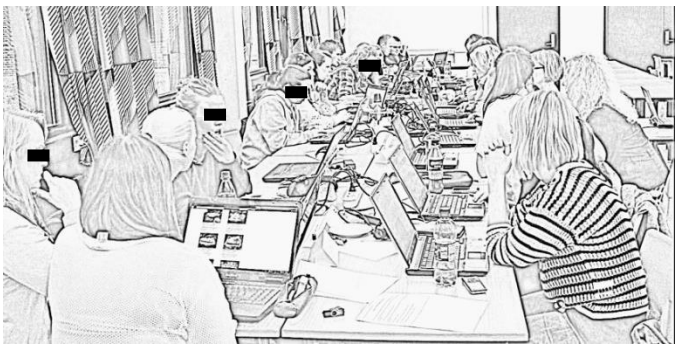


Image III—Second workshop related to the second wiki assignment (Date: March 20th, 2012).

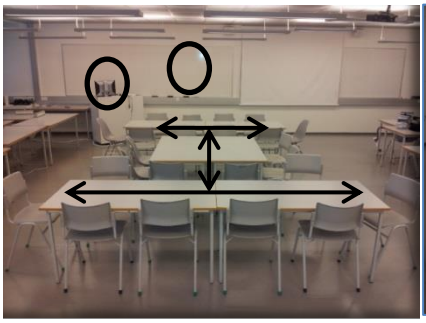
Image I is taken from the classroom where the students had their first workshop in relation to the second wiki assignment. The photo is taken from the rear end of the classroom before the tables were rearranged. The classroom is normally organized in a “bus formation”, where students sit behind each other in several rows of tables, and the students are faced toward the teacher. The two other images show how the students sat together during the two workshops, which were held in two different classrooms.

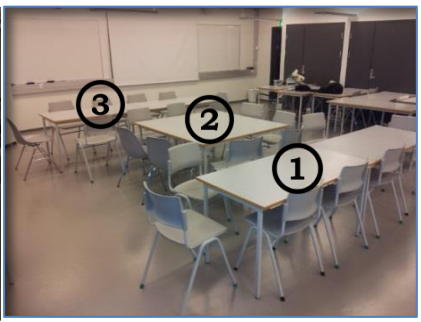
Image II is from the first workshop related to the second wiki assignment, and Image III is from the second workshop when a different classroom was used. In both workshops, the students are sitting in a redesigned "rectangular-shaped" table arrangement. Note also that the tables are positioned in the rear (far) end of the classroom in the second workshop.

This table arrangement aimed to strengthen the students' experience of being in a whole-class project together with all the other students. In the first workshop, the students used time organizing the project, whereas in the second workshop they used time finalizing the work. Note also that the student faces are not turned toward the teacher, but rather toward each other. Most of the students have brought their own laptops, and a few use pen and paper.

In *the third wiki assignment,* the students met once on campus. The images below show the workshop setting where the students worked on this assignment.

Figure 4.3-c Three images of the table arrangement in the workshop related to the third wiki assignment.





Images I and II—Classroom used in workshop related to the third wiki assignment (Date: March 29th, 2012).

Image III—Students working with third wiki assignment (Date: March 29th, 2012).

The two images above (I and II) are taken from slightly different angles at the far end of the classroom. The table arrangement consists of three table areas that are close to each other (see the different numbers marked on the table areas on the image at the right). The physical learning environment was rearranged with the intention of better supporting collaboration in the whole-class project. Because the teacher felt that the level of plenary communication was not optimal with the table arrangements in the second wiki assignment,

a “H-formation” was designed in the third wiki assignment (see the different arrows on the image at the left). The goal with this table arrangement was to better facilitate verbal communication between all the students. Notice also that the students are sitting closer to the whiteboard and the classroom computer compared with the first and second wiki assignment (see encircled areas in the image at the left).

This image (III) is taken from the corner in the front of the classroom. Note that the students are sitting around three smaller table arrangements. The students at each table arrangement are sitting with their faces toward each other.

4.3.3 The students

In total, 24 students undertook the third wiki assignment in the course “ICT for teachers” in spring 2012. There were four male and 20 female students. An anonymous questionnaire was used at the beginning of the course to gather some more background information about the students.[iv] Three-quarters of the students were between 20 and 30 years old, while one-quarter were above this age. Seventy percent of the students had not yet finished their initial teacher training, while 30% were practicing teachers. Most of the in-service teachers are primary school teachers.

A survey at the beginning of the course revealed that almost all the students reported that their main expectation was to learn more about how to use ICT in classroom teaching. Both preservice and in-service teachers shared their expectation for practical “hands on” training in how to use different digital tools. However, there was a large variation as to which school subject the students were interested in. A major instructional challenge in the course is to make it relevant for all the students.

Second, all the students were high-frequency users of computers. Almost all of them reported that they use the computer several hours every day. This includes more than one hour each day for leisure activities. In addition all the students reported that they had a Facebook account. Three of four students checked their account several times daily, while the rest checked their account weekly.

Third, the students had received little wiki training in advance. Although the students had finished the first part of the course, they had not done any obligatory assignments on how to use wikis. As already mentioned, a basic requirement to start the course is that one needs to have passed the first part, which emphasizes basic digital skills. Although this course had 10 obligatory assignments, none included the use of wikis. As a consequence, only a few students knew how to use a wiki in advance. In the preliminary survey, only five of 27 students reported that they had written text in a wiki before. It was therefore expected that some students might have some initial problems using the wiki (e.g., MediaWiki), because it requires some simple coding skills. Another difference was that the time lapse since the students had finished the introductory course on the “Basic Use of ICT” varied among the students. Some had just recently finished this part of the course, while others had taken it several years ago. As a result, some students also did not know how to use other digital tools like Google Docs.

Moreover, none of the students received any specific initial training on team skills or how to collaborate in whole-class projects. They were expected to learn this on their own with little intervention from the teacher. They also had not received any explicit training in how to use wikis; they were just provided links to screencast videos, and then they were to learn wikis on their own.

In addition, one should note that the attendance at these evening sessions was normally quite low. Since the course is offered in the evening, the students are usually a bit tired. The in-service teachers have been working all the day, while most of the preservice teachers have been attending other courses during the daytime. The students are not required to meet at the evening sessions. Usually, about half of the students attended the lectures. This indicates that quite a lot of the students did not give the course top priority. Some of the preservice teachers were perhaps more focused on doing their obligatory assignments and getting the credit points with a minimum of effort. However, most of the students showed up for the workshop sessions related to the wiki assignments.

4.4 Data collection

4.4.1 Introduction

In accordance with a case study approach, it was important to collect multiple sources of evidence (Yin, 2009). One of the main challenges in the current study is to organize the large variety of complex data in such a way that they can be used to answer the research questions. As such, the group interviews are given status as primary data in the current study, because they can be used to address all the three different sub-research questions (1. The value of student work, 2. Students' shared responsibility, 3. Peer learning). They also give information about the students' work from the entire project work period. The disadvantage is that these data provide limited information about the details of the interplay between an offline and an online setting. To answer the main research question, it was therefore important to supplement the interview data with other data that could provide richer descriptions of this specific type of interplay.

Furthermore, the review shows that few wiki studies collect enough data from both an online and an offline setting to make it possible to analyze "the interplay" itself in any detail. This also requires the collection of a substantial amount of data from the online setting. In the current study, this includes the use of both wiki log data retrieved from the wiki pages and screen capture data from the workshop setting ("workshop data"). The wiki log data are used to obtain more information about the students' work over longer time periods. This includes the workshop periods, the course period, and what happened to the work after the students finished the course. In addition, these data are used to "frame" the analysis by providing an extensive qualitative description of the final student wiki products.

The screen capture data refer to the screen data collected while the students are using their laptops during the workshops. These data from the laptop screens give information about how the online setting interplays with the offline setting in the workshop periods. One garners information about how different digital tools are combined and used to support collective work in a face-to-face setting in different ways. While the wiki is the main digital technology, students are also encouraged to use other synchronous tools like Google docs. While some of the studies in the review have used wiki log data, none have collected information from the ongoing student work as screen capture data. As a consequence, most studies do not have the type of data necessary to study the interplay between an offline and an online setting in a successful way.

In addition, the audio recorder from the laptop screens gives data from the verbal interaction in the smaller groups in the offline setting. However, the limitation is that the researcher cannot see the off-screen factors that influence the on-screen work. For example, it is not possible to see exactly where on the screen the students are looking. Without eye-tracking technology or video data of head movements, it is difficult to get information on where the students are looking on the screen. However, the dialogues from the audio recording data from the laptop will give a lot of indirect information about how the person is using the screen, such as if the student is reading aloud information from the screen. The students' use of cursors also gives an indication of what the students are looking at.

Nor does the screen capture data provide any information about additional physical artifacts in use (e.g., pen, paper, documents, and textbooks). Supplementary video data can provide such information, but in many of the workshops it is not possible to place one camera close to all the students. Instead the video camera is positioned so that it can capture all the students while they are working. The primary aim is to give an overview of how the students are collaborating together in the five sessions. Depending on the position of the video camera, it is only possible to observe some of the students closely who are sitting close to the camera with their faces directed toward it. To some degree the use of only one video camera limited the amount of data about how students used the other physical artifacts. The table below gives a "rough" overview of how the different data types are used to address the three sub-research questions.

Table 4.4.a An overview of the connection between the sub-research questions and the different sources of evidence.

Sub-research question	**Sources of evidence**
1. The value of student work	- Group interviews - Wiki log data
2. Students' shared responsibility	- Group interviews - Workshop data (Video data and screen capture data)
3. Peer learning	- Group interviews - Workshops data (Video data and screen capture data) - Wiki log data

As we can see from the table, the interview data will be triangulated with workshop data in relation to all the research questions. The sources of evidence are different in the way that group interviews can be regarded as perceptual data and the workshop data (video and screen capture data) can be regarded as observational data, while the wiki log data can be regarded as text data. Regarding the value of the student work, the wiki log data are important, because the text data provide more information about this issue. Regarding the second question about students' shared responsibility, the workshop data are especially important, because most of the important decisions were made in the workshop periods. In relation to the third question about peer learning, the combination of both workshop data and wiki log data is useful. The screen capture data can provide detailed information on peer learning as a micro interaction, while the wiki log data provide information about peer editing over a longer timeline.

The different data sources also cover different timelines of the wiki-mediated group work. First, the wiki log data are used to describe the longer timelines, such as the evolvement of the student work within the timeframe of the workshops, the project period, and also the years after the course has ended. Second, the workshop data (video and screen capture data) cover the timeline within the workshop period. Special analytical attention is here directed toward micro interactions within a period of a few minutes or even a few seconds. Third, the group interviews give information about the entire project work period from the perspective of the students. In this way, the different types of data also supplement each

other, because they cover different timelines. This is important when the aim is to better understand the interplay between the offline and the online setting.

These timelines are organized a bit differently from what is common in CHAT-inspired multilevel methodology. For example, Moen, Mørch, and Pavoola (2012a) recommend research strategies that combine micro, meso, and macro levels, with each having different temporal and spatial qualities. First, the micro-level data focus on actual interactions in knowledge-creation processes. Second, the meso-level data represent a series of interactions and productions as parts of evolving trajectories of participation in knowledge-creation processes. Third, the macro-level data target broader historical and/or institutional perspectives (Moen et al., 2012a). The analysis in the current study will mainly cover the micro and meso levels. Although the wiki log data cover longer time periods, this should be interpreted as an evolving trajectory of knowledge production. One important reason is that it is assumed that CKA is connected to a new pedagogical practice that, to a lesser degree, is part of the existing socio-historical practice.

It is the combination of group interviews, workshop data, and wiki log data that provides the rich information about the complexity of the students' group work. It is only when all these different data sources are analyzed together that it becomes possible to study interaction as semiotically rich units that build on artifact-based learning activities in the interplay between an offline and an online setting (e.g., reading, talking, listening, observing, and acting). In the following sections, the advantages and disadvantages of the different data sources will be presented and discussed in further detail.

4.4.2 Group interviews with the students

4.4.2.1 The specific type of group interviews in this study

In the current research study, group interviews were chosen instead of individual interviews. The main relational challenge in group interviews is that the interviewer is not only a researcher but also the students´ teacher.[29] There is a risk that this can create a more asymmetrical relationship than normal, which has a negative influence on the conversation. One way of avoiding this scenario was to not do individual interviews. It was assumed that the students would feel more comfortable in a group setting. Focus group researchers have also pointed out that this method can increase participation from persons who do not like being interviewed alone or who think they have nothing important to say. Some persons may experience individual interviews as too formal or scary. It is then easier and safer to talk about sensitive or difficult topics together with others who are in a similar situation (Kitzinger, 1995; Liamputtong, 2011). Kitzinger (1995) claims that it is wrong to assume that groups are less able to discuss sensitive topics. Rather, less inhibited participants may break the ice for shyer participants, and participants can support each other in expressing controversial feelings that deviate from the mainstream culture or from what they think the interviewer expects of them.

[29] The person in charge of the group interviews will be described as interviewer and not moderator. The double role of being both teacher and researchers is discussed in section 4.7.2, page 126.

As a data source, the group interviews are very important, because they are used as a primary data source in the triangulation of data in the empirical analysis.[30] Fontana and Fry (2008, p. 126) define group interviewing in the following way: "Group interviewing is essentially a qualitative data-gathering technique that relies on the systematic questioning of several individuals simultaneously in a formal or informal setting." The main goal with group interviews is to collect rich data about how the students experienced the project work. This was important, since the students were expected to work together in new ways in the teacher education context. The students were therefore given the opportunity to talk more about specific episodes from the workshop sessions. They could to some degree decide what incidents they wanted to talk about. Likewise, other researchers claim that one of the main advantages of group interviews is that the interaction often produces a rich understanding of the participants' experiences and beliefs. This is why group interviews are particularly suitable if one wants to explore complex issues where participants have diverse understandings. The groups can even potentially co-construct new knowledge and ideas through their sharing of experiences, and multiple perspectives about a topic are generated (Currie & Kelly, 2012; Gibbs, 2012; Gill, Stewart, Treasure, & Chadwick, 2008; Liamputtong, 2011).

In the current study's interviews, the students chose to show up in six different groups ranging in size from two to five students. In total, 20 of the 25 students participated in the group interviews. The table below gives an overview of the sizes of the groups and how long the interviews lasted.

Table 4.4.b Overview of the sizes of the groups and how long the interviews lasted.

	Number of students	**Approximate duration of interview**
Group interview 1	2 students	20 minutes
Group interview 2	5 students	30 minutes
Group interview 3	3 students	30 minutes
Group interview 4	4 students	40 minutes
Group interview 5	2 students	60 minutes
Group interview 6	4 students	30 minutes

The interviews were conducted approximately one month after they had finished all three assignments related to the project work. This was one month before their final oral exam. This made it possible to use the group interviews to cover the whole project period, as the workshop data covered only a part of the collective work in the offline setting. All students who had participated in the course were invited to participate in a group interview. Since the students in the current study ended up doing quite a lot of the work in smaller groups, it was regarded as relevant to organize the interviews in groups of similar size. However, the students were free to decide who they wanted to do the group interviews together with. According to Currie and Kelly (2012), group interviews are different from focus group discussions, because they recruit participants from naturally occurring groups. Interviewing can occur in a field setting such as a classroom, and participants will often be homogeneous

[30] See section 4.5, Data analysis, page 106.

in regard to specific characteristics or experiences. Likewise, in the current study the students were selected from a natural setting. They were also homogenous in the sense that they had all participated in the project work.

Concerning group size, there is some disagreement concerning the minimum amount of persons in a group interview. The group size in the current research study is smaller than what is common in focus group interviews. According to Gill et al. (2008), the optimal size for a focus group is from six to eight participants, but groups can also be successful with as few as three or as many as 14 participants. Similarly, Gibbs (2012, p. 188) recommends between four and 12 people in a focus group. The disadvantage with large groups is that they can become too chaotic, because group management becomes more difficult. Participants may also become frustrated because of less talking time. On the other hand, the risk with small groups is that there will be no discussion at all. This is why some of the methodological literature recommends that participants be over-recruited so that the group does not end up being too small (Gill et al., 2008). However, there are examples of researchers who have done group interviews with only two participants (Gibbs, 2012). One example is a study by Currie and Kelly (2012) who explored friendship by interviewing pairs and trios together. For example, these pairs would even correct each other's versions of what really had happened. Frey and Fontana (1991) also claim that it is possible to do group interviews with as few as two persons. The distinct characteristic will still be that participants need to have more control over the direction of the talk compared with an individual interview. The experience from the group interviews in the current study is that it was more difficult to facilitate a discussion between only two students.

Furthermore, the interviews lasted from approximately half an hour to one hour. In comparison, this is a slightly shorter time period than what is recommended in focus group interviews. For example, Gibbs (2012, p. 188) suggests that the interviews should be between 45 minutes and two hours. One reason why the interviews were shorter here is because the groups were smaller than in focus groups. As the table above shows, there are also significant variations in the length of the interviews. The length was dependent upon how much the students had to discuss about different issues. In some of the interviews (e.g., group interview with 2 students lasting 60 minutes,) the interviewer also used more time talking about the project and some other issues related to the course. This may have created some bias. For example, Gill (2008) warns the interviewer (or moderator) against getting too involved in the conversation, because one may then give participants cues as to what they "should" say (introducing bias) rather than giving them confidence to be open and honest about their own views. Williams and Katz (2001) also suggests that the interviewer not try to educate the research participants or attempt to resolve any conflicts. In the current study, this was a challenge in some of the interviews, since the researcher was also the participants´ teacher. On the other hand, when the interviewer also made some comments, this appeared to create a more informal atmosphere. Since most of the groups showed openly that they were quite critical toward the project, it is not likely that this approach created more bias directed toward praising the course. On the contrary, the interview relationship suggests that the students were comfortable in raising critique. Although most of the participants were cautious about criticizing the teacher, they mentioned several aspects related to the course work

4.4.2.2 The students chose their own groups

The students could choose their own group for the interview. This increased the likelihood of students showing up with others they could trust. It was important that the students feel comfortable with each other during the interviews. Similarly, Gill et al. (2008) suggest that there is no "best" solution to the mix of ages, sexes, and participants' social backgrounds, but one needs to consider the possible impacts of the specific group mix in advance. Group interviews will fail if participants are uneasy with each other and do not want to discuss their opinions openly. In the current study, it was assumed that a good relationship between the students would strengthen the quality of the interaction. As such, most of the students showed up with the persons they had collaborated with in the smaller groups in the whole-class project. In four of the groups from the interviews, the students had also collaborated together in the first wiki assignment (GI 3–6). One exception was the second group (GI 2), where one of the students had not collaborated with the other students in the first assignment. The other exception is the first group (GI 1) where the students had not collaborated in the first wiki assignment but had in the second assignment. Another deviation from the norm was that a group of five students who had done a subtask together in the second wiki assignment preferred to show up in two separate smaller groups with two and three students (GI 3 and GI 5). One reason may have been that they did not collaborate very closely during the project work and that they had also experienced some conflicts. This shows that students who could potentially disagree with each other preferred to not show up in the same group.

Likewise, other focus group researchers recommend the use of relatively homogeneous participants, because it is more likely that they will be comfortable speaking with each other. Interviewees should share the same social and cultural experiences that are under investigation. It can therefore be relevant to interview an existing group, such as people who already work together. Friends or colleagues will be more able to relate each other's comments to incidents in their shared daily lives. Moreover, they will challenge and disagree with each other more often. If participants are familiar with each other, this will usually stimulate the discussion, but there is also a risk that it can close off the discussion (Kitzinger, 1995; Williams & Katz, 2001). Gill et al. (2008) also claim that it is usually easier to recruit pre-existing groups. They will usually share the same experiences and probably be more comfortable with each other. It will then be easier for the participants to challenge each other.

Letting students organize the groups themselves also reduces the problem with hierarchy relations in the groups. This could have potentially become a problem in the interviews since the students felt that there were two sub-groups in the course, one group of in-service teachers and one of preservice teachers. Some of the statements in the group interviews showed that some of the preservice teachers experienced feelings of inferiority in relation to the in-service teachers, because the latter were older had more professional work experience.[31] However, this did not become a big problem, since most of the in-service teachers showed up together in the same group. Likewise, focus group researchers have found that hierarchy relations in a group may inhibit the discussion (Kitzinger, 1995)}(Williams & Katz, 2001).

[31] See more in section 7.2, The size of the group has an influence on peer learning, page 204.

4.4.2.3 About the interview guide and the interview conversation

In the current study, the interview guide was designed as a loose schedule of topics to be discussed. Eight general questions were included in the interview guide.[32] These were created in advance and were posed to all the students. Three of the general questions were specifically related to the educational use of wiki technology. Three additional questions were also indirectly related to wikis through a focus on the potential of open sharing, collaborative writing, and the use of sources. One question was related to project management. Not all the general questions were posed directly to the students but were rather used as reminders of topics of interest the group interviews should cover. Some of these general questions were followed up on if the students did not bring them up but not necessarily all of them. It was regarded as more important to follow up and stimulate the students to elaborate more on their own comments. In this sense, the conversation was loosely structured. It was important to create a spontaneous and informal atmosphere and let the students decide what direction the conversation would take. The majority of the questions were follow-ups to what the students were talking about. The goal was to stimulate further elaboration around the topic by posing new open questions to the group.

In addition, student blog posts were used as "mirror data" in the group interviews. The main goal was to follow up on reflections students had already made. During the project work, small groups of students were required to write one comment about their ongoing work with the wiki assignments. Part of the interview guide consisted of selected statements from some of these different blog posts.[v] The students were encouraged to give further comments about what they had written. In the interview setting, these statements were presented to the group on separate slides on a projector so the students could read them. These quotations were somewhat different depending on what blog posts the specific group in the interviews had posted. These quotes were related to the more specific tasks the smaller groups of students had worked with. The goal was to stimulate the students to continue to reflect upon the tasks they had completed.

The use of blog posts also aimed to strengthen the student perspective. The blog posts aimed to "trigger" further discussions of the topics the students had brought up. The goal was to stimulate further reflection and make it easier for students to remember specific incidents in more detail. As suggested by Currie and Kelly (2012), this use of group interviews can help participants recall and elaborate on previous incidents. The group dynamics can stimulate the participants' ability to recall specific events and encourage elaboration beyond what would have been possible in one-on-one interviews, and issues that were not anticipated could be brought up.

The blog posts were considered to be less "biased" by the researcher's choices than video data. Because of time limits, the video data would have required that the researcher select only a few excerpts. In using blog posts, a large part of the existing content could be included. Special priority was given to presenting posts that revealed tensions likely to stimulate further group discussion. Even though the researcher had to select excerpts from some of the blog posts, the point was to direct the conversation as little as possible. In addition it was assumed that it would have been more time-consuming to prepare the video

[32] See Interview guide in Appendix 2.

data for the group interviews compared with the short blog posts. It was important that the students continued to reflect upon what had happened by using their own words. Likewise, focus group researchers emphasize that the conversations can move in new and unexpected directions by letting the participants use their own vocabulary, generate their own questions, and pursue their own priorities. The interaction can help participants explore and clarify their own views in ways that would be difficult to obtain in conventional individual interviews. In this way, the interview data can be used to generate new hypotheses and develop new concepts (Kitzinger, 1995; Williams & Katz, 2001). Although it is quite common to present a series of statements on large cards in focus groups (Kitzinger, 1995), it is rare to use statements that the group has created.

Furthermore, because the interview guide was short, most of the questions from the interviewer sought to clarify issues students were already talking about. The intention with these follow-up questions was to stimulate the students to reflect more upon the topic. It was important to build on the student perspectives as much as possible. Likewise, other focus group researchers claim that the interviewer needs to be able to listen, probe, and direct group interaction to maintain the energy within the group. The interviewer can encourage the participants to discuss inconsistencies in their own thinking or between the participants by asking for clarifications. This requires that both the interviewer and the participants are able to listen carefully to each other (Kitzinger, 1995; Williams & Katz, 2001).

The interviews were conducted as open and informal conversations, where students were allowed to interrupt and disagree with each other. The interviewer encouraged the students to elaborate on others' comments and be critical toward the project. This was important to be able to develop new and better designs based on the wiki assignments. On the other hand, the group interviews were also quite similar to a traditional individual interview in the way the interviewer directed a large part of the conversation. However, one should note that the students also sometimes posed questions to the interviewer about the project, because he was a teacher. Nevertheless, most of the time the students expected the interviewer to initiate and direct the conversation. In the larger groups in the interviews, there were some discussions between the students, but in the smaller groups the students primarily answered questions posed by the interviewer. The smaller groups would usually agree more quickly and wait for new questions from the interviewer. Regarding this issue, the group interviews were different from most focus groups, as researchers recommend that the moderator should be careful not to direct the discussion too much. For example, Gill et al. (2008) suggest that the moderator keep the discussion focused without leading it.

Likewise, the methodological literature claims that one important difference between group interviews and traditional individual interviews is that the interview guide is usually looser. For example, it is not common that all the questions in the interview guide are covered. This is why the general rule of thumb is "the fewer the questions the better." One should have less than a dozen predetermined questions. It is more important that the interviewer probe and expand on issues according to the discussion (Gibbs, 2012) (Gill et al., 2008). Compared with individual interviews, group interviews will more often move into areas that have not been anticipated by the researcher. A skilled group interviewer will manage to follow up on these topics and also bring the discussion back to the main points in the interview guide. A rule of thumb is that the questions should move from the more general to the more specific.

The order of questions should also be relative to the importance of the different issues. However, discussions will often take on a life of their own, which influences this order (Gibbs, 2012) (Gill et al., 2008).

In the group interviews in the current study, the aim was to create a spontaneous and informal conversation. This is why the interviewer did not select the persons who were allowed to speak. The conversation was instead more similar to an informal conversation where anyone could speak whenever they wanted to. The researcher did not put forth any extra effort to involve respondents who were silent (except by sometimes asking if other students in the group agreed or disagreed with what was being said). As a result, some students talked more than others in the group interviews. However, because the groups were so small, all the students would usually make some contributions to the interview. Although there was variation in how much the students spoke, there were no groups where it was experienced as a problem that one student was too dominating. Likewise, focus group researchers claim that it is important to avoid letting a few persons dominate the discussion. Instead one should encourage shy participants to contribute (Fontana & Frey, 2008) (Williams & Katz, 2001). It is a challenge when certain participants do not contribute to the group discussions while other students dominate the discussions too much. The presence of some group members may result in others feeling too intimidated to speak. Some students may also choose to simply conform to the dominant ideas present in the group (Liamputtong, 2011). However, there was a risk that by directly posing questions to specific students in this study, one could easily reinforce the "classic" student-teacher interaction, which can have a negative influence on the group dynamics. However, because the small groups sometimes reached an agreement quite quickly, the interviewer may have lost some information related to potential disagreements by not challenging the students more.

4.4.2.4 Avoiding threats against the validity (bias)

One obvious threat against validity in this research study is that the interviewer and the teacher are the same person.[33] This may result in students exaggerating their positive opinions about the project to please the teacher. The interviewer used several strategies to reduce the possibility of creating this kind of bias. First, at the beginning of the interviews, the students were informed that the interviewer would not be involved in the formal assessment of the students' project work. In this way, the students could criticize the project work without risking any negative consequences. The interviewer also told the students that they should look upon themselves as "co-researchers" and that their opinions really mattered. They were encouraged to be honest about the main challenges of and possible improvements to the wiki assignments. Likewise, other focus group researchers have found that research participants often enjoy discussing topics and feel empowered if they are allowed to be active in the interviews (Gibbs, 2012; Kitzinger, 1995).

Second, the teacher tried to create a good relationship with the students during their project work. For example, he made coffee for the students in an attempt to make them feel more comfortable. Moreover, the teacher did not get upset when the students criticized the

[33] Read more in section 4.7.2, The double role of being both teacher and researcher, page 126.

project work in the fifth workshop session.[34] Instead, he tried to show that he was grateful for these critical comments. One important advantage was that the interviewer did not have to spend extra time to establish a good relationship with the interviewees. Most focus groups researchers emphasize that the interviewer or moderator needs to have good interpersonal skills that can create a comfortable situation. The interviewer needs to be confident and comfortable about managing the participants (Gibbs, 2012; Gill et al., 2008; Kitzinger, 1995; Liamputtong, 2011; Williams & Katz, 2001). The reason for this is that a good discussion is reliant on a non-threatening environment where participants feel free to discuss their opinions and experiences without fear of being judged or ridiculed (Liamputtong, 2011). The participants must feel at ease in disclosing specific information to the interviewers and the others in the group (Williams & Katz, 2001). Also, the students were comfortable with each other, because they knew each other from before.

Third, compared with a moderator in a focus group, the interviewer in the current study directed more of the process and asked questions more frequently. In some of the interviews, this was necessary to drive the conversation forward and maintain the energy. However, Currie and Kelly (2012) claim that these data are still not more "naturalistic" or "valid" than other kinds of data. The data need to be regarded as co-constructed through interviews in a context-specific activity. One should also note that group interviews will inevitably interfere with individual expression (Fontana & Frey, 2008). For example, Williams and Katz (2001) claim that focus groups will give more superficial biographical information compared with individual interviews. One threat is "groupthink," which results in students not disagreeing enough with each other (Fontana & Frey, 2008). However, because the groups were small in the current study, the students were provided with more individual talking time compared with what is usual in focus groups.

Fourth, the interviewer tried to avoid being more positive toward students who were more positive toward the project work. Alternatively, when students were critical, it was viewed as important to address these issues with interest. On some occasions, the interviewer even tried to show observable positive interest in students' critical comments. This was important to give the research participants the feeling that honesty was valued. Sometimes the interviewer would reflect upon his own role as a teacher to model an open and critical atmosphere. However, it was still important not to favor any specific opinions about the project work in the group discussions. Likewise, Gibbs (2012, p. 188) claims that it is important that the moderator tackles conflicts and stimulates discussions without being judgmental. The main goal was to facilitate an open conversation with the students about what they liked and what they found challenging in the project work.

In addition, the interviewer participated by making a few comments during the interview. This was done in an attempt to strengthen the informal atmosphere in the interview setting. Similarly Gill et al. (2008) claim it is important to be yourself when you are a moderator in focus group interviews. By being comfortable and natural, participants will feel more relaxed.

[34] See excerpt in in section 6.8, The problem with unequal contributions, page 182.

Fifth, a less formal meeting room was chosen instead of the classroom as the venue for the interviews. It was assumed that being in a classroom might strengthen the feelings of asymmetry in regard to the interviewer, who usually was a teacher in the same classroom. For example, Gibbs (2012, p. 187) claims that it is important that the interviewer sit down around the table together with the students with the intent of signaling a symmetrical relationship with them rather than a subordinate relationship. Gill et al. (2008) also find that it is important to choose a venue at the school that is comfortable and free from distractions. The advantage with choosing the school as a venue is that it may encourage attendance, but the risk is that the participants will behave more as students.

Sixth, at the beginning of the group interviews, the interviewer (or moderator) informed the students about the presence of the audio recording equipment. Participants were assured about their confidentiality, and the students were given the opportunity to withdraw at any time. The interviews were just audio-recorded, because it was considered less intrusive than using a video camera. According to Gill (2008), focus groups are seldom videotaped, because one needs two cameras to capture the whole group interaction. Furthermore, the participants may experience the video camera as obtrusive, and it may affect the spontaneity of the conversation in a negative way.

Small audio recorders were used so that they would be experienced as discrete when placed on the table in front of the students. However, the disadvantage here is that it was sometimes difficult to distinguish between the different voices in the conversation. For example, Gill et al. (2008) recommend the use of good quality multi-directional external microphones in group interviews to cope with the variation in volume among different speakers. Nevertheless, the sound quality was good enough during most of the group interviews. Most of the interviewees had distinct voices. However, the sound quality was a bit poor in one of the larger student groups where there was more overlapping talk. However, this was not a big problem, since the analysis of the interviews would only to a small degree focus on specific persons in the interview.

Overall, the statements in the group interviews indicated that the students were able to support each other when critical issues were shared. This shows the presence of openness and honesty in the interview situation. If they wanted to, the students could even prepare critical remarks before the interviews. There is no reason to believe that the students who did not want to participate in the interviews declined to do so because of any discomfort. In general, one could claim that a large number of students showed up considering that they did not get anything in return for their participation. Another question is why the students were somewhat more critical in the interviews compared with what the data from the workshops sessions showed. One reason may be that the students found it more difficult to be openly critical while the project work was ongoing. When the video cameras were on, students might have had a stronger feeling of “sabotaging” the project if they stopped the work to raise critical issues. A second reason may be that the students had time to talk about the project before the group interviews. This may have given them the opportunity to articulate these feelings more clearly when they had a reflective distance from what had happened.

4.4.3 The workshop data (video and screen capture data)

4.4.3.1 About the workshop data

In the current study, two types of "video data" were collected from the workshop sessions. First, a video camera was placed in the classroom to capture the interaction between all the students in the group. In addition, activities from the students' laptop screens were recorded as a video file. These screen capture data can be regarded as a specific type of video data. These two forms of data will here be labeled "workshop data." They provide rich, high-quality data on what actually happened in the workshop. In comparison, interview data are different, because they rely on a reconstruction of what actually happened. When the recording process becomes automated, this reduces the reconstructive bias of the researcher. In comparison, field notes will always highlight some "important" aspects, while video data record social events as they occur with a level of detail that is not possible through methods that rely on reconstruction (Jordan & Henderson, 1995, pp. 50-51). For example, a trained observer would never be able to keep track of the overlapping activities of several persons with any accuracy or any hope of catching adequate detail. Many situations are also difficult to describe in words because of the density of behavioral details. In addition, we do not have a vocabulary for much bodily behavior (Jordan & Henderson, 1995, pp. 50-53). Since the researcher is the teacher in the course, it was extra important to reduce the potential reconstructive bias from the researcher. Another advantage with the workshop data was that the teacher could continue his professional work while at the same time collecting data. It would be much more difficult to both teach and write observational notes.

4.4.3.2 The data collection period

A pilot study was conducted one year (spring 2011) before the main intervention period. The plan then was to both collect workshop data and hold some group interviews. However, all the students except one refused to participate in the research project. The main reason seemed to be that the data collection strategy was too ambitious. The students did not like the idea that the researcher wanted to record all their course work from their laptops as screen capture data. This included work done at home and at other times than during the course sessions. As a consequence, a less ambitious data collection strategy was chosen the year after (spring 2012). The screen capture data would only cover some of the workshop sessions on campus. However, it was still uncertain if the students would consent to participate.

The workshop data (video data and screen capture data) were collected during a one-month period. Twenty-five students worked with obligatory assignments as a part of the ordinary course. At the same time, they could decide if they wanted to participate in the research project in this period. The data were collected during the evening sessions within this time period. In addition, group interviews were conducted approximately one month after the students had finished the three wiki assignments. The table below gives a general overview of the workshop data that has been collected in the present research study.

Table 4.4.c An overview of the workshop data in the present research study.

Session (date)	**Which assignment?**	**Group size**	**Data**
First session Date: 060312 (Approx. 110 minutes)	The first wiki assignment: Project work about musical instruments	9 students in the class chose to do this task together**.**	- Video recording of whole session with additional audio sources. - Screen capture data from 9 different student laptops (100%). All of which were in use (Some without audio recording and quite short).
Second session Date: 080312 (Approx. 130 minutes)	The first wiki assignment: Project work about the human body	8 students in the class chose to do this task together. (Different students from the first session)	- Video recording of the whole session with additional audio sources. - Screen recordings from 7 different student laptops (100%) (1 student did not bring laptop).
Third session Date: 130312 (Approx. 160 minutes)	The second wiki assignment about rock carvings	- 20 students (The whole class was expected to meet). - 3 students were abroad. 2 students did not attend.	- Video recording with additional audio sources. -Screen recordings from 13 different student laptops (65%).
Fourth session Date: 200312 (Approx. 120 minutes)	The second wiki assignment about rock carvings	- 24 students (Whole class). - 1 student did not come.	- Video recording with additional audio sources. - Screen recordings from 11 different student laptops (46%).
Fifth session Date: 290312 (Approx. 150 minutes)	The third wiki assignment about pedagogical use of wiki	- 21 students (Whole class). - 4 students did not come.	- Video recording with additional audio sources. - Screen recordings from 5 different student laptops (24%).
Interview session Date 260412 (Lasted from 20 to 60 minutes)	All the assignments	Six group interviews with 2–5 students. 20 students in total. 5 students did not come.	- Audio recordings

In the first assignment, only 17 of 25 students participated in the research project (first and second sessions). The reason was that the students were invited to choose between four different tasks. The teacher had originally planned that the students were going to work in groups of approximately six students. However, the group size had to be adjusted according to the student preferences for the different assignments, which were unbalanced. As a consequence, it ended up as two small groups of three and five students and two large groups with eight and nine students. Only the two large groups were considered to be relevant for the research study, because CKA focused on collaboration in large groups. These groups were slightly larger than the normal group size. In most of the group work at the

institution, it was typical to have a maximum size of six students in group work. The two large groups agreed to meet with each other the next week on different days on campus in an offline setting (first and second sessions). The researcher would then collect data from their collaborative work. This schedule also made the data collection easier, because the amount of recording equipment was limited. The group of five students also had to postpone their work, because some of the students in the group were abroad. Also, in the group with three students there was one student who did not want to participate in the research project.

In total, video and screen capture recordings were collected from five different sessions, and all the sessions were videotaped. Most of them lasted approximately two hours. In every session there were a few students who did not attend. It varied who these persons were. In the fifth session, there were as many as four students who did not come. The teacher had not arranged a system for the students who did not show up (e.g., such as giving them an extra task to do) but rather expected the students to organize this themselves. In general, these sessions had a much higher attendance rate than the other lessons where about half of the students usually met.

The percentage of screen capture recordings varied between the sessions. In the first assignment, all the students who used laptops collected these data, while about half of the students did this in the second assignment. One explanation was that some of the students did not use the laptop actively, because they worked very closely with another student.

Another limitation with the workshop data is that they do not include the student work between the workshop sessions. In all the assignments, students were encouraged to do preparatory work, but how much they actually did varied. In the following sections, the more specific strengths and weaknesses of the two types of workshop data will be discussed in further detail.

4.4.3.3 Collecting video data from the offline setting

In the current study, it was important to examine how all the students worked together as a large group in the workshop on campus. The video camera was therefore positioned so that it could capture student collaboration at a plenary level in the offline setting. Since the table arrangement was different in each workshop session, the video camera was positioned at different spots in the classroom. In four of the five sessions, the video camera was placed in the corner of the classroom a few meters away from the group. From this position, the camera gives an overview of the bodily movements around the main table in the classroom that the students used.

It was important to collect data that opened up for an examination of bodily movements, gestures, and the use of artifacts in the offline setting. According to the theoretical framework, the project work should be studied as an interaction not only between persons but also between persons and artifacts. However, the positioning of the video camera will also limit the scope of investigation, because it cannot capture all the ongoing activities. A video camera is significantly more limited than the human eye (Jordan & Henderson, 1995, pp. 53-54). For example, it was difficult to observe the close use of physical artifacts,

gestures, and facial expressions (except for a few students sitting very close to the camera). This would have required the use of more cameras that were closer up to the students. The specific positioning of the camera, the aim of the camera, the level of zooming, and the audio level will influence who and what is visible and in the foreground.[35]

It was also important to place the camera at a discrete position in the classroom so that it disturbed the students as little as possible. In addition only one camera was used to make the data collection less intrusive. The disadvantage here is that some students are less visible, because they were sitting with their backs to the camera. This made it difficult to see what they were doing (e.g., whom they were talking to and what gestures they were using). In some of the sessions, it was also difficult to observe in detail what the students sitting farthest away from the video camera were doing (e.g., fourth session). This is why Jordan and Henderson (1995, pp. 53-54) recommend the use of two video cameras to get approximately the same type of information from all the research participants.

Extra audio recorders were used to supplement the quality of the audio recordings at a plenary level. They were placed at different strategic positions on the tables so that they could capture the sound from different locations in the classroom. The audio recorder from the video camera usually only captured what was said in the plenary discussions when one person spoke at a time. It was also difficult to hear the voices that were located farther away from the audio recorder in the video camera. Moreover, it became even more difficult to distinguish between the different voices when many students spoke at the same time.

The video camera was also directed toward the same area most of the session time. In this way, the researcher could focus more on his work as a teacher during the workshops, and the students would be less disturbed.

Likewise, Jordan and Henderson (1995, p. 54) recommend leaving the camera in the same place, but they also claim that another advantage is that this can counteract unconscious tendencies concerning the data collection. Moreover, there is no operator behind the camera. Jordan and Henderson (1995, pp. 55-56) claim that most studies using video data have revealed that participants habituate to the presence of camera quite rapidly if there is no person behind it or if they are very involved in their work. The camera instead becomes a "piece of furniture" that nobody pays much attention to. This is important, because participants may be able to modify their verbal language for a lengthy period of time if they know they are being videotaped. It is also difficult to estimate the level the participants were influenced by the video camera. Indications of irregular behavior on the videotape may be that the participant looked into the camera or avoided showing their face to the camera. If this behavior changes after some time, it indicates that the participants have become habituated to the camera (Jordan & Henderson, 1995, p. 55).

[35] See images of classroom in section 4.3.2, The workshop setting on campus, page 80. Image II in Figure 4.3-a *The table arrangement in the first wiki assignment* show where the video camera is positioned in the student group that worked with musical instruments. Image II and III in Figure 4.3-b *The table arrangement in the second wiki assignment* show where the video camera is positioned in the two workshops in two different classrooms. Image III in Figure 4.3-c. *Three images of the table arrangement in the workshop related to the third wiki assignment* show where the video camera was positioned in the third assignment.

In the current study, there are few indications that the video camera made the students behave in irregular or unexpected ways. For example, some students told jokes to each other, which indicated that they felt quite comfortable in the setting. There were also many examples of "off-task" behavior in the fifth session, which indicated that the behavior was close to normal. Nevertheless, there appeared to be less informal social communication and "small-talk" than usual. However, it is likely that the amount of free Internet surfing was lower than usual, because their screens were being recorded. None of the students visited entertainment sites or had private chats with each other on the laptop screens. Several studies show this is normal behavior among students in higher education with access to laptops. In this way the data are biased toward being somewhat more academically orientated compared with what would be a "normal" situation. However, the teacher/researcher knew the students from before and did not notice any significant changes in behavior in these sessions compared with their behavior in the rest of the course.

4.4.3.4 Collecting screen capture data from the laptop screens in the offline setting

In the current study it was also important to collect screen capture data that can visual information about how the students use digital tools on their laptop screens in the offline setting. These data not only provide a detailed record of how the students use wikis during the workshop but they also include all programs and applications that are used on the laptop screens. The students were expected to use many different tools in their wiki work, and the screen capture data made it possible to analyze the complex combinatory use of these different digital tools.

The term "screen capture data" is here used to describe this specific type of data. However, one should note that other terms such as video capture, video screen capture, and screencast data are also in use. The basic characteristic is that the data capture real-time work on computer screens (Geisler & Slattery, 2007, p. 186). In general, there are few studies of student learning that collect this type of data. There are some examples of studies of how technical writers use multiple texts and orchestrate the interplay among these texts when they create a document (Slattery, 2003, 2005). However, very few studies have explored how the wiki tool is used in combination with other digital tools (e.g., search engines, word editor).

In the current study, the data were collected with the help of the free screen recording software tool BB Flashback Express, which the students downloaded on their personal laptops at the beginning of the first session. The downloading required some extra use of time, but most students were happy about getting access to this kind of software, because it could also be relevant to use in their future work as teachers. At the beginning of each workshop session, each student was given a memory stick from the researcher to record the screen capture data during the session. This software could run in the background while students were doing different activities on their laptops (e.g., using word-processing software or a web browser). In this way, these screen data were captured in second-by-second detail in a relatively unobtrusive manner.

However, the fact that the research subjects may have experienced this type of data collection as invasive was a challenge. In the first wiki assignment, the screen recording data

was saved two times during the project work (before the break), because the files were quite large. The stick was handed in to the researcher after the session. A disadvantage was that the students had to spend extra time saving the data. In the first wiki assignment, this took more time, because the students saved the screen capture data as a video file instead of saving it as a project file. As a consequence, the students had to begin saving the screen capture data five to 10 minutes before the session ended, because it took some time to save the data. Even though a teacher assistant was present to support the students' use of the software program, it still took time saving the files. This took a little bit of time away from the project work, but the students did not show any observable negative behavior because of this. As a consequence, the screen recording data did not capture the last period of the students' work.

However, before the workshops in the second wiki assignments, the researcher discovered that it was more time-efficient to simply save the data as a project file and not as a video file. Because it took some time to save the screen capture data on the memory stick, it was also to save the data two times during the sessions. The data were therefore saved one time before the break, and this made it necessary for the teacher to encourage all the students to take a break together at approximately the same time. In this sense the data collection process had some influence on how the project work was organized during the workshop sessions.

Some students may also have felt uneasy due to a feeling of surveillance when all their screen activities were being recorded. This was a serious problem in the pilot study, because only one student consented to participate in this type of data collection. Then the students were supposed to record screen capture data both in the workshops and in other settings off campus. However, the frequency of informal conversations during the work indicates that the students did not experience the screen recording software as very disturbing. Nevertheless, there are some indications that the students worked more effectively when they recorded their screen operations. *First*, the students did not spend much time on "off-task" activities on the screen (e.g., social communication, surfing on entertainment sites). Some comments from the screen capture data also show that the students were aware of the recording equipment. For example, one student made a joke about another student who was doing "off-task" activities and reminded this person that she was being recorded. It is likely that the amount of social "off-task" activities was reduced because of the use of the screen recording software. On the other hand, the presence of "off-task" activities was very high in the fifth workshop.[vi] In most cases, these students also did not deliver any screen capture data on the memory stick to the researcher. Only one-fourth of the students recorded their screen operations in the third wiki assignment. Despite these weaknesses, many students recorded such data in the other workshops, which indicates that recording equipment was not experienced as obtrusive.

Interestingly, in a study by Geisler and Slattery (2007) that included collection of screen capture data, the researchers found that few research participants expressed concern with the method. Even though the participants knew they were going to be surveilled, they were relieved that the researcher would not be physically present while they were working. The researchers found that screen capture data provide an automated, detailed, and relatively unobtrusive method of collecting data related to work being done on computers.

Moreover, it is important to be aware that most of the students not only recorded their screen activities but also that the laptop was also used as an audio recorder during the screen work. Most students managed to save the data with the audio sound on. This provided information about the many parallel ongoing verbal discussions in the screen surroundings nearby. It even included the more quiet side comments between students. The large number of audio recorders was considered to be vital for gaining high-quality audio data. In some of the workshops, many of the students used the audio recorders simultaneously, which made it possible to get a more complete "audio picture" of the many overlapping conversations in the smaller groups that were a part of the larger group work. It was easier to follow who, how, and when the students were talking to each other. As such, these data can better capture the most essential parts of student interaction at a dyadic level. Likewise, Jordan and Henderson (1995, pp. 53-54) suggest using supplementary audio tape recorders placed at strategic points in the room to provide additional information.

4.4.3.5 The advantage of combining video and screen capture data

In combination with data from the video camera, it was also possible to observe what the students were doing while they were working on their screens.[36] In the current study, some of the audio recordings did not provide good enough sound. As a consequence, it was difficult to hear what the students were talking about. However, by combining the audio sources from several different screen recordings, the video camera, and the separate audio recorders, it was possible to improve the quality of the sound of the voices. This synchronization was done manually by combining audio recordings that were located close to each other. In this way, the presence of many different audio resources in the classroom made it possible to significantly reduce "recorder bias" (reliability). Overall, the workshop data provided a more complete picture of how students work in the interplay between an offline and an online setting during the workshops.

[36] See also section 4.3.2, The workshop setting on campus, page 80.

4.4.4 The wiki log data

4.4.4.1 About wiki log data

In the current study, wiki log data also serve as an important data source. Initially, the students published wiki texts as a part of an assignment in a specific course in teacher education. Because the work is distributed openly, it can be read, interpreted, and used by persons other than the teacher. In addition, the wiki texts can be used as text data by researchers.

These text data have some unique characteristics. In comparison with a printed text, which is static, the wiki text will frequently change. A log stores all the wiki edits in an archive. This log automatically keeps track of the contributions made by each member. In this way, one can easily retrieve any previous versions of the article as a digital text. In addition, one can find information about the time of the edit, which username made the edit, and optional comments attached to the specific edit. The time stamps in the log can also provide relevant information about what happened during the project work. The log provides the specific time (in hours and minutes) and information about the size of the change (file size in kilobytes). This makes it possible to examine how the different wiki versions build upon one another and how the text evolves over time. In the MediaWiki (Wikibooks and Wikipedia), there is also a separate discussion page attached to each wiki page. This allows persons to post comments and engage in discussions. Likewise, a log with different versions of the discussion page is stored in an archive.

In the current study, these wiki log data were important, because they give additional information about the students' work in the online setting. This makes it easier to examine how the students produce the wiki pages in the interplay between an offline and an online setting. Few of the wiki studies in the review have analyzed this interplay in any great detail. Most studies prioritize merely collecting data from the offline setting, and just a few combine these data with wiki log data. One example is Arnold et al. (2012), who use wiki log data to analyze students' edits. In addition, they use a questionnaire to gather data about learner experiences and attitudes. Another example is Choy and Ng (2007), who use quantitative data from the wiki log to map student participation. In addition, they interview the students about their experience with collaborative writing.

A major advantage with the wiki log data is that they can easily be collected by visiting the web page any time after the students have made edits, and the data collection does not disturb the students. This is why several wiki researchers claim that wiki log data can be used to analyze students' learning activities in a more reliable way compared with perception-based studies (Arnold et al., 2012; Hadjerrouit, 2014; Kessler & Bikowski, 2010; Leung & Chu, 2009). In comparison, the researcher interacts directly with the students when conducting group interviews or collecting workshop data. Because this type of data collection is more obtrusive, there is a risk of creating different types of bias. First, the students may behave differently, because they are aware that they are being observed or interviewed. Second, the presence of the researcher may influence how the students behave (Krippendorff, 2012, p. 45). The wiki log data avoids these threats against validity, because there is no direct

contact between the researcher and the students. In this way, the data reduce potential bias.

On the other hand, the wiki log gives no information about the other screen activities. This is a problem if students do most of their written work in another application (e.g., a text editor like Word). For example, the wiki log data do not give any information about project management. To some degree, the students used Facebook to solve such issues in an online setting. The screen capture data and data from other websites are here used as supplements. Furthermore, Naismith et al. (2011) criticize the claim from Trentin (2009) that version-tracking data like a wiki log can be a reliable indicator of collaborative activity, because the wiki log data provide no information about interaction in the offline setting. Without supplementary data, we do not know whether the students are doing the wiki editing alone or together with others. For example, two students can be sitting in front of the screen and doing the work. Students may also have used other digital tools during collaboration and only used the wiki for final publication. This is why wiki log data often will depend on being triangulated with other qualitative data to reach a valid understanding of what happens in practice. For example, during the workshop periods in the current study, both video data and screen capture data are used to capture real-time interaction.

4.4.4.2 The wiki log data that was collected in the current study

In the current study, the log data were collected within various time periods during the project work (before project start, before workshop, after workshop, at project deadline, after project deadline). This includes wiki data from both Wikispaces (second assignment) and MediaWiki on Wikibooks (first and third assignments) and Wikipedia (second assignment). The most important periods are during the workshop, during the entire project period, and also the period after the course was over. Wiki log data were also collected until 2015 to provide information about what happens to the wiki texts after the students finished their work.[vii] In the first and third wiki assignments, it was important to systematically compare the original wiki version at the start of the assignment period and the students' final version. A summary of this work will be described in the next chapter.

A significant amount of the data in the written report presents different types of text-production work quantitatively. The textual units are then categorized and measured in numerical terms. Suitable statistical techniques, such as frequencies, are then used to provide an overview of the text work. This involves both the use of automatically generated statistics (e.g., word counts) and content categories that are first coded, then counted manually, and finally placed in different types of tables that summarize the work. With inspiration from Krippendorff (2012, p. 103), it is possible to claim that the wiki log data in the present study provided statistical accounts in three different ways.

First, some of the quantitative wiki log data were extraneous to the textual unit but still associated with it (Krippendorff, 2012). One example in the current study is the statistical overview of the number of viewers that have visited the wiki pages. These data could only be retrieved as separate features from the Wikipedia page and the student-produced YouTube videos but not from the wiki assignments in Wikispaces and Wikibooks. These numbers are descriptive and automatically generated.

Second, some of the quantitative wiki log data measured the size of the data that had been collected. These measures, or counts, are also descriptive and do not usually require much attention (Krippendorff, 2012, p. 103). One example in the current study is how the word count of the length of the wiki texts is generated by using a specific feature in Microsoft Word. By copying the text into this software program, it is possible to retrieve precise information about the exact length of different units of text. This word count can be regarded as a computer-assisted analysis, because the data are automatically generated and do not require any manual counting (Krippendorff, 2012, p. 103). Another example is the simple quantitative estimation of the frequency of the comments that students make on the wiki discussion page. This required manual counting.

Third, quantitative wiki log data were also collected from the counting of units that were related categories made by the researcher. One example is how it was first necessary to develop a coding scheme to measure the frequency of different types of wiki editing. Most of this coding work was easy (adding text, removing text, and keeping the text as it is) but the coding of rewriting was not always self-evident. For example, when a student only removed and added some sentences in one paragraph, this was coded as rewriting. However, this editing could also have been coded as two separate operations of adding text and removing text.[viii]

In addition qualitative wiki log data have been collected from all the three wiki assignments. The qualitative text data include not only content in the wiki text but also the comments that have been published on the wiki discussion page. For example, in the Wikipedia assignment, there was some activity on the discussion page between students and outsiders. Likewise, studies from the review show that wiki log data can be analyzed both qualitatively (Kessler & Bikowski, 2010) and quantitatively (Hadjerrouit, 2014), but there are fewer examples of studies which combine both these types of data.

4.5 Data analysis

4.5.1 The analytical strategy

In this explorative case study, it is especially important to use a coherent analytical strategy that follows a systematic procedure (Yin, 2009, p. 127). This is important because it reduces the risk of doing a biased analysis that confirms the researcher's preconceived opinion (Yin, 2009, p. 14). In this study, the data analysis can be divided into five phases or distinct analytical steps. The table below gives an overview of the complete analytical model used in this study.

Table 4.5.a An overview of the analytical strategy in the present study.

Different phases in the analysis	**Type of analysis**
Phase 1. Inductive or open coding of the data	Separate open coding of group interviews, workshop data (video and screen capture data), and wiki log data
Phase 2. Theory-driven content analysis of the group interviews	Codes and categories are generated from the literature review (with some modifications).
Phase 3. Data triangulation	Other qualitative data are used both to enrich and validate findings from the group interviews building on categories developed through the analysis of the interview data.
Phase 4. Using two CHAT-concepts to analyze the data	Two theoretical concepts (contradictions and germ cell) are introduced in an attempt to further analyze the different enabling and inhibiting conditions in the data. The aim is to identify the fundamental inhibitor in the teacher education context and the germ cell of CKA.
Phase 5. Expanding CKA as a theoretical concept	The data are further discussed through the establishment of several different conceptual trails. The theoretical generalization of the empirical findings builds on the principle of ascending from the abstract to the concrete.

4.5.2 Phase 1—Inductive coding of the data

The first step of the analysis is based on an inductive, or data-driven, explorative approach. In the first phase of the analysis, the three different types of data (group interviews, the workshop data (screen capture and video data), and wiki log data) were analyzed separately. In this way, all the data get an "equal" amount of attention. All the group interviews were transcribed as was most of the plenary discourse from the workshop sessions. In addition, content logs were made from some of the screen capture data and most of the wiki log data. The wiki log data were summarized with both qualitative and quantitative methods. In line with interaction analysis (IA), this first step of the analysis was inductive (Jordan & Henderson, 1995). IA tends to proceed inductively from the empirical observations. These interactions can be analyzed as general patterns, interesting exceptions (idiosyncrasies), or random actions. The aim is to describe general patterns from multiple sets of empirical observations. This requires an analysis of several similar incidents in the data corpus that confirms the proposed generalization (Jordan & Henderson, 1995, pp. 39,41,45-47).

The group interviews were conducted as relatively open conversations, where the interviewer tried to encourage the students to reflect more upon the mirror data (blog posts) they had already created.[37] As a consequence, the interview guides were a bit different from each other, because the smaller groups of students had done different subtasks in the whole-class project. Although the interviews covered some more general topics, the main challenge in the first phase of the analysis was to compare the diverse discussions and establish some common themes or categories. The transcribed interviews were coded inductively with the help of Hyperresearch, a software tool that performs computer-assisted analysis.

In this first phase of the analysis, it was important to try to keep the codes in the interviews free from predetermined analytical categories. The interview data were therefore coded and categorized on the basis of themes the students highlighted in the interviews. This first analytical step is inspired by principles from *open coding* (Marshall & Rossman, 2011, pp. 214-215). This type of coding is done independent from the research questions. The codes are grouped according to conceptual categories that can be regarded as baskets in which segments of data are placed that reflect commonalities among the codes. Clustering is about creating outlines according to which data are the most overarching. In the first phase of the analysis, the researcher needs to avoid using matrixes, because this would risk forcing the data into predefined categories (Marshall & Rossman, 2011, p. 217). Likewise, Yin (2009) also recommends that the first round of case study analysis should be closer to the data than the research questions or the theory-driven analysis. IA also holds that it is important to avoid the use of predetermined categories in the first phase of the analysis (Jordan & Henderson, 1995, p. 43). The codes and categories were developed as they were simultaneously compared with each other and were identified through successive approximations. The goal was to make general categories that could cover the main topics or themes in the interviews. As such, the following five categories were developed: (1) Students' learning interests, (2) The coordination of the learning process, (3) The challenge of collaborative relationships in large groups, (4) Collaboration in large groups being less fair, and (5) Suggestions on how one can improve the instructional design. The categories describe fundamental dimensions related to (1,2) learning, (3) relations, (4) justice, and (5) instructional design. These categories could provide a better overview of the data material. Here, one should be aware that the establishment of these broad categories did not exclude deviant statements, which were considered to be as relevant as the more general opinions of the group (e.g., Liamputtong, 2011, p. 174).

The workshop data were also analyzed inductively in the first phase of the analysis. This includes both the videos and screen capture data. The video data and some of the screen capture data were looked through several times. In the first step of the video analysis, the researcher watched the different video recordings and wrote a content log with some time stamps. Critical incidents were highlighted. Actions that looked interesting at a plenary level were also followed up in greater detail by looking at the work in smaller groups through the screen capture data. In this way, the researcher moved back and forth between the video and the screen capture data to get a better understanding of what actually happened in the

[37] See section 4.4.2.3, About the interview guide and the interview conversation, page 91.

collaboration between the students. In the first step of the analysis, this makes it possible to be more responsive to the phenomenon itself rather than to the characteristics of the representational systems that need to be used later, as this might constrain the direction of the analyst´s thinking (Jordan & Henderson, 1995, pp. 50-53). Although this work is time-consuming, Jordan and Henderson (1995, p. 50) claim that is not possible to let others do this work, because it is this type of analysis that lead to a deeper understanding of the phenomenon.

Likewise, Geisler and Slattery (2007) recommend an inductive strategy when analyzing screen capture data. The researcher should look at the screen capture data several times and then begin to produce an inductive interpretation of the recorded sessions. Often, one will find clues to the motivation behind the work within the recording itself. As with ordinary video data, the main advantage with these data is that they can be played back as videos after they have been collected. The advantage is that the data are not distorted when they are collected. The video can also be stopped and manipulated using different video editing tools.

In addition, content logs were made of work on laptop screens that belonged to some of the most active students. While this work was done, the researcher wrote analytic memos related to the data as a part of the ongoing coding work. The goal with this work was to search openly for interesting episodes, general patterns, and tensions. In this phase, it was important to experiment with a variety of construction pictures in regard to how the data fit together. These preliminary sketches moved the analysis forward. Similarly, Jordan and Henderson (1995, p. 46) recommend that one use content logs to get an overview of a large data corpus with many potentially interesting observations of the phenomenon. As recommended by Jordan and Henderson (Jordan & Henderson, 1995, p. 43), the logs were used to construct short summaries of events as they occur on the tape. In the current study, this included some annotations and explanations of the events. The level of detail in the transcription was not very high, because the primary goal is to get a quick overview of the data corpus. However, the log was not supposed to cover all the data in a consistent way but rather make it easier to later locate particular sequences that would be transcribed in more detail. According to Jordan and Henderson (1995, p. 48), one needs to think very carefully through what kind of analysis one wants to perform before one starts a full-scale transcription. It takes a lot of time to transcribe the data. In this study, it was particularly the plenary discourse that was considered to be the most relevant for studying CKA in practice. In this first phase, the interesting incidents were only noted, and no full multimodal transcription of these episodes was done. Some of this initial coding work and the associated memos are available in the case study database.

The first step of analyzing the wiki log data involves writing a description of how the students used the wiki to do the assignments. A summary was written according to the substantive characteristics in all three different wiki assignments. This includes both a qualitative description of the text and some simple quantitative descriptions of the work (e.g., word counts). The automatic word counter in Microsoft Word was used for this purpose. The changes to the wiki texts were also compared within different time periods (before workshop, during workshop, from project start until deadline).[ix]

4.5.3 Phase 2—Theory-driven content analysis of the group interviews

In this second phase of the analysis, the group interviews were upgraded to be used as the *primary data source*. As a consequence, each section in the empirical analysis begins with an analysis of the findings from the group interviews. One reason why the interviews were considered to be highly relevant is that these data covered the students' experience of the whole project period. In comparison, the workshop data and the wiki log data cover only a part of the students' work process. The interviews also cover the period between the workshop sessions that the video and screen capture data give no information about. The wiki log data (also Facebook data) gave only a limited amount of information about these time periods. The major strength of the group interviews is that they give an overview of how the students experienced the entire project. They also reveal how the students think the instructional design can be improved.

In addition, the interviews give information about episodes students experienced as important in the workshop sessions. Much of the interview time is devoted to students explaining what happened during the project work and what they experienced to be the challenges in the group work. The interviewer wanted to investigate student perceptions of the key concerns during the project work. In this sense, the data represented an extension of what happened during the project work. Since the interviews were conducted one month after the project work's end, the students had time to reflect upon and discuss what happened in more detail. It is assumed that the distance in time makes it easier for students to express their feelings and attitudes toward the work more openly. In addition, the time period is not so distant that students would have forgotten the details of their collective work.

In this second phase of the analysis, theory-driven codes were introduced. The group interviews were reorganized according to the sub-research questions. In addition, the categories that are described as problem spaces in the literature review (Chapter 2) were used to help frame the further analysis. This was done in an attempt to provide possible answers to the three sub-research questions. Still, most of the interview data were included in the empirical analysis and the final written report. The exception was a few statements about the instructional design that were considered to be irrelevant. In addition, the data were simplified through summarizations and paraphrasing of the findings. In this phase, the interview data were also more closely analyzed and compared with findings from other studies in the review. Some of the initial categories were also modified and adjusted so that they would better fit with the conceptual framework from the literature review (e.g., Marshall & Rossman, 2011, p. 215).

4.5.4 Phase 3—Data triangulation

In the third phase of the analysis, other data sources are triangulated with the group interviews. This includes both the workshop data (video and screen capture data) and the wiki log data. These new sources of data are analyzed with the help of the conceptual framework and categories that have been developed in the analysis of the group interviews. The data triangulation is used to validate the findings from the group interviews but primarily to enrich the findings. Likewise, this type of data triangulation approach is common

among researchers who use cultural-historical activity theory (CHAT). According to Devane and Squire (2012), CHAT does not prescribe any particular research method, but researchers often use a varied set of data collection techniques, including interviews, observations, video, and historical materials. Ethnography (e.g., participant observation, interviews, interaction analysis) and historical analysis (e.g., oral histories, document analysis, archival analysis) are popular approaches. The goal is to understand the particulars of an activity system from multiple perspectives. It is also important to understand the activity from the users' points of view (DeVane & Squire, 2012).

In line with putting an emphasis on the research participants' perspective, the main findings in the group interviews will here be used to direct the analysis of the other qualitative data. In each of the three chapters in the empirical analysis, the group interviews are first used to analyze the specific sub-research questions. These findings are then summarized in each chapter and used to establish a conceptual framework that guides the further triangulation of new data. Accordingly, Yin (2009, p. 116) recommends that one should avoid analyzing the different data sources separately. In this way, the interviews help reduce the complexity of both the workshop data and wiki log data by directing the analysis toward more specific areas.

In relation to the whole data corpus, most of the data from the group interviews have been included in the analysis, while it is only possible to present a few selected episodes from the workshop data. While interaction analysis is important in the analysis of the workshop data (Jordan & Henderson, 1995, p. 47) (phase 3), the group interviews are primarily analyzed according to a theory-driven content analysis (phase 2). Interaction analysis is considered to be particularly useful if one wants to explore patterns that have been identified in early observations or interviews (Marshall & Rossman, 2011, p. 187). The goal is to provide richer answers to the three sub-research questions and increase the construct validity (Yin, 2009).

The group interviews are also interesting to use as a primary data source, because students sometimes highlighted specific incidents from the workshops. This has made it possible to go back and analyze these specific episodes in more detail by looking more closely at the workshop data. The workshop data could then provide more details around the experiences that the students highlighted in the interviews. This triangulation strategy is also important, because the researcher may observe or interpret the video data in a different way than the research participants (Jordan & Henderson, 1995, p. 54). Although the students in the group interviews will not remember all the details, they will emphasize some issues more than others. In accordance with interaction analysis, these statements will be used to direct analytical attention toward more specific areas in the workshop data and the wiki log data. The researcher may even be unaware of these incidents, because they are hard to notice in the observational data. In this sense, the group interviews are used to support the search for important workshop data. The findings from the interview data are therefore closely connected to the observational data, because they will to some degree also address the same episodes in the workshops.

Also, some of the episodes that the students emphasized in the interviews were not very dominant in the workshop data. Students may have different reasons for highlighting certain data that perhaps the researcher at first glance would think are of minor importance.

Because the amount of workshop data is so extensive, it is difficult for the researcher to locate such incidents without the help of the participants. It is a challenge to understand what is experienced as important or not. The group interviews reveal a multitude of voices and opinions about what happened, which guided the further analysis of the workshop data. As such, it was also important to avoid too many analyst-constructed typologies created by the researcher. In qualitative studies, there is always the risk that the researcher will impose a specific "worldview" on the participants (Marshall & Rossman, 2011, p. 215). By letting the group interviews to a large degree direct the further selection of data, it was assumed that the analysis would build more on the student perspective.

In general, the strength of both the workshop data and the wiki log data is that they can provide much more data about episodes that are just briefly described in the interviews. The supplement of new data sources added new perspectives to the analysis. These are not only examples that illustrate dominant patterns but also interesting exceptions that might represent a possible new practice. The data were used to develop a deeper and more comprehensive understanding of the research questions. For example, the workshop data (video and screen capture data) give detailed information about how the students responded to the tasks, while the group interviews can say something about how the students experienced the work. The interviews not only give information about the general experiences and attitudes, but they also give information about specific incidents that the students considered to be important. The workshop data (video and screen capture data) could then be used to supplement the zooming-in on different levels of action in the classroom. The screen capture data were primarily used to zoom in on individual work with artifacts and dyadic interaction, while the video data were primarily used to capture the plenary interaction (both verbal and nonverbal). These workshop data were important, because they provided a much more detailed account of how students interact in the specific classroom practices. Interaction analysis will also usually require the use of videotaping and audiotaping to produce a permanent record of the interactions of interest (Marshall & Rossman, 2011, p. 187).

To be able to explore CKA as a context-specific phenomenon, it is also necessary to study the student group work in relation to the *temporal* and *spatial ecology* of social action. In line with interaction analysis (IA), the research questions will be answered by analyzing the mechanisms behind how students employ social and material resources (artifacts) when they do wiki work. Jordan and Henderson (1995) claim that the physical co-presence of persons is *always* managed by socially recognized (though often unstated) expectations regarding occupancy of space, interaction with others, use of objects and resources, display of physical presence, and voice. These mutual expectations are used to structure interaction with others. In line with IA, the case study will not only involve the analysis of the interaction between the students but also the interaction between the actors and the artifacts (Jordan & Henderson, 1995).

To some degree, the workshop data and wiki log data are also used to confirm or disconfirm statements from the group interviews. Although the interview data to a large degree coincided with the observation performed by the researcher, there was a much stronger element of critique in the group interviews. These comments made it possible to go back and begin to look at the video data again from the students' perspective. The major strength

of the video data is that the data could be played many times. This made it possible to analyze what had actually happened at a great level of detail. According to IA, it is through these repeated viewings that "invisible" phenomenon may become apparent and reveal deeper orders of regularity in actors' behaviors (Jordan & Henderson, 1995, pp. 43,45,52). Although there is an element of validation here in confirming or disconfirming that the specific episodes actually happened, the main aim is to use the new data to enrich the findings from the interview data. Likewise, it is quite common to use focus group interviews in combination with other data collection techniques (Gibbs, 2012; Kitzinger, 1995; Williams & Katz, 2001) (Currie & Kelly, 2012). Groups interviews can be used to clarify, extend, qualify, or challenge data that have been collected with other methods. One can explore "the gap between what people say and what they do" and also use the groups to give results back to the research participants (stimulated recall) (Gill et al., 2008).

Moreover, note that the relevant amount of new data is larger in relation to the third sub-research question about peer learning. The reason is that the group interviews provided limited information, because the data were less detailed in this area. By triangulating the data and including both workshop data and wiki log data, it is possible to examine peer learning as a much richer and more complex process. For example, the wiki log data are used to analyze both peer editing and peer feedback in more detail. Although the group interviews provide some data about peer editing, the log data strengthen the validity, because they provide direct data about the actual peer editing.

The examination of peer editing requires the use of a coding scheme that can be used to categorize the different types of editing. In the current study, this involves using codes such as "adding text," "deleting text," "modifying text," and "keeping the text as it is." This coding scheme is quite similar to one used in a wiki study by Leung and Chu (2009). In their study, the following codes were used: "Add existing text," "Delete existing text," "Modify existing text," and "Format paragraph or layout" (Leung & Chu, 2009). One difference is that the "formatting of paragraph and layout" has been included in the code "modifying existing text" in the current study. However, the coding scheme was not predefined but rather developed as a part of the analytical work. This was done because it was difficult to fully anticipate all the codes that were relevant due to all the different types of editing that were in use (Krippendorff, 2012). In this way, the coding work is also part of the conceptual work related to how one can study peer editing activities.

After the coding of the editing activities was done, the frequencies were counted manually. This gives a statistical estimation of the different types of editing in the current study. Some text excerpts are also included in the written report to exemplify the peer editing. In addition, the interaction between students and outsiders (especially on the Wikipedia page) has been analyzed in more detail. This involves both the editing and the feedback. The comments on the wiki discussion page will here primarily be interpreted as qualitative data. Although the interaction with outsiders is mentioned by a few students in the group interviews, these data provide a much richer account of how the interaction evolved.

It is evident that the wiki log data can provide detailed data about the peer editing, while the workshop data (video and screen capture data) provide more detailed data about the peer feedback that is given as a part of the ongoing discourse. While the studies in the review

emphasize peer learning as a formal part of the instructional design, one could claim that both the wiki log data and the workshop data provide information about different types of informal peer feedback. In this way, the new data were used to develop more complex patterns, themes, and categories about the different research topics. In this sense, the workshop data and the wiki log data could help strengthen the construct validity related to CKA as a pedagogical practice. In the final summary in each of these chapters (5,6,7), the sub-research questions will be answered.

4.5.5 Phase 4—Using two CHAT-concepts to analyze the data

In the fourth phase of the analysis, the theoretically driven analysis of the change process will build on the utilization of *contradictions* and *germ cell* as concepts. These two concepts will be used to systematically compare the different findings across the three sub-research questions. According to the theory, it is necessary to study CKA as a concept-in-practice that is created within a specific socio-historical context. Since the wiki assignments in the current study attempt to introduce a new pedagogical practice, two possible scenarios may emerge. On one hand, it is possible that new practices will manifest themselves as observable new interaction patterns. On the other hand, it is possible that the students will continue to work the way they are used to. By utilizing the notion of contradictions and the germ cell as theoretical concepts (see Chapter 3), this makes it possible to analyze both inhibitory and enabling conditions from the data in relation to CKA as a pedagogical practice. On one hand, contradictions will primarily be used as a theoretical concept in an attempt to synthesize findings related to the conditions that inhibit CKA as a pedagogical practice in the teacher education context. On the other hand, the germ cell will be used as a concept to synthesize the enabling conditions that can identify the simplest unit of CKA as a pedagogical practice. These concepts also serve to utilize a “deeper triangulation” of the multiple different data sources in study.

4.5.5.1 Searching for the germ cell of CKA as a pedagogical practice

In this study, it is assumed that CKA as a pedagogical practice will emerge through a germ cell. The germ cell is the smallest and simplest unit that can be used to describe CKA as a pedagogical practice in the teacher education context. The germ cell describes the singular entity that shows the essential relations of the whole process. It also carries in itself the foundational contradiction or conflict of motives present in the complex whole. According to the main research question, it is important to analyze how this germ cell emerges in the interplay between both an offline and an online setting.

The germ cell is a fundamental relation that represents the essence of CKA as a concept-in-practice. As suggested in the theory, it is vital to identify the germ cell as an initial singular relation before one can develop a concept into more complexity. This notion of a germ cell is especially helpful when it is assumed that new ways of working may be emerging, but they are not necessarily to be found as a part of the dominant interaction patterns in practice. The germ cell here should not be regarded as a principle but rather as a specific type of interaction that contains the fundamental logic of the pedagogical practice. Although the literature review gives some information about what CKA as a pedagogical practice in

teacher education could look like, the theory suggests that the germ cell needs to be identified as a part of the empirical analysis. In accordance with the original research question, this includes a comparison of data from both an online and an offline setting.

It is also likely that the early manifestations of CKA as a pedagogical practice will not necessarily be empirically generalizable, because it is something new that is not yet part of the main interaction patterns. According to the theoretical framework, the identification of the germ cell requires a close examination of deviations from what is to be expected of the findings in the data. These irregularities or deviations may be early symptoms of something new that is difficult to find. As mentioned by Engeström (1987), every universal phenomenon will first manifest itself as an individual, particular, specific phenomenon. At first it will always be the exception to the rule and deviate from previously accepted and codified norms.

In the analysis, it is therefore also important to compare different deviating incidents or idiosyncrasies with each other. These might be interconnected even though they at first glance may look very different from each other. As a next step, the different data that have been labeled as "enabling conditions" (chapters 5, 6, and 7) will therefore be compared with each other. This is done to explore whether there are some more common characteristics that can make it possible to describe the germ cell.

It is also important to examine what is commonplace with more scrutiny than normal. This may be phenomena that both the researcher and the students are not very aware of and that are not necessarily mentioned in the interviews. This includes the analysis of phenomena that are usually "taken for granted," such as interaction patterns at a micro-level. The workshop data and the wiki log data provide unique opportunities to investigate the details of the interaction.

This analytical approach is in line with *step 2 of the principle of ascending from the abstract to the concrete*.[38] This step identifies the germ cell by conducting a careful and systematic analysis. Although the data represent deviations or what is "taken for granted," it is assumed that by synthesizing such data one can potentially discover the germ cell of CKA as a pedagogical practice. This initial relation needs to be grounded in a comparison of several episodes that are in some way interconnected with each other even though on the surface they can be different. According to the theory, the inherent conflict of motives in the germ cell also needs to be described.

It is only after the germ cell has been identified that one can construct a new coherent pedagogical practice. One needs to understand what the "initial relation" is to develop richer definitions of the concept in the future. One can of course question whether the description of the germ cell is correct. This issue addresses the paradox of whether we can know what to look for if we do not know what it looks like. Is CKA as a pedagogical practice more of a conceptual construction created by the researcher than something that one can actually find in the data? The validity of the germ cell will in this sense rely on how convincing the analysis

[38] See section 3.3.3, Step 2 – Identification of the germ cell behind the problematic situation, page 60.

of the enabling conditions are and the quality of the inferences that are made on the basis of these data.

4.5.5.2 Contradictions as possible inhibitors

In the current study, it is assumed that a successful implementation will need to build on the energy from the contradictions in the course as an activity system. The contradictions are the necessary drivers of change, but according to the theory this does not imply that they are automatically resolved. Rather, it is likely that unresolved contradictions can act as inhibitors in the initial phases of a change process. The contradictions will then manifest themselves through different types of problems or conflicts. In the current study, such difficulties will be labeled as inhibitory conditions in the empirical analysis. These inhibitory conditions will, in the final part of the empirical analysis, be compared with each other in an attempt to identify the major tensions and contradictions in the teacher education context. It is important to investigate whether the tensions that exist may in some way be interconnected even when on the surface they look different. Although the analysis will not be emphasizing the importance of the commodity as a primary contradiction, an attempt will still be made to identify the fundamental inhibitor of CKA as a pedagogical practice. It is important to know the major tensions and contradictions in the context to successfully implement CKA as a durable pedagogical practice in teacher education. As a new object, the wiki assignments are expected to both stabilize and destabilize existing pedagogical practice. The new practices will seldom emerge as a quick fix or radical breakthrough. They will instead meet resistance and create several tensions that result in many different types of problems or conflicts. CKA as a pedagogical practice will emerge as a contradictory object that needs to be explained. However, this can also be regarded as a necessary first step within the principle of "ascending from the abstract to the concrete" when a new phenomenon is introduced.[39]

Furthermore, since CKA as a pedagogical practice represents something new, it is expected to create different kinds of resistance. If this occurs, it is not only important to identify the germ cell or "the seeds" of what is new but also to identify the mechanisms in the activity system that attempt to reject this pedagogical practice. This requires a close examination of the underlying conflicting motives or contradictions in the course as an activity system. Initially, the analysis has been open to the investigation of three types of contradictions (primary, secondary, and tertiary contradictions) as potentially relevant for the data.[40] On the level of being a tertiary contradiction, the wiki assignments will be analyzed as a new and more advanced conceptual tool that is introduced into a course on teacher education. However, although the students are challenged to work together in new ways, it is far from certain that a culturally more advanced object will emerge. CKA as a pedagogical practice will here be analyzed as a contradictory object that the students are expected to struggle with. Moreover, the secondary contradictions will be analyzed in relation to the wiki-mediated group interaction. These contradictions will be described as more closely attached to different components in the triangular model.

[39] See section 3.3.2, Step 1. Practical experimentation in a problematic situation, page 59.
[40] See more about contradictions at different levels in section 3.2.2, page 55.

Even though the theory suggests that contradictions are drivers of change, they can also function as inhibitors of change if they are not resolved. As a consequence, a study that attempts to implement CKA as a pedagogical practice can either lead to a genuinely new pedagogical practice or it can result in disintegration. The minimum requirement in the analysis is to identify the major tensions and contradictions in this specific activity system in teacher education.

In the current study, special attention was directed toward the study of difficult situations or breakdowns. According to DeVane and Squire (2012), both researchers and teachers should be encouraged to acknowledge that contradictions are the drivers of change in a system. However, there is no need to "throw out" the whole instructional design if it creates problems. Usually there will be no quick and simple answers. Instead they recommend a close examination of the activity system as a whole. In accordance with this analytical approach, it becomes important to carefully examine the student resistance (e.g., conflicts, breakdown situations) that emerges when a new way of working is implemented. Such episodes will reveal tensions that arise during the project work.

Likewise, (2008) recommends that researchers should to a greater degree study technologies that have broken down to see objects that tend to make themselves invisible when they are working properly. By giving analytical attention to moments of breakdown, innovation, and abandonment, one can better observe the often unseen networks of artifacts, people, and institutions that support existing practices. Studies of new technologies should therefore investigate both how the technology is accepted and how it meets resistance. This type of analysis can also reveal the particular characteristics of the existing activity system and how it attempts to reject new elements introduced from the outside. As a consequence, the study of "failed courses" can potentially provide insightful data about the fundamental institutionalized practices in the educational setting.

Jordan and Henderson (1995, p. 47) also underscore the notion that one should pay particular attention to deviations from the normal stream of activity or local rules for social interaction as they highlight the importance of studying breakdown situations. The careful analysis of such incidents may reveal the unspoken rules by which people organize their lives. It might also be possible to better understand the constraints in the material world that often cause trouble. Likewise, it is assumed that episodes that reveal student resistance may not only be important to better understand inhibitory conditions but also the more fundamental aspects of the existing pedagogical practice that can potentially interfere with CKA as a new practice. This is why it is important to use contradictions as a concept.

In this way, the analysis of contradictions can help us better understand why some practices are sustained and what is coming-to-be in the system. In the long term, this type of analysis can result in the rediscovery and renewal of the object in the activity system (DeVane & Squire, 2012). As such, the present study will address the presence of contradictions at several different levels (primary, secondary and tertiary).

4.5.6 Phase 5—Expanding CKA as a pedagogical practice

The aim of the present study is to use the data to expand and further develop CKA as a pedagogical practice. In other words, when the germ cell of CKA is first described, it is possible to discuss more systematically how CKA can emerge as a pedagogical practice in teacher education. This ambition coincides with Yin (2009, p. 15), who claims that case studies are primarily generalizable to theoretical propositions. In analytical or theoretical generalizations, the researcher is striving to generalize a particular set of results to some broader theory (Yin, 2009, p. 43).

In the last part of the dissertation, CKA will be discussed along five different "conceptual trails." These trails analyze how the germ cell can potentially evolve into more complex forms of pedagogical practices. Although the conceptual trails build on the empirical analysis, they also move deeper into different theoretical and conceptual explorations. They represent a step away from the close interpretation of the data toward a broader historical and theoretical analysis.

This generalization follows the principle of ascending from the abstract to the concrete.[41] In accordance with this principle, the identification of the germ cell permits the reconstruction of something that represents a new concrete whole. Here, the notion of "conceptual trails" refers to the future-oriented trails that can guide the further development of CKA as a pedagogical practice. These paths of inquiry build directly upon the description of the germ cell but they also attempt to further expand the concept. This analysis is inspired by step 3 within the principle of "ascending from the abstract to the concrete." In step 3, the logic of the object's development needs not only to be reproduced theoretically but also requires its historical formation.[42]

In itself, the data in the current study limits the empirical analysis to step 1 ("Practical experimentation in a problematic situation") and step 2 ("Identification of the germ cell behind the problematic situation"). Because of the lack of iterations in the research design, the data do not cover step 3 ("Testing the germ cell") and step 4 ("Suggesting a solution to the initial problematic situation") to a large degree. One important reason is the relatively short project time period for exploring the concept-in-practice.

These conceptual trails represent a concept formation that primarily builds on the idea of CKA as a "perspective concept." The concept might become important in the future but has not yet been acknowledged in the research literature or as a dominant pedagogical practice in the teacher education context. The theory of expansive learning claims that it is very important to construct new theoretical concepts that can guide future actions and possible transformations of activity systems. The germ cell opens up for multiple applications and extensions that can potentially lead to the development of an expansive theoretical concept in the future. In principle, the same germ cell can produce many new pedagogical practices that build on the same origin. In line with this perspective, it becomes important to describe a variety of future-orientated manifestations that all build on the same germ cell. Several core pedagogical concepts will be redefined within separate discussions of these different

[41] See section 3.3.1, The principle of ascending from the abstract to the concrete, page 58.
[42] See section 3.3.4, Step 3, Testing the germ cell, page 61.

trails. These concepts (and instructional models) can serve as a heuristic tool that can be used to improve pedagogical practice in teacher education. In relation to the methodological literature, this discussion can be interpreted as a specific type of theoretical generalization inspired by the principle of ascending from the abstract to the concrete.

However, to change an activity system, it is necessary to redefine the object. It is assumed that CKA can be one such concept that can potentially transform the activity system in teacher education in the future. This is why the analysis of CKA will be used to discuss core pedagogical concepts. This theoretical discussion constitutes an important supplement to the limitations in the empirical study, which covered only a brief period of time.

Because the primary data collection period lasted only one month, one can question whether this is a long enough period of time to study the emergence of CKA as a pedagogical practice. For example, Nardi (1996) claims that the time period within CHAT research should be long enough to understand how objects and the broader patterns of activity change over time. Even though the main data collection period was quite short, some of the text data indicate how the collectively produced digital artifacts have changed over several years (e.g., what happens with the Wikipedia article afterwards). The Wikibook project has also been going on for several years.

The exploration of the conceptual trails can also be regarded as an attempt to move beyond the predefined sub-research questions that constitute three more separate types of analysis. These trails will build on the definition of the germ cell and, to a greater degree, address the main research question with its emphasis on the interplay between the online and offline settings.

4.5.7 Summary of the analytical strategy

As described here, the analytical strategy combines a theory-driven analysis with a data-driven analysis. This strategy is similar to what Marshall and Rossman (2011, p. 208) refer to as an "*editing analysis strategy*" that combines inductive coding strategies with theoretically driven analytical strategies. Phase 4 and phase 5 show a significant element of theory-driven analysis, but one should note that this was done in the final stage of the analysis. It was important to use theory only in the late phases of the analysis to try to avoid finding exactly what you think you are looking for. Both interaction analysis and content analysis have been used to analyze the data. The reader should also be aware that few other CHAT studies have attempted to utilize these two theoretical concepts (germ cells and contradictions) in the analysis of both an offline and an online setting.

4.6 Transcribing and reporting the data

4.6.1 The transcription strategy

The empirical analysis in the written report is organized according to the three sub-research questions (Chapters 5, 6, and 7). The analysis addresses how student work with the three different wiki assignments in both an offline and an online setting. This section will give an overview of how the different data sources were transcribed and reported in the dissertation.

First, all the data have been transcribed by the author and not someone else. This was important for the researcher to be closer to the data. According to Kvale and Brinkmann (2009, p. 180), transcriptions from an oral to a written mode should be regarded as an analytical process in itself. The level of detail in the transcriptions also varies between the different data sources. While the transcription of the group interviews includes only the verbal interaction, the excerpts from the workshops also include the use of different artifacts. Another difference is that the dialogues in the group interviews would usually build on turn-taking, which let one person speak at a time. In comparison, there is much more overlapping talk in the verbal interaction in the workshops. It would also have been inconvenient to let anyone else transcribe the workshop data, because only some selected parts of the interaction are transcribed. This was not always clear in advance.

In addition, the translation of quotes and utterances into English made it necessary to make some adjustments. For example, the utterances in the workshop data have sometimes been slightly rewritten so they fit better with the norms for correctly written language (e.g., grammar and sentence structure). A direct translation word for word from Norwegian would have made the reporting of the data far less readable in English. However, it was still important to ensure that the basic meaning of the quotes and utterances remained unchanged.

4.6.2 Using a case study database

In the current study, a case study database was also established (Yin, 2009, pp. 120,128). This includes both transcriptions and the tentative coding work of the data. Because of the extensive collection of data, it is not possible to include all the data in the written report. While most of the data from the group interviews have been thoroughly analyzed in the report, this was not possible for the workshop data (video and screen capture data). For example, only a small number of excerpts from the workshops are presented in the report. These excerpts constitute only a small percentage of all the verbal interaction during the workshops. Thus, a case study database was established to provide a link between the data presented in the written report and the more detailed data material that was collected. The database consists of both transcribed data and case study notes that show the preliminary categorizations of the data (phase 1 of the analysis).

Furthermore, a significant amount of the preliminary analysis and coding of data was done with software for computer-assisted qualitative data analysis (Hypertranscribe,

Hyperresearch). The files in Hypertranscribe are also connected to the actual data recordings. Some of these transcriptions have also been copied into different Word documents, which are labeled with different code numbers. These documents make it possible to locate the original transcription in Hypertranscribe or as screen data from different web pages. However, most of original data are in Norwegian.

A reference system with numbers is used provide a direct link between the presented data in the written report and the original transcriptions of the same data. This case study database not only provides a better overview of the data corpus but also makes it easier for external reviewers to trace and assess the correspondence between the reported data and the original data in the case study database. The specific database number refers to the location where one can find the more detailed transcriptions of the same data in the case study database. Likewise, Yin (2009, pp. 120,128) claims that the case study database strengthens the construct validity and the reliability by establishing a more solid and transparent chain of evidence. It makes it possible for an external observer or reviewer to trace the evidentiary process from the report backward by referring to the different documents, interviews, or observations in the case study database (Yin, 2009, pp. 42,120,122,128). In the following paragraphs, the transcribing and reporting of the three main data sources will be described in further detail.

4.6.3 Transcribing and reporting the interview data

The group interviews were transcribed from an audio recorder. In general, the quality of the sound was good, but it was sometimes difficult to distinguish between certain voices. This would have been easier if video data had been used instead. For example, it was easier to distinguish the male students from the others in the group because they were only a few persons. To follow the utterances of one specific student throughout the transcription, the students were labeled with different number codes (S1, S2, and so on). Like with the workshop data, the students were anonymized in relation to gender to ensure that the male students were not identifiable.

In general, the interviews were transcribed from a verbatim oral style to a more formal coherent written style, which made the data more readable. This also includes the quotes presented in the report. Most of the conversations had clear turn-taking sequences, and the interviews were also transcribed according to one person speaking at a time. Nonverbal communication (e.g., pauses, emphases in intonation, and emotional expressions like laughter and sighing) was only included in passages where it was interpreted as especially relevant to the conversation. In general, most of the interview data have been paraphrased to improve the readability of what was said. Likewise, Kvale and Brinkmann (2009, p. 186) claim that in the interview, conversation and the subject's stories are transformed into a literary style, which may create more nuances around a statement and strengthen the communication of the meaning to the readers.

These adjustments were not considered a big issue, because the emphasis in the analysis was on what the students were saying. Likewise, Liamputtong (2011, p. 172) recommends that a "polished transcription" in group interviews (focus groups) is better if the purpose it to conduct a thematic analysis. Kvale and Brinkmann (2009, p. 182) also claim that

specialized forms of transcription are usually not necessary if the intent is to do a content analysis of the interview texts. Verbatim descriptions may even be in conflict with the possibility of publishing a readable story from the data. This is because oral language transcribed verbatim may appear as incoherent and confused speech (Kvale & Brinkmann, 2009, pp. 186,187).

There were also a few passages in the group interviews where it was very difficult to hear the conversation, because several students were talking simultaneously (some parts of GI 2 with five students). These passages are to a greater degree transcribed word-by-word, and the passages are marked where one cannot hear what was said. To strengthen the reliability, the researcher listened to the audio data several times to ensure that the transcripts were as correct as possible. The transcription was not verbatim, but there was still an emphasis on transcribing the content in a correct way.

Furthermore, the group interviews in the report contain a varied mix of individual accounts, group accounts, and excerpts from student speech. Likewise, Liamputtong (2011, pp. 174-175) claims that focus group discussions can be analyzed in three different ways: as group data, individual data, or interaction data within the group. *First*, in the instances where the voice of one student is quite prominent, this has been reported as an individual account. This often happened when the students were talking more directly to the interviewer instead of talking to each other. Usually the individual statements are paraphrased. When there are particularly interesting comments, these are presented as quotes.

Second, when there are instances where two or more students agree on an issue, this will be referred to as a group opinion. The students support each other in a way that indicates that they agree on a topic. The different utterances are then paraphrased or summarized into a coherent group opinion. The report of these statements typically begins with the phrase "The group said…" The content has usually been shortened. In group interviews, a group opinion will often be considered as at least as important as an individual opinion (Gibbs, 2012: 186; Gill et al., 2008).

Third, in the instances where several students build on each other's statements, this is sometimes reported as interaction data from the verbal dialogue. Students sometimes ask each other questions, exchange anecdotes, and comment on each other's experiences or opinions. These data are reported as excerpts and are therefore richer in detail. The dialogue reveals more of the nuances and/or the complexity in the student reflections. Interaction data are more important in group interviews compared with individual interviews when the research subjects are encouraged to talk to one another. The interaction is then to a lesser degree be controlled by the researcher (Kitzinger, 1995). These data include not only the interaction between the participants but also between the interviewer and the participants.

However, most of the data is reported as individual accounts. They refer to statements from single students and not groups. Still, it is important to notice the context of what the others are talking about to better understand the individual comments. According to Liamputtong (2011, p. 174-175), most focus group researchers leave out the social interaction data in the analysis and the report. Although group data are sometimes used, the data are treated in the same way as those of the individual interviews. They are described as single voices

rather than as comments within the broader group discussion. Moreover, it was important to include minority opinions in the group interviews. Likewise, Kitzinger (1995) recommends that one should also give attention to deviant case analysis and minority opinions in group interviews.

4.6.4 Transcribing and reporting the workshop data

The workshop data (video and screen capture data) are primarily presented as excerpts in the written report. As a minimum, all the excerpts consist of a representation of the students' speech. The length is usually a couple of minutes. Most of the time, the verbal language constitutes a very important part of the student interaction. In addition, most of the excerpts include a brief transcription of how the students use their bodies and different artifacts as a part of the interaction in the offline setting. While the screen capture data give information about how the laptop screen is used, the video data provide information about the embodied interaction in the offline setting.[43] According to Jordan and Henderson (1995, pp. 64-66), interaction will in some situations primarily be accomplished through talking. However, this is different in instrumental interaction that attempts to solve a task. Here the manipulation of physical objects or artifacts is crucial. Turn-taking is then not only about "turns at talking," but also "turns with bodies" and "turns with artifacts." The speech and the physical activities are intertwined in the turn-taking system in a more complex way. The video data usually includes information about both how the different artifacts are used and how the bodies interact with each other. The annotations usually provide some key descriptions of what is happening. In some instances, still images from the video data are used to provide richer information about how students use physical artifacts like their laptops or how they position their bodies in relation to each other in the workshop setting. In the written report, both the annotations from the video and the screen capture data are presented together in a separate column. This reporting of data constitutes an important supplement to the verbal dialogue. The rich descriptions cover important information about the interplay between an online and an offline setting during the workshops.

As such, the instrumental interaction in the current study is especially evident when the students work in small groups in front of their laptop screens. In these excerpts, annotations of screen operations have been included from the screen capture data. These annotations give information about how certain applications are employed, and in some instances they also give information about what students are typing on their laptops. In general, these annotations should be regarded as brief summaries of the rich information the screen capture data provide. Note that no screen images have been included, since this type of information was not considered to be relevant for the analysis.

Furthermore, several of the excerpts in the current study include annotations of nonverbal behaviors from the video data, such as changes in body position and gesturing. Likewise, Jordan and Henderson (1995, p. 67) claim that the most relevant of these nonverbal activities are gesturing and gazing, which are used to coordinate the conversation. Because the video camera was positioned quite far away from the students, it was difficult to get valid information about a student's gaze.

[43] See footnote nr.35, page 99

The level of detail in the presentation of the verbal interaction also depends on the specific purpose of the analysis. In general, there are very few verbatim transcriptions of the data. Both the quotations from the group interviews and the excerpts from the workshop data have to some degree been polished. For example, the excerpts from the workshop data are often slightly adjusted so that they fit better with conventional turn-taking principles. However, there is one example of a verbatim transcription.[44] In this specific incident, it was necessary to do a detailed transcription to enable a meaningful analysis of the data. Note also that most of the conversations at a plenary level in the workshop have been transcribed and archived in the case study database. Some content logs were also made in relation to the screen capture data.

4.6.5 Transcribing and reporting the wiki log data

A significant amount of the wiki log data in the report is presented as quantitative summaries of different activities. When these data are presented in the report, they refer to the case study database where the original data are archived. The case study database provides more detailed information of the procedures behind these estimations. This includes both the coding work and the criteria used to analyze both the quantitative and qualitative data. In this way, the database ensures that the coding work is transparent, because one can examine the analytic procedures behind the data presentation. Note that the researcher did this coding work manually by himself. The use of more coders could have strengthened the reliability, but the coding was instead done several times to reduce the possibility of errors. The coding work was mostly straightforward and not very difficult, so there was little issue with biased interpretations of the data. The qualitative wiki log data is usually paraphrased—for example, concerning the interaction between the students and outsiders.[45]

[44] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[45] See section 7.9.2, Outsider feedback, page 263.

4.7 Ethical considerations

In this section, three major ethical challenges will be discussed. This involves the issue of free and informed consent, the double role of being both teacher and researcher, and the issue of anonymizing the data. The topics cover issues related to both the data collection process and the data analysis.

4.7.1 Free and informed consent

Regarding the issue of *informed consent*, the researcher handed out an information sheet about the research project before it started. Students were informed that the study aimed to investigate how students collaborated with computers. Although this information was quite general, it gave them a correct picture of what was in focus. It was important to use the information sheet to ensure that the consent was voluntary. Principle 8 in the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities* also refers to the obligation to inform research subjects. Research subjects need to be given enough information so that they know what the research project is about. This includes general information about the purpose, methods, and consequences of participation. One must also clarify that participation is voluntary. In addition, it is required that the information be presented in such a way that it is easy to understand (Ethics, 2006).

The researcher followed the principle of informed consent by giving a 15-minute oral presentation about ideas related to "collective intelligence." The students then received more information about the type of collaboration that the researcher wanted to investigate. The emphasis here was on the importance of letting students collaborate in new ways in larger groups than what was normal in the teacher education context. From a learning perspective, it was important to be open in regard to the pedagogical ideas that the instructional design in the research study built upon. A potential disadvantage is that this openness could create a "Hawthorne effect." That is, students might expend more effort than usual to try to collaborate in an effective way. They may also behave in what they think are more appropriate ways of collaborating. This bias is not considered to be a serious problem, since the research project focuses on qualitative data and factors that are important in collaboration and that promote CKA. If the students were more motivated to explore new practices, this might be of extra relevance for the analytical generalization in this research study.

Moreover, the students were given a few days to read the information and decide whether they wanted to participate in the project. This is accordance with the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities,* which recommend that consent forms should not be handed out unexpectedly. Instead, the students should be given adequate time to develop an understanding of the research project (Ethics, 2006). Accordingly, it was important that the students were given enough time to reflect upon their participation in the research project. The research study began one week after the students received information about the research project.

There was also an element of *ongoing consent* during the research period. Before each workshop session the students could choose whether or not they wanted to record the

screen capture data. In the last workshop, many students chose not to record these data on their laptops. The students also got to choose whether they wanted to participate in the group interviews. Most of the students participated, but a few did not attend. According to the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities,* the research informants have the right to withdraw from participation at any time without any penalty or negative consequences (Ethics, 2006). One way of strengthening this option is to obtain ongoing consent during the data collection phase.

This is important, because the research subjects will sometimes not know what they are giving consent to before they are actually participating in the research project. For example, Mitchell (2004) emphasizes that the research process will often change during a self-study research project. The outcomes of the process are unknown at the beginning, and this also reduces the ability to given an informed consent. It could therefore be a good idea to obtain consent regularly throughout the different phases of the research period. One example is that significantly fewer students chose to do a screen recording when they were working with the second and third assignments. One important reason seems to be that they did more "off-task" activities in these sessions.

Furthermore, it is important to be aware that the researcher did not as a teacher participate in any kind of summative assessment work in the course. This way, the students would not think that they could get better grades by participating in the research project. It is highly important to avoid putting pressure on the students' right to free choice regarding participation in the project. Principle 9 in the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities* highlights the importance of freely given consent. As a general rule, potential research subjects must feel no form of pressure concerning their participation. It is therefore also important that the information about the research project is presented in an objective way (Ethics, 2006). Other studies have also shown that student teachers can be reluctant to provide critical evaluation of a teacher educator's practice, because they do not want do potentially create any disadvantages in relation to the formal assessment (Berry, 2004).

The students were explicitly informed about this matter before they decided whether they wanted to participate in the research project. It was important to underscore that a refusal to participate in the research study would have no negative influence on grades. The teacher even reminded the students about this issue once during the first workshop. He then told them that he would have nothing to do with the grades they received. This episode started with the students joking about wanting to please the teacher in an attempt to get good grades.[x] According to Mitchell (2004, p. 1430), one obvious challenge is the possibility that the "teacher has a power relationship over the students that will lead to coercion of students to participate in the research." There is also a risk that students will not only try to please the teacher get better grades but that they might think that in other ways they will gain an advantage such as later receiving more guidance from the teacher. If such motives influence student decisions, one can question whether the consent actually is free. This is why it is very important when doing research on your own students that one is careful not to impose any pressure on them that make them feel obliged to participate in the project.

At the same time, there is still a risk that students may give biased answers in an attempt to please the interviewer, who is the same person as the teacher in the course. To avoid this, the teacher began the interviews by repeating the message that he would take no part in the exams in the course. Nevertheless, there might still be a risk that the students will unconsciously say things they think are expected of them. However, the level of critique in their responses also suggests that they felt quite safe in the interviewing environment.

A challenge here is that the teacher might unconsciously later favor, in some way or another, the students who participated in the research project. Mitchell (2004) claims that the best way of tackling this challenge is to be conscious about it as a potentially serious problem. For example, the researcher knows that good interview data depend on students being honest toward the researcher. Likewise, Mitchell (2004) claims that many self-study researchers approach their students more as collaborative partners. The teacher might often first criticize his own teaching practice so that the students will feel more comfortable in doing the same. To some degree, the group interviews were also useful for the students in the sense that they were given the time to reflect on their own learning process. For example, in one of the group interviews the students complained so much about the project work that the researcher, as a teacher, offered to give them some extra help on how to use the wiki technology at a later point in time.

Furthermore, it is worth mentioning that the process of obtaining consent was a huge success compared with the pilot study conducted one year prior (spring 2011). In the pilot study, all the students refused to collect screen capture data. One of the reasons may have been that in the pilot study the students were asked to collect data over a much longer time period and that also involved the use of computers at home, too. In addition, the students got more time to reflect on their participation in the second round. The students also had more contact with the researcher before the research project started, because it was placed later in the course period.

4.7.2 The double role of being both teacher and researcher

The current study is conducted in a course where the researcher also has teaching responsibilities. This *double role of being both a researcher and a teacher* created several ethical challenges (some which also involved threats against the validity of the data), which will be discussed here.

4.7.2.1 Creating analytical distance from the data

First, it was important to create a certain analytical distance to the data. The researcher has been teaching the course under investigation over a period of many years. The researcher is not only responsible for the research design but also for a large part of the course design. There is a risk that one may be prejudiced and interpret the data as more positive or negative than what they actually are. According to Principle 40 in the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities,* researchers are responsible for preventing research from being presented in a misleading manner. One cannot present research that favors desirable results (Ethics, 2006). Likewise, Samaras

(2011) warns against presenting the data and the study in a way that makes one look more successful as a teacher. This has been raised as a serious critique against self-study research, because the researcher is the same person as the teacher. People tend to be biased toward themselves in either a too positive or too negative way. Likewise, there is a risk that the researcher in this study has internalized a range of values and beliefs about the course of which he is unaware. For example, since the quality of the student work did not turn out as good as expected, a conflict of interest may happen unconsciously. By being a honest researcher and criticizing the instructional design, the researcher will inevitably also risk putting the teacher in a "bad light," which here this is the same person. Right after the data collection period was over, the researcher experienced strong negative feelings of disappointment toward the whole project. There was a feeling of failure in the role of the teacher in the project, which increased the likelihood of doing a biased analysis in the months after the data collection. Even though the researcher was aware of the importance of doing a critical analysis, a hasty approach to the analysis might have unconsciously directed the analysis toward becoming either too positive or too negative. This is why it is important to create some degree of analytical distance from the data. These challenges were addressed by using different techniques that could decrease the possibility of conducting a biased analysis.

The *first analytical technique* was to collect more "objective" workshop data (video and screen capture data), which give information about the interaction independent from the perception of the researcher. The video data include not only the student interaction but also the actions of the teacher in the workshops. From one perspective, these data constitute an important supplement to the group interviews, which did not focus much on the role of the teacher.

Another advantage of the video data and screen capture data is that one can revisit the interactions at a later point in time. It is possible to do a close analysis of what actually happened even a long time after the actual incident occurred. As mentioned, just after the course was over, the researcher had relatively strong emotions regarding how the project work turned out. It was obvious to the researcher that in the period immediately after the data collection, he would be quite emotionally attached to the data. In this period, it would have been difficult to perform an unbiased analysis, because the project did not end up being the success the teacher had expected.

In delaying the first phase of the data analysis by several months, it was possible to begin the analysis of the recorded sessions with a more calm and detached mindset. The analysis of the teacher involvement was also not part of this first phase of the analysis, since this was regarded as an even more emotionally difficult topic to analyze. The main aim of this delay was to avoid doing a potentially biased analysis. According to Jordan and Henderson (1995, pp. 43,45,52), the strength of the video data is that one can go back and recheck the original data at any time. This makes it easier to find counterevidence to reduce the chance of "confirmation bias." In this way, the bias of the researcher is transferred to the "bias of the machine."

One strategy for reducing the potential for bias was to go back and look at the video several times. In this way, the anxiety related to observing the teacher was gradually reduced. This

opportunity would have not been possible if the researcher had written a log after the course or had used a predefined observation scheme. These data collection methods require some kind of interpretation of the data as they are collected. They will therefore be more influenced by the perspectives the researcher has in advance. By using video data, it is almost possible to go back in time and revisit the incident at any later point later. In this way the episodes were reanalyzed by listening to and tentatively coding the material several times.

The use of a coherent theoretical framework in the analysis also helped create a greater degree of analytical distance from the data. This includes both the use of theory-based codes from the review and the two CHAT concepts. It was in the first phase of the analysis that the risk of doing a biased analysis was at its highest.

The *second analytical technique* was to use the group interviews to govern the analysis of the workshop data. One important objective in the group interviews was to give the students the opportunity to reflect critically about what happened in the workshop sessions. Students were encouraged to participate as "co-researchers" and reveal their honest opinions about the project work. By giving these interview data the primary status in the data triangulation, it is possible to claim that the analysis of the video data was less biased by the researcher. Instead, the video data are more strongly influenced by student perspectives. However, even though students were critical in the interviews, one can question whether they were totally honest toward the interviewer when talking about the teacher, since he was the same person as the interviewer. Since the project was based on students' shared responsibility, this was not considered to be a big issue. If the teacher had had a dominant position in the workshop sessions, it would be expected that the students would find it more difficult to criticize the role of the teacher. By letting the teacher be in the background, it was expected that the main focus would be on the student interaction. However, the video data show that the teacher is still quite heavily involved in the ongoing project work (assignments, physical learning environment, and so on).

It is of course possible that the students would have been even more critical toward the teacher if another person had been the interviewer. However, since the students did the interviews together in groups, this may have made it quite easy to be open about critical or sensitive issues. In combination, it was expected that both the workshop data and the group interviews would strengthen the validity of the findings.

4.7.2.2 Being a researcher can interfere with one's professional work as a teacher

Another critique that has been raised is that the role of the researcher will interfere with one's attention toward one's role as a teacher. When time is used to conduct research, this may reduce the capacity to respond to classroom events from a teaching role ((Hammack, 1997) in (Mitchell, 2004)). Mitchell's (2004) counterargument is that most self-study researchers are driven by a desire to improve their teaching and their students' learning. Research does not necessarily have to stand in the way of teaching but can rather be seen as necessary to improve teaching practice in a more systematic way. Mitchell (Mitchell, 2004) also criticizes those who assume that teacher research always implies that one needs to

change practice. It might be that the teacher just wants to gain a better understanding of the existing classroom teaching practices.

Nevertheless, from a practical perspective, it might be difficult to both teach and do research at the same time. In the current study, this challenge was addressed by setting up the video camera and sound recording system before the session started. In this way, the amount of lesson time would not be significantly reduced because of the research project. The teacher could continue doing his work with the students. Also, the video camera's position in the back of the classroom would not disturb the students much. It would have been very difficult if the teacher had to do systematic observations while teaching.

Still, the students were encouraged to record their own screen capture data, and a few minutes were needed to start this process. A technical assistant helped the students use the recording software so that it would not take much time. An important reason for choosing the specific software (BB Flashback Express) was that it was free so that the students could use it in later professional work. In this way, the data collection process also had some learning value for them.

4.7.3 Anonymizing the data in the research report

The Norwegian Data Protection Office (NSD) was notified about the current research project and gave permission to conduct the study. Principle 10 in the Norwegian *Guidelines for Research Ethics in the Social Sciences, Law and the Humanities* emphasizes that all research and student projects involving the processing of personal data must be reported (Ethics, 2006). Personal data is all information that can be traced to an individual, directly or indirectly. The data in the project have also been treated with confidentiality and stored on an external hard drive. In accordance with principles 14 and 16, the data were anonymized and saved in a way so that they could not identify any individuals (Ethics, 2006). Ethical risks depend on how the data are analyzed and reported. Students always need to give consent if the researchers want to publicly show data that are highly identifiable (Mitchell, 2004). Otherwise, it is important to protect the confidentiality of the research subjects and the institutions involved (Kvale & Brinkmann, 2009, p. 186).

As such, it is important that the data be *anonymized* in the proper way in the written research report. The basic requirement is that all identifying information about the students be removed in the final publication. Readers of the report should not be able to identify the students who participated in the study. Accordingly, several different anonymizing strategies have been used.

First, the data were anonymized as a result of the choice of analytical strategy. A significant amount of the data was analyzed at the group level, making the data less identifiable on an individual level. The excerpts from the workshop data and quotations from the group interviews are also relatively short. When excerpts are used, all names and other identifiable cues have been changed. This makes it difficult for the students who participated in the project to be able to identify which student said what. A significant amount of data has also been anonymized through the paraphrasing of data. This includes most of the statements from the group interviews and some of the video data as well. By paraphrasing the data, it

was possible to include sensitive issues and still be certain that the students' personal identities would not be revealed. For example, this could involve the more critical remarks from the group interviews. Moreover, the screen capture data were automatically anonymized in the annotation of the screen operations. In addition, the data are primarily used with a theoretical purpose, which is to discuss CKA as a pedagogical concept.

Second, the gender of the students has been anonymized in the written report. Because there were only four male students in the whole group, these students are either presented as gender-neutral or as female students. This is done to ensure the anonymization of this small group of students. Otherwise, they would be recognized in the interactions by the other students who participated in project if they were to read the written report. Likewise, Kvale and Brinkmann (2009, p. 186) claim that it is necessary to mask events or persons that are easy to recognize. Nevertheless, some students may remember some of the episodes that describe plenary interaction in the offline setting. This is almost impossible to avoid. However, in the analysis, there is less emphasis on individual actions and more on the interactions in the workshop data. In addition, as mentioned, the excerpts are usually relatively short, making them more difficult for the students to identify.

When reporting from the interview data, gender neutral labels such as "a student" or "a second student" are often used. Sometimes fictional names are also used to improve the readability of the written analysis. This was usually in done in relation to the analysis of longer quotes. In addition the student statements were anonymized when the data referred to the group opinion. In the reporting of excerpts from the workshop data, other labels such as S1 and S2 are also often used. These numbers indicate where the students are sitting around the table in relation to each other. Since the gender issue is not a part of the analysis, it was unproblematic to label the data in this way. In addition, the names of the course and the institution where the students did their work have also been anonymized.

Third, still images from the video data that show students have been anonymized. This was done using a feature in a photo editing program (Picasa) to convert the images into cartoon drawings. This made the image blurry with just black and white colors. A special concern was directed toward easily identifiable characteristics of persons (e.g., special hair style). This is why the student faces were also covered with a black line. This was important to ensure that no one could be recognized. Since the main purpose of these images is to display the students' seating positions, the artifacts-in-use, and the material learning environment, this kind of anonymization did not influence the quality of the analysis.

Fourth, the screen data from the Internet have been anonymized. One should note that the data from the global wiki environments in the current study are public. It was therefore important to make it more difficult to find these wiki pages. One strategy was not to show any screen images of the students' work on the wiki pages. This makes it much more difficult for others to trace the students' work on the open web. Instead, the wiki screen work has been described through qualitative descriptions. The translation of the wiki work from Norwegian to English also makes it more difficult to use a search engine to locate the screen data.

Moreover, this was not considered a big issue, since the students had originally published their wiki work anonymously. It is the same with nearly all of the Wikipedians involved in the student work. A few of the students had published their names and actively chosen to be public persons in this community. Their contributions constitute only a very small part of the data collection. These data have also been paraphrased to ensure anonymity.

The data from the students' Facebook group have been anonymized in the sense that only a brief summary of how the students used this group is included in the written report. One issue with collecting personal data from the open Internet is that it might be very difficult to anonymize the data. If quotations are used in the final publications, it may be easy to track them through search engines and find personal data linked to them. One needs to be very careful to avoid using quotes that might reveal the identity of the students. In the description of how the students used this group, it was also important to anonymize specific information that may make individual persons easy to identify (for example, about their background). In this case, it was therefore important to be very cautious and instead paraphrase the data.

5 Exploring the value of student-produced collective work in teacher education

This chapter attempts to answer the first sub-research question that addresses how the value of student-produced collective work emerges in teacher education. The first part will explore how students perceived the value of their work in different ways. Here, data from the group interviews will be used and presented within the framework of four major areas:

- Supporting new pedagogical practice in classroom teaching
- Supporting the development of professional teacher knowledge
- Producing knowledge for a "global" audience
- The influence on the quality of students' individual learning

In the second part of the chapter these findings will be summarized and triangulated.

5.1 Supporting new pedagogical practice in classroom teaching

As one major area, the group interviews show that students *assess the value of their work in relation to its relevance for classroom teaching*. One of the most important overall objectives in the course is also to strengthen the students' ability to use ICT in their own classroom teaching. Several of the students in the group interviews reflect upon the potential of the wiki as a tool that can support their classroom teaching. However, the students have mixed opinions about its value. On one hand, several students report that the wiki is not relevant to use in classroom teaching in primary school (GI 2, GI 5, GI 6). One student thinks that the technology is too difficult for smaller children to use. However, she is not certain about the issue, because she need to become more familiar with the wiki technology (GI 2). Another student in the same group also thinks that the wikis could perhaps be used as a web page, but she claims she still lacks the technical skills (GI 2). These students are unsure about the potential of using the wiki technology. They have acquired neither sufficient technical nor pedagogical skills during the project work to draw any conclusions on the matter.

On the other hand, several students think it is possible to use the wiki to support project work with older children in secondary school (GI 1, GI 2, GI 3, GI 6). For example, one student suggests that the wiki could have engaged the children more, because it is new way of working. The children would improve all the five basic competency skills mentioned in the national curriculum. In addition they would learn about source criticism, which is important, because many of them are not critical enough regarding what they publish (GI 1). Sally, another student, is exceptional in her rich descriptions of the different advantages with using wikis in classroom teaching:

> No, I really believe that both teachers and students can use it. The students learn to use OpenOffice, and Wikispaces is quite similar. And if you first learn how to use a software program, it does not matter what kind of program it is. One needs to choose something one wants to teach the students. I don't think it is so difficult that one cannot learn how to use it. And instead of creating a lot of posters that are thrown away, one could instead produce something on the Internet that stays there.

> It's fun, and one can show their work at home and to others. One would experience ownership, and it would be a nice resource for others to use. And then one could visit the page and actually find something.
>
> When we did the assignment about rock carvings, we were unsure if they originated from the Bronze Age or the Stone Age. Then we Googled it, and we found a page that a school had made about the Bronze Age. There were a lot of drawings, and the students had written about it. It wasn´t so informative, but it was really nice. And I would imagine that the students were really proud of their product. (GI 2)

Although Sally's statement is an exception, it is interesting in several different ways. First, she thinks that the children would be prouder of doing these kinds of assignments compared with an ordinary poster assignment. This description of a sense of pride is here connected with the idea of having a collective ownership of the work. Likewise, this issue of pride was also highlighted in several of the studies in the review where the students produced Wikipedia articles (e.g., Roth et al., 2013). Sally emphasizes that the work can be found through open searches on the Internet, such as through Google. This availability of the work is also emphasized as a confirmation of its value in the study by Roth et al.: "(…) When you Google [the subject], my page is the first result. If that's not a sign of a semester well-spent, I don't know what is" (Roth et al., 2013, para. 32). The value of distributing student work is here not only related to the fact that others can find your work, but it is also connected to the positive experience of knowing that others can find and read your work. The important incident was when Sally found a web page about rock carvings from the Bronze Age that other children had made. This episode helped her realize the potential of letting kids in her school publish their work openly. Although the wiki page was not so informative, it was of value for her, because it gave her the answer that the rock carvings originated from the Bronze Age. Sally's appraisal of the wiki coincides with the positive feelings described by the student in the study by Roth et al. discussed above.

Sally's idea is that the wiki can be used as a replacement for printed posters in schools, which are often thrown away. In a strikingly similar way, a student in the study by Roth et al. (2013), also emphasizes the value of the student work not being thrown away: "I really like the fact that the work done for this class won't just get thrown away at the end like most homework" (Roth et al., 2013, para. 28). While the student here associates the wiki with an alternative way of doing homework, Sally highlights the value of the wiki as a poster that is available to many others. This not only includes the children's families and relatives but also other teachers and students who seek information about the topic. Here, Sally differentiated between two types of outreach. First, the "wiki poster" is of value for people in the close surroundings of the student who know about the work and can easily find it. Furthermore, the student' work can also be of value for others in the larger educational context. This includes a range of unknown students or teachers who will be searching for information on the open Internet and who might accidently stumble upon the wiki.

Furthermore, Sally operates with a different conception of ownership of students' work. She anticipates that students will experience wiki work as fun, because they can show their work at home and to others. This also creates a feeling of ownership. Notice that this idea of ownership is very different from the idea of ownership that emphasizes the protection of

one's own work. Sally connects ownership with the sharing of information on the open Internet and the pleasure of letting others reuse one's work. When she expresses that the wiki would be a nice resource for others to use when they later find it, she acknowledges the value of helping others within a time extended perspective that stretches far beyond the deadline of the project period. These ideas are similar to some studies in the review that show students enjoying the thought that their work can be revised in the future. This notion of ownership is not related to academic performance in the classroom in itself but is rather connected with the act of sharing your work with others as far as possible.[46]

Notice also the language Sally uses in her reflections. When the wiki is labeled as a poster, the wiki is not a strange and alien element in the classroom context but is instead regarded as a new part of a pedagogical practice that already exists. The familiar poster assignment is transformed into a wiki-based poster assignment. In this way, Sally re-conceptualizes the wiki work on campus in teacher education as becoming work with posters in her classroom teaching with children. The wiki moves from being a technological tool to becoming a pedagogical tool. The poster assignment is re-conceptualized from its original position, where it was "locked" to a specific time and local setting, into becoming something that transcends the constraints of time and space. In a fundamental way, she embraces the advantages of displaying digital information on the Internet because of its potential reusability. With a wiki poster the student work can be used and shown within an online environment with a much greater potential outreach. However, Sally does not mention anything about the potential of the continuous improvement of existing work. The primary focus is on the increased reader value of publishing the work openly.

By comparing the wiki with other tools in Openoffice, she also shows that the tool is easy to use and is already part of her existing repertoire. She has no need for extra training. In this way Sally differs from students in many of the studies in the review, who expressed that they lacked sufficient wiki skills.

[46] See section 2.4.5, Time-extended peer editing, page 37.

5.2 Supporting the development of professional teacher knowledge

5.2.1 Sharing across schools in an online setting

As another major area, the group interviews show that the students appraised the value of the wiki as a tool that can *support professional collaboration between teachers*. Several students in the group interviews acknowledged how the digitalization of information permits new ways of sharing and reusing information. One student highlights the point that information on the Internet does not disappear. This makes it possible to download and reuse a digital learning resource in much the same way as teachers use paper copies (GI 4). An in-service teacher in the same group emphasizes that the digital storage of information provides more freedom, because teachers do not need to do the same thing year after year. It is easy to make personal adjustments to different plans used in the school. While a student test in print must be used as it is, a digital test makes it possible to add or remove any item you like (GI 4). The students here highlight how the digitalization of information opens up for new opportunities of copying and reusing information, which strengthens teachers' autonomy.

Some students also think that Wikibooks could be a highly useful collective learning resource (GI 1, GI 2, GI 3). One student thinks this kind of collective work is worthwhile, because there is a lot of time pressure in the daily work as a teacher. More collaboration is a good alternative to all the individual work with lesson plans and so on. The production of a Wikibook would be a great starting point, but it requires that some conditions be fulfilled. The group would, for example, need to agree upon what to do, which is easier in a group of eight than a group of 30 (GI 2). Another student in the same group says:

> I think it can be a good resource for teachers making lesson plans. One person could coordinate this activity at each school: 'I have a very good lesson plan; can you help me publish it?' I think math could be a very good school subject to start with, but I cannot imagine that I will teach students to use a wiki, such as that the students would read literature or do their work in the wiki. At least not in the near future. (GI 2)

Although some students support the idea of a wiki as a tool that can support professional collaboration, this student still thinks that the school would need a dedicated person that could help colleagues do this work. The comment also illustrates that the expense of sharing is that it will require the use of extra time.

The students also disagree on how realistic it is that teachers will develop their own collective learning resource. For example, one student thinks that the workload will be too great. The wiki resource in the project is not widely known, and there are too few contributors. This reduces the quality, because facts are not updated (GI 4). Another student in the same group suggests that the main goal should be to find the enthusiasts who want to develop a collective learning resource like Wikibooks, as this work would be too heavy a burden to take on alone (GI 4). The comment illustrates that some students do not think that the large majority of teachers would be involved in this kind of open sharing of resources. Although it is more time efficient to collaborate, the publication of resources would still

require some extra time of the contributors. Today, publishers do most of this work, and teachers are primarily expected to use these resources, not produce them.[47] In this sense, the wiki assignments challenge the ordinary conceptions of how *the division of labor* is handled in the school sector. As suggested by the student, it might be unrealistic to expect that most teachers would have time to do this as part of their professional work. This is why one of the students suggests that one should instead try to recruit enthusiasts. Because of the existence of the online setting, it is in principle possible to gather many of them in the same environment even though they are geographically spread out at different schools. Another question is whether participation in an online setting by itself would be enough to motivate them.

Several students address the challenge of scaling up the number of contributors so that wiki use can become successful (GI 4). A major weakness with many wiki projects is that they are not able to attract enough contributors. If there are too few contributors, this will have a negative influence on the quality of the product over time because of a lack of updates. However, this will also depend on the content in the resource. For example, one student points out that the fact that certain school subjects remain unchanged for quite a long time. While new knowledge about the human body is discovered all the time, facts in geography are more durable (GI 4). According to this student, is would be easier to produce a collective learning resource within a knowledge domain that is more stable, as it would require less frequent updates of the resource. Likewise, Xiao et al. (2007) found that although most of the students are satisfied with the quality of the content, several of them felt that the quality was not equal to that of a traditional textbook. The quality was viewed as noticeably lower in some of the articles, and the students complained that some of their peers did not put enough energy into the work (Xiao et al., 2007).

5.2.2 Sharing within the school

The students also have mixed opinions regarding the sharing of resources between teachers within one single school. On the more negative side, two students, Jessica and Linda, say they have experienced attempts to share resources openly at the schools where they work, but they failed. At Jessica's school they set up a "resource binder" at each grade level. The point was that teachers were supposed to find relevant assignments and other teaching materials that other colleagues at the school had made. However, because of the extra work of putting the material into the binder, this was usually never done. There are a few enthusiasts who share what they have done and inform people that they can just help themselves, but the rest do not seem to care and "keep their cards close to their chest" (GI 4).

Jessica also explains that the municipality created an online environment within the local learning management system where teachers could share their resources. However, when she attended a training session, she discovered that the only person who actually shared resources was the course instructor. This is the reason why she has also stopped sharing. She does not bother anymore (GI 4). Linda has experienced something similar at her school. It is

[47] In Norway, the recently finished ARK&APP (Gilje et al., 2016) project illustrate how teachers still build most of their classroom teaching on traditional textbooks.

technically easy to share resources in the school's learning management system (Fronter), but still nobody does it. When someone makes a plan for the next half year, they prefer to keep this work to themselves. Linda thinks the main reason is that people think that everybody should do the same amount of work and get nothing extra without any additional effort (GI 4). Jessica suggests that the lack of a culture of sharing in the school should be regarded as part of a broader trend in society:

> Jessica: I think I see this trend everywhere. People have strong ownership over their work. I observe it at my workplace, but it is also the same in this course. People think that if they have done a lot of work, then others shouldn´t benefit from it without having done anything for it. In a culture of sharing, one needs to get something in return.
> Interviewer: A mutuality?
> Jessica: A mutuality. Like when someone in our class refused to write their exam notes in a wiki because they did not want anybody to read their good exam notes. (GI 4)

Jessica explains that the lack of interest in sharing exam notes is part of a broader societal trend that emphasizes norms of reciprocity. On the other hand, there is one example of unrestricted open sharing from within a school. One in-service student said that he usually shares his lesson plans with a colleague who teaches at the same age level at his school and that this kind of sharing is much better compared with both of them making their own individual separate plans. The colleague has also made a lot of binders with lesson plans over recent years, so he can copy anything he wants from these binders. However, they have not yet shared these resources with other colleagues in Fronter, but they will perhaps do it if time permits (GI 4).

Note that while Jessica and Linda reject sharing in a larger group or in an open environment, the two teachers who practice unrestricted sharing do this in a close dyadic collaboration. The disadvantage with this kind of sharing is that it will not necessarily reach others outside the school. This kind of sharing is perhaps also motivated by the positive feedback one receives from colleagues, whereas this may not happen when work is published in an open wiki environment on the Internet.

5.3 Producing knowledge for a "global" audience

As a third major area, the group interviews show that the students were interested in *the authentic value of their collective work*. The students have mixed opinions regarding this issue. On the positive side, there are students who are proud that they have made a contribution that others can benefit from. For example, two students are grateful that their work can be of help to others because it is published openly. The students highlight that other school classes can now watch the video clip they have made about rock carvings before they go on a field trip (GI 4).

Two other students who did a lot of the work on the Wikipedia article are very proud of what they have accomplished. One of them highlights that the work is connected to the best of Norwegian values: "I feel I have volunteered and contributed to the Norwegian social democracy" (GI 5). Even though the work has been done as a student, this student feels that she has volunteered. This experience of "volunteering" indicates a strong feeling of doing something more than just participating in the course. The student has entered into a more socially responsible student role. These strong feelings of authenticity and pride coincide with findings from the review. In one study, the students really wanted to do good work when they understood that many people would read and use their work (Farzan & Kraut, 2013). In another study, many students highlight the pleasure of knowing that others outside the class could benefit from their work (Roth et al., 2013).

It is also interesting that the student from the current study associated the work with democratic values in the phrase "contributed to the Norwegian social democracy." This experience is linked to a feeling of informing and educating the general public, since the encyclopedia is so widely used in the society. Likewise, in a study by Roth et al. (2013: para. 32) in the review, a student states that all students in the course have made a "tangible, solid contribution to human knowledge."[48] Both these examples illustrate a significant move from producing your own knowledge to the production of collective knowledge. While the student in the current study emphasizes the value of the wider Norwegian context, the student in the study by Roth et al. (2013) underscores the contribution to human knowledge in an even broader, more global sense. These differences might be explained by the large differences in the degree of outreach and amount of readers in Norwegian and English Wikipedia. As suggested by Ravid, Kalman, and Rafaeli (2008), this type of work can empower both students' and teachers' control over knowledge. However, it will still depend on their belief in their ability to make contributions to human knowledge even though they are not experts. The Wikipedia studies suggest that this is possible.

Nevertheless, there are some limitations concerning the use of Wikipedia. Although the two students claim they might make more contributions themselves in the future, they do not think young children in primary school should do this kind of work. It is more relevant for upper secondary school and students who are soon to be adults (GI 5). Likewise, the Wikipedia studies in the review were also conducted with tertiary students.

[48] See section 2.3.6 Socially responsible students, page 31.

Furthermore, the students in the current study were not only proud of their work on Wikipedia; they were at the same time embarrassed, because they received critique from Wikipedians on their use of sources. They experienced this as uncomfortable and described the feeling as “getting a punch in your face” (GI 5). Other students were also ambivalent about publishing their work on the open Internet. For example, one student thinks it is scary to publish something on the Internet because this increases the importance of the student work: “It was exciting, because we were supposed to collaborate and be innovative; but it was also scary, because we had to edit others’ work and publish facts on the Internet” (GI 1). This student enjoyed the process, but moving out of the secure walls of the classroom created an insecurity related to the quality of her own work. Likewise, the studies in the literature review also show that contributions on Wikipedia created fear, stress, and tensions among some of the students (Roth et al., 2013).

5.4 The influence on the quality of students' individual learning

As a fourth major area, the group interviews show that the students were concerned about the value of the collective work in relation to their own *individual learning or academic performance*. In the current study, the students had signed up for the course because they wanted to strengthen their digital competence and individual skills on how to use ICT in classroom teaching. Several of the students reflected upon how the wiki assignments influenced their own individual learning in relation to these goals.

5.4.1 Individual learning outcome is low

First, most comments show that the students were still preoccupied with the *perceived value of their own individual learning* in the project work. Regarding this matter, several students also claim that the degree of individual learning was low because they did not put a lot of effort into the work. For example, some students in one group said that they only made minor revisions in the first and third assignments but more in the second assignment, because it required that the work be done from scratch (GI 3). Likewise, students in another group only made minor revisions in the first assignment, because it was very specific and predefined. They primarily focused on layout and design issues and less on the school subject. Nor did they add much new content (GI 6). Similarly, another group described the first assignment as "easy cleaning work" (GI 2). The statements indicate that the students put a low level of effort into the first and third assignments. This again had a negative influence on the level of individual learning.

5.4.2 Lack of training in technical skills

Second, there were students who felt that they did not acquire enough *technical skills*. Several students reported that they wanted to learn more about how to use the wiki technology (GI 1, GI 3, GI 5). This coincides with several studies in the review reporting that students found it difficult to use the wiki and would have preferred more technical support (Choy & Ng, 2007; O'Shea et al., 2011) (Hadjerrouit, 2014; Roth et al., 2013; Zheng et al., 2015). Some students in the current study were disappointed, because they did not get this opportunity (GI 1). The group interviews also show that there are significant differences in the students' technical skills. Some report that it was easy to use the wiki technology (GI 3, GI 5), while others found it more difficult. For example, one student said that she did not know anything about how to make a Wikispaces page, which was used in the second assignment. She would have preferred that all students be taught how to use Wikispaces, because this is the most relevant wiki to use with kids in school. One reason is that one can use different colors, which make it more appealing than the MediaWiki. Because she has not received any training on how to use this tool, she will have to acquire this knowledge on her own or find somebody who knows how to do it if she wants to use it in school (GI 3). Another student was also frustrated, because she thought it would have been really nice to make a wiki page with the children in her school, but she knows nothing about how to use the wiki. The problem was that when they worked with Wikispaces in the second assignment, only a few persons got to use the wiki (GI 1). One reason was that only a few of the students had the necessary technical skills in advance and so they were the ones to do

these tasks. Most of the other students who emphasized the lack of individual acquirement of technical skills were negative toward the project work, because they did not get the opportunity to learn these skills. Some types of wiki technology were also considered to be more relevant for classroom teaching, because they were more flexible in relation to different layout features (Wikispaces). The student wanted to learn how to use this wiki and they were less interested in the team skills that the teacher emphasized.

5.4.3 The acquirement of new team skills

Third, most of the students in the current study were skeptical toward *collaboration in large groups*. They prefer collaboration in smaller groups—like in the first assignment, which consisted of groups of eight and nine students (GI 2, GI 3, GI 4, GI 6). For example, students in one group underscored the fact that individual learning outcomes did not increase when the students worked in large groups (GI 4). However, there were also a few students who reported that it was exciting to work in such large groups, because this was something they had not done before (GI 2, GI 6). For example, one student highlights that the ability to tackle chaos in group work should also be regarded as learning. These situations let students discover their true human character. She claims they have learned new ways to organize themselves through the project work. They have also reflected upon what works and what does not work (GI 4). Although this student may not have acquired many new technical skills, she emphasizes the value of reflecting upon the benefits and limitations of human collaboration. In this sense, this specific student has to a greater degree adopted the original objectives of the assignment emphasized by the teacher. Another student also supports the importance of the goal of the assignments but suggests that this specific course was not ideal for facilitating these kinds of skills: "(…) if your goal is to observe how a class organizes itself and solves a task, that is very important. I do not really know if it would be the most important issue here (…)" (GI 6). This student claims that the conditions in the course are far from ideal. This comment is interesting, because many of the students who were negative in the review literature had also been participating in courses related to educational technology. It might be that these courses are not idea for acquiring team skills, because students usually expect to acquire specific individual technical skills more than "soft" group skills.

5.4.4 The level of individual background knowledge and interest

Fourth, a major challenge in the current study was related to the lack of *background knowledge* and interest in the assignment topics. Especially in the third wiki assignment, several students were concerned about the quality of their work because of their lack of background knowledge. Although the students had done two wiki assignments, they did not feel that they were ready to write about wikis from a more academic perspective (GI 6). For example, one student said that she would have never have volunteered to write about a topic that she had no knowledge of (GI 4). Another student also expressed that the lack of background knowledge was perhaps strongest in the third assignment (GI 4). Likewise, some of the studies in the review showed that students worried about the quality of their work because of their lack of background knowledge. They feared that some of their writings may be incorrect (Karasavvidis, 2010a; O'Shea et al., 2011; Xiao et al., 2007; Zheng et al., 2015).

However, the students were more interested in the first and second assignments in the current study. For example, one group found the first wiki assignment to be both interesting and relevant (GI 6). One student explains: "(…) the interest and motivation was there from the beginning. And everyone had a lot of ideas about doing this and that. Then we just divided the tasks and started" (GI 6). She found the first and the second assignments to be okay, because they were relevant for her work as a teacher in primary school. In the third assignment about the educational use of wikis, she did not know what to do (GI 6).

There were also variations between the students in the first wiki assignment. Because the school subjects had been defined in advance by the teacher, some students were not that interested, because they had specialized in other areas. For example, some students in one group felt it was demotivating that they did not get to choose which topics they wanted to work with. They had to work with music in the first assignment, which was not their main interest. This was also a topic that they knew very little about. Their recommendation is that sufficient background knowledge should be a necessary requirement for making wiki contributions (GI 3). The lack of student choice and the lack of preparatory classroom teaching can be regarded as significant weaknesses in the instructional design.

In comparison with some of the studies in the review, it is possible to claim that this study did not utilize student interests to a large enough degree. For example, Ravid et al. (2008) highlight that each student can make a contribution within his or her area of expertise. Students can bring in more perspectives and diversity, but then the project needs to build more closely on student interests.

Furthermore, some of the students in the group interviews were far from convinced that a "group of amateurs" could produce a text of high quality. A basic idea in the project was that the collective performance would improve beyond the sum of the individual contributions. One student was skeptical about this idea that they could become knowledge producers themselves:

> I have been raised with the impression that Wikipedia is a pretty solid source of information. I have always thought that the text there is correct. When I am supposed to begin to write there and only have a degree from a university college and not even a University, what I think is… Should all those who perhaps have more knowledge about the topic begin to learn something from me then? I don´t know if I am able to say this in the correct way. Well, what if I write something that is not correct. Then others will criticize it. And something may end up being incorrect. Just some thoughts. (GI 4)

This student assumes that knowledge should be finite and quality-approved before it is published. These students prefer the traditional strategy where competent persons produce and advance knowledge. Part of the reason behind the skepticism is that some of the students felt that they had a very low level of background knowledge about the topics they worked with.

Moreover, some students even suggested that the collaboration became even more difficult, because all the students had approximately the same level of knowledge or skills. For

example, one student said: “And then you are supposed to go in and edit something that others have written. I honestly must admit that I do not trust myself enough to think that mine is much better than yours. (…)” (GI 1). This student questions whether more revisions automatically lead to a better text product when the level of background knowledge among the contributors is at approximately the same level. To be qualified to change others’ work, the students here assume that they must be certain that their own knowledge is on a higher level than that of the other contributors. In this case, the confidence is not there. Likewise, several studies in the review show that students are concerned about inexpert editing done by peers in class (e.g., Lund & Smørdal, 2006). The group interviews indicate that if the level of individual background knowledge is too similar, this can have a potentially negative influence on the collaboration.

5.5 Summarizing the interview findings and establishing a triangulation strategy

The group interviews show that the students perceive that the value of their collective wiki work cover four conceptual areas:

- 1. Supporting new pedagogical practice in classroom teaching
- 2. Supporting the development of professional teacher knowledge
- 3. Producing knowledge for a "global" audience (authentic knowledge)
- 4. Improving the quality of students' individual learning

However, the group interviews show that students value these areas differently. The data also show that tensions are created within each major area. In the table below, the students' perceptions have been categorized as either *enabling or inhibitory conditions* in relation to how the student-produced collective work was valued.

Table 5.5.a Possible inhibitory and enabling conditions related to the value of the students' collective work.

	Possible enabling conditions	**Possible inhibitory conditions**	**Tension**
1. Supporting new pedagogical practice in classroom teaching (from GI)			
"The wiki as a poster"	- The teacher transforms a technological tool into a new pedagogical concept.	- The teacher continues to use the wiki as solely a technological concept.	- Technological concepts vs. pedagogical concepts
"The wiki as a poster"	- Open sharing creates a sense of pride and a new kind of ownership among students in school. - The level of outreach includes a range of new target groups.	- Protected submission of work to the teacher only. - Protective ownership of work that is not shared, because the primary focus is on individual performance and grades.	- Deleting vs. reusing students' work in school - Shared ownership vs. protective ownership
2. Supporting the development of professional teacher knowledge			
- Professional collaboration and sharing in an online setting across schools	- Need to gather the enthusiasts online**,** because the act of sharing resources requires extra time.	- Not for the ordinary teacher. Only for the few enthusiasts. - Difficult to scale up a collective project with enough contributors.	- Extra time burden vs. no extra time burden - Voluntary contributions vs. obligatory contributions

- Professional collaboration and sharing with the school	- Sharing needs to be based on norms of reciprocity. - Sharing happens in close relationships.		- Open unrestricted sharing vs. restricted sharing
3. Producing knowledge for a "global" audience			
Entering a cosmopolitan role	Proud	Scared	Ambivalence: Exciting vs. scary, Proud vs. embarrassed
The knowledge domain	- Develop resources in "stable" knowledge domains**.** -Some topics are easier to keep updated. Few contributors and low level of background knowledge is not a problem.	-Few contributors and low level of background knowledge is a problem.	- Production of valuable vs. not valuable societal knowledge - Few vs. many contributors - Stable vs. dynamic knowledge advancement areas
4. Improving the quality of students' individual learning			
Degree of individual learning outcome		- Low learning outcome in large groups and use of group grades**.** - Low level of individual effort among most students.	
Acquirement of technical skills		- Technical skills: Lack of training in individual wiki skills.	
Acquirement of new team skills	Ability to tackle chaos and organize themselves (team skills).		- Knowledge advancement in different group sizes (small groups vs. large groups)
The level of individual background knowledge and interest		- Predefined contributions decrease the quality**,** because students lack background knowledge and interest in subject. - Collaboration (peer editing) becomes more difficult when all students have the same level of background knowledge.	- Predefined contributions vs. interest-based contributions - High vs. low level of background knowledge - Amateur vs. expert

5.5.1 Inhibitory conditions

As we can see from the table above, there were several inhibitory conditions that did not support students' co-construction of valuable knowledge. First, the students are concerned about the relevance of *the wiki work in relation to classroom teaching.* Most of the students were skeptical toward the idea. One reason is that they felt the wiki to be too technically difficult to use with smaller children, but the students were also unsure about the relevance and value of using this tool. In addition, when these students talk about the wiki, it is still a technology and a technical tool. The large majority differ from Sally, who has managed to transform the wiki from being a technological concept to becoming a pedagogical concept. The value of the openness that the technology affords is also not acknowledged.

Second, in the area of *professional collaboration between teachers,* the current study shows that most students show little interest in professional collaboration and sharing in an online setting across schools. The students acknowledge the value of copying digital information from each other, but several students are concerned about the extra use of time that the production of these kinds of resources will require. Another reason is that the students suggest that a norm of reciprocity must be the fundamental premise to make sharing happen. Some students are negative, because they do not necessarily get anything in return when they do this kind of work. Most of the students do not think that teachers will share their work openly or without any restrictions. Open sharing is not a common part of the professional culture in schools nor in the broader society. An exception can be found in the enthusiasts. Successful online collaboration will depend on efficient strategies that can locate and gather these persons who are spread out geographically. In a local offline setting, sharing is most successful "global" audience in small groups where persons know each other well and already collaborate closely.

Third, some students were skeptical toward the possibility of *producing knowledge for a "global" audience.* One concern was that their own level of background knowledge was not good enough to publish their own work openly. Moreover, because the teacher had defined the topics in advance, this made them less motivated. This again decreased the likelihood of making high-quality contributions. They were skeptical toward the idea that they could produce resources that could be of authentic value for society. Some even questioned if it was actually responsible for them to publish something openly if they knew the quality was low. Other students suggested that it is easier make contributions in domains where the knowledge is more stable and can remain unchanged for longer periods of time. More dynamic knowledge areas require more frequent updates. This will demand a larger number of contributors, and it will therefore be more difficult to sustain the development of these kinds of collective learning resources over an extended period of time. When there are too few contributors, the content will not be updated and will gradually lose its value. It is more likely that errors will not be fixed, and there will be less overall improvement of the text.

In addition, several students reported ambivalent feelings. They thought it was scary to publish their work openly. Some were also embarrassed about the critique they received. Moreover, they disliked that others could change or remove their work after they had finished it. They were unsure about the idea of knowledge as something that is co-constructed over an extended time period.

Fourth, several students disliked the fact that there was little emphasis on their own *individual learning during the project work*. For example, some students were disappointed, because they did not learn the technical skills necessary to use the wiki. This was especially evident in the second wiki assignment, when only a few students worked with the design and layout in Wikispaces. This shows that many students still perceived that the individual acquirement of technical skills should be the most important course objective. Moreover, most of the students also felt that the whole-class projects did not improve the quality of the collective work. Instead, they felt that the differences in workloads became larger. Several students reported that a few students did most of the work and that there were also some free riders. They felt that they could have done the same work by compiling contributions as individuals or in small groups.

The quality of the students' contributions was also threatened by a lack of background knowledge and student interest. Many students felt that they lacked sufficient background knowledge to do the work successfully. The students were expected to find relevant knowledge by themselves, but this became difficult because of the short project period. Further, not all students found the topics in the assignments to be interesting. To "force" the students to collaborate closely with each other, the teacher had preselected the topics the students could work with. This created another problem, because the students felt that they had similar level of individual background knowledge. Peer editing became more difficult, because it made the students doubt whether they could actually improve others' work.

5.5.2 Enabling conditions

As we can see from the table above, there were also several enabling conditions that supported students' co-construction of valuable knowledge. First, in the area of *classroom teaching*, the example of "the wiki as a poster" is perhaps the most interesting as an enabling condition. Sally transforms the wiki from being a technological tool into becoming a relevant and valuable pedagogical concept for her own classroom teaching. On one hand, her construction of the "wiki as a poster" transforms the "outside technology" into something familiar. The poster is already in use in schools as part of the existing practice. On the other hand, she expands the idea of the poster as an established concept in the school context. The wiki is redefined as a new type of digital poster that has a much larger outreach than the traditional printed poster. It can strengthen access to student work in a new way. The wiki is here used to construct a new object through the lens of the poster as a concept. The term wiki is no longer the primary label; rather, it is a tool that creates access to the idea of a new kind of poster.

The example also clearly illustrates how a teacher who wants to use a new technology needs to produce convincing pedagogical arguments concerning the value of doing so. Although Sally's sophisticated reflections are an exception, they powerfully illustrate how technologies need to be integrated into a pedagogical language to be viewed as useful for the teacher.

It is also worth noting how Sally's idea of the poster is closely connected to the idea of shared ownership. Her conception of ownership is about distributing and sharing one's work with others rather than protecting one's work from others. As a turning point, Sally

highlights how she found other students' work on the open Internet through search engines. This helped her acknowledge that published student work can be of value to unknown others at a later period in time. The episode illustrates how there can be value in the reuse of students' work by distributing it in an online setting rather than just deleting the work.

Second, in the area of the *production of professional teacher knowledge,* the students also mentioned several topics that can be interpreted as enabling conditions. First, several students highlighted the advantages of digital information. It has become much easier to copy and reuse information with the online setting, but the students disagreed on the implications of these new opportunities. Since open sharing and distribution requires that teachers spend some extra time, the students suggested that it would be important to locate the enthusiasts. The Internet makes it possible to gather the enthusiasts, who are spread wide geographically. However, an effective outreach strategy would be required to locate these enthusiasts. With their focus on this small group, the students also signaled that they do not see themselves in the role of sharing their work in an online setting. The enthusiasts base their fervor for sharing on a set of ethics different from that of most other teachers. Because of their dedication, they are willing to both spend extra time and share their work openly.

Third, the students also felt that they were producing *authentic knowledge for a "global" audience* that was of value for others, because the work was published and distributed openly. This enabling condition was most evident among the students who contributed with the Wikipedia article. One reason may be that they received feedback from outsiders on their work. This might have strengthened their feeling of being part of a vibrant online knowledge-production community. These students also expressed the most intense feelings related to their own work in the group work. One student was especially excited about entering a new role of becoming knowledge producers and contributing to the Norwegian social democracy. This statement illustrates an experience of entering a cosmopolitan role with a responsibility that includes a large area of outreach to the general public. It also involves a strong feeling of doing something good for society. However, since the students also received critique on their work, there is a significant element of ambivalence related to having one's work out in public.

Fourth, a few students felt that the wiki project facilitated *new kinds of individual learning.* One student felt that the project work allowed her to experience how it feels to tackle chaos, because the students had to organize themselves without being given specific directions. Although the students struggled, she thought it was an interesting experience. This example suggests the emergence of a new type of team skill, but the brief comment from the student leaves unclear what this skill more specifically consists of.

5.5.3 Triangulation strategy

These areas will be further pursued in the analysis with the help of other data sources. The first sub-research question addresses how the value of student-produced collective work emerges in the teacher education context. The group interviews show that this value emerges through many different practices that are connected to a collective level of work. In the further analysis, new video and screen data will be triangulated in an attempt to deepen

our understanding of the value of students' collective work in the teacher education context. In addition, the value of the collective work needs to be better understood in relation to the degree of individual learning, including the analysis of which "knowledge production" skills are required. The table below gives a brief overview of how the new data will be triangulated in relation to the data from the group interviews.

Table 5.5.b An overview of how new data about the value of student-produced collective work are triangulated in relation to the findings from the group interviews.

New data (screen data and video data)	**Building on the following data from the group interviews**
1. Creating valuable knowledge in the teacher education setting.	- Supporting new types of classroom teaching - Supporting the development of professional teacher knowledge - Producing knowledge for a "global" audience
2. Individual "knowledge production" skills.	- Improving the quality of students' individual learning

These new data will be analyzed both in relation to both what knowledge is of value in the teacher education context, and what kind of individual "knowledge production" skills are required to succeed with this kind of work.

5.6 Creating valuable knowledge in the teacher education setting

Statements from the group interviews indicate that children in school, preservice teachers, and in-service teachers can produce collective knowledge that can be of value in the educational system. New data will here be triangulated in an attempt to further examine how different groups can create valuable knowledge as a part of a pedagogical practice in the teacher education context.

5.6.1 Creating value for the public

First, the group interviews suggest that it is valuable to let *student teachers publish their collective work openly*. Particularly the students who wrote the Wikipedia article were proud of making a societal contribution. Likewise, some studies in the review emphasize the importance of open textbooks, because they are available to students with limited financial resources who usually struggle to afford regular textbooks (Ravid et al., 2008; Xiao et al., 2007).

The positive value of the student work is confirmed by the pageview statistics related to the Wikipedia article about rock carvings, which show that during a period of approximately one and half years, the article has had more than 4000 pageviews.[xi]

This is the same as a daily average of eight pageviews. The article has also remained more or less unchanged over this period, with only three edits made by two editors. The few revisions give an indication that student teachers can produce information for a wider audience that can be of significant value. Likewise, Farzan and Kraut (2013) found that the text contributions from undergraduate students had the same survival rate on Wikipedia as the individual contributions from PhD students. This indicates that students with limited initial knowledge can make high-quality contributions. In accordance with statements in the group interviews, rock carvings as a knowledge domain was perhaps an easier area to work with, because the knowledge in this area is relatively stable. Similarly, some of the Wikipedia studies in the review highlight the potential value of letting students educate the general public. It is proposed that these student contributions can even be regarded as part of the general outreach mission that universities have (Farzan & Kraut, 2013).

In the second wiki assignment, a smaller group of students also made a wiki subpage titled “Video.” In the “wiki example”, made by the teacher in advance, the students could find two published videos about rock carvings from YouTube. These videos had a limited number of viewers.[xii] In the final student-designed wiki, these original videos had been removed, because the students had made their own three-minute instructional video about rock carvings. The video shows that the students had traveled out and visited two different sites in the local region. In the written summary of the project work, the students explained that they made their own video resource, because they had found only a few relevant online video resources. They decided to make a short, but informative video. The target group was school students who already had some background knowledge about rock carvings. At the end of the video, there are also some questions that can be used to check whether the students had acquired any knowledge by watching the video (Source: students’ written summary of the project work in second wiki assignment).[xiii]

This new video was published on YouTube on March 20th 2012 and was at the same time embedded in the Wikispaces page. On YouTube, the students also describe how the video is relevant for three specific objectives in the national curriculum (two objectives from fourth grade and one objective from seventh grade). The statistics on the number of views of the video show that it has been viewed several thousand times.[xiv] The large number of viewers is also an indication that something of societal value has been produced. It is likely that the video has reached several target groups outside of the educational institution. Although the primary target group in the video included both teachers and students, the student producers regarded tourists as another potential target group. The advantage with publishing the work on a site like YouTube is that anyone can easily watch the video. In this sense, some part of the student work has been successful in producing valuable knowledge for the general public. A few studies in the review also show that the value of student work stretches far beyond the formal educational setting to a wider audience. In one study, the students helped popularize scientific knowledge so that it could reach the broader society, and 30% of the page hits were from users outside the students' home country (Israel) who had not participated in the course (Ravid et al., 2008).

Moreover, the work with the rock carvings from one specific region also exemplifies how valuable work can be done that is related to one specific local context. There were few resources about rock carvings from this particular region on the Internet before the students made their resource. This added value is similar to one study from the review that also emphasized that Wikibooks could be used to strengthen smaller or more specialized topics on which few textbooks were available. When the number of authors increases, this has the potential to add more perspectives and richness to a textbook. A printed textbook will usually be constrained to a small number of authors who can present only a limited number of perspectives (Ravid et al., 2008).

5.6.2 Producing multimodal textbooks

Second, the wiki log data show how students emphasize *the value of producing more multimodal textbooks or learning resources*. When the students wrote about the pedagogical use of wikis in the third wiki assignment, they emphasized the value of producing alternative textbooks such as a Wikibook. In one paragraph, they describe the Wikibook as a good alternative to the traditional textbook in print, because a Wikibook can provide access to various types of information, such as different tasks, videos, and a range of relevant external links. This information is available at any time, and it can be used both as a supplement to or a replacement (substitution) of the printed textbook. These textbooks also make it easier for teachers to choose other teaching methods in their classrooms.[xv]

It is possible that these positive descriptions of multimodal textbooks build on the students´ experiences with the first and the second wiki assignments. For example, in the second wiki assignment, the students produced both original photos and a video about rock carvings. The final student-designed wiki ended up consisting of eight wiki pages with the following titles: "Images," "Facts," "Videos," "Places in the region," "Student work," "Tasks," "Curriculum objectives," and "Sources." Here, one could also find a link to the Wikipedia article the students had created. The table below compares the "Example wiki" made by the

teacher with the student-designed wiki page as a final product. It gives an overview of the resource according to how the main topics were organized.[xvi]

Table 5.6.a A comparison between the teacher designed "Example wiki" and the student-designed wiki in the second wiki assignment.

Main topics on wiki sub-pages	**The teacher-designed "Example wiki"**	**The student-designed wiki**
Text resource (Facts)	- 3 links to different text resources	- A short text with information about rock carvings (361 words). Includes one photo from external photographer.
Student-produced digital stories	- 3 links to examples	- 3 links to examples (The same links used in the teacher-designed wiki). A short text (43 words) and 3 added illustrative images (Source to image not mentioned).
Video resources	2 links to videos about rock carvings	- One student-produced video about rock carvings (3 minutes). It is embedded in the wiki and linked to a video at YouTube.
Images	- 2 links to different photo galleries of rock carvings	- The students used photos from four different rock carving sites (2, 10, 2**,** and 6 photos). They are published as separate slideshows. In total, two students took 20 new photos from four different rock carving sites in the region. These were published on Flickr and then embedded in the wiki. At the fifth site, 19 photos from an external photographer were used.
Different rock carving sites	- 1 link to a newspaper article about the topic	- Brief description of three rock carving sites in the region (Site S: 45 words, Site B: 47 words, Site C: 66 words). Introductory text is 55 words. The page includes one photo from an external photographer.
Tasks	(no page)	- A crossword and a drag-n-drop exercise about rock carvings. External link to the exercises**,** which doesn´t work anymore. - A smartboard lesson plan which is made as a Notebook file.

Compared with a traditional textbook, we see that wiki resources can be used in several different ways. For example, the resource was not published as a printed version; instead, it aimed to offer something different it its inclusion of videos, images, and quizzes. The students not only reused other resources, but they also produced new multimodal resources. In their explanation of the collective work, the students write that they found photos from only one rock carving site on the Internet. This is why they decided to travel and visit four other sites. These photos were published at Flickr so that they could create a photo gallery for each site.[xvii] In total, the wiki page contains photos from five of the most important rock carving sites in the region. These photos are presented as five separate slideshows from different sites on the same wiki page. The photos have been embedded from the Flickr website where the photos were published. Four of the slideshows use student photos (2, 10, 2, and 6 photos). Nineteen photos from an external photographer

were used for the fifth site. A visit at Flickr almost four years after shows that most of the student-produced images have had very few views (approximately 30 views) since they were published in March 2012.[xviii] Furthermore, the students write that they selected the motifs of the rock carvings they thought the children would like to see. It was also important the motifs be easily visible. The slideshows were made from each site so that the students could enjoy looking at the photos without needing to click on them to move forward.[xix]

It is possible to claim that the students in the current study made resources that were of value for the local context in which they were living. The wiki about rock carvings illustrates how learning resources can be created as unique adaptations to local environments. For example, the group of students who both made the video and took the photos moved out of both the normal offline and online settings. They did fieldwork outside of the institutional building by going to an authentic context where they could find rock carvings. Since the students were given only one week to do this work, it is possible to claim that the students put a significant amount of effort into the collective work. They went beyond the minimum requirements of the assignment by moving into a new offline setting.

In contrast, the first wiki assignment builds on the reuse of existing videos. Most of the selected videos had already been published on YouTube, and some of them were not necessarily made for a specific educational purpose. For example, the students explained that they selected videos of children playing musical instruments so that it would be more motivating for other children to use. This gave the wiki resource a specific and unique focus.[xx] This illustrates how students can reuse others' work and modify it in a certain way to make it relevant for an educational context. In comparison, none of the studies in the review place emphasis on student-produced multimodal wiki resources. Although most of the studies give little information about the type of wiki text students have made, they appear to primarily build upon "unimodal" text production. For example, there are no examples of studies allowing students to use a wiki to create a compilation of relevant video resources.

5.6.3 Creating value for the professional work setting

Third, concerning *the issue of sharing knowledge among teachers*, the group interviews show that students emphasized the importance of norms of reciprocity. Some students are negative in regard to this, because they do not necessarily get anything in return when they do this kind of work. The wiki log data confirm that the students did not continue to make any contributions on the wiki pages after the project work was over. This coincides with studies in the review, which found that very few students continue to edit the work after the project period is over (Lampe et al., 2012; Roth et al., 2013). Students do not seem interested in continuing to work on school projects after project completion.

However, in a statement about the pedagogical use of wiki in the third wiki assignment, the students acknowledged the importance of open sharing: "If the wiki is published openly, other teachers can also use the resources and participate in the further improvement of the wiki".[xxi] The students here underscored that others can continue to develop the wiki. The maintenance of the quality of the work will therefore rely on new persons continuing to improve the work. It is primarily in this way that the textbooks can strengthen professional collaboration among teachers in an online setting.

It is also likely that the instructional video about rock carvings has created value for other school teachers. Although the pageview statistics on the Wikibooks site were limited, the data here show some use of the resource pages. In December 2012, approximately half a year after the course had ended, the two wiki pages from the first wiki assignment had 169 page visits (video resources about the human body) and 103 page visits (video resources about musical instruments) for the month December. The article about the educational use of wikis had 57 page visits in total for the same month.[49] The number of visits may seem quite small, but over a period of three years, the total number would reach 3,000–4,000 visits if the frequency were to remain at this level every month. One could therefore claim that this work has been of some value for the professional work setting, because these Wikibook pages were primarily targeted to the school sector, and it is not likely that other persons would be interested in reading these wiki pages. However, there is little information about the purpose of this usage, and there is also very little further development of the wiki pages. One reason is that the wiki project was not followed up in the years after 2012. With new teachers in the course, the wiki assignments were gradually removed from the course. Also, there has been no marketing of the existing wiki pages by the teacher education institution.

Regarding the Wikispaces page about rock carvings, it was not possible to retrieve any statistics about the number of views. Of note, the wiki page was later vandalized, and because the pages have not been restored, this indicates that no one has used the resource since. It shows the downside of total openness which is the potential decline of the value of the learning resource. One reason why the students did not continue to use this resource is perhaps because it was too specialized. Teachers are not required to address rock carvings as a topic in classroom teaching. This makes it less likely that the site would continue to be used regularly. Compared with Wikipedia and Wikibooks, the Wikispaces site is also more difficult to find on search engines. The fact that others are less likely to find the resource also reduces the value of the work. Although contributions in global wiki environments like Wikipedia and Wikibooks are less glamorous, they make the text more available and less vulnerable to vandalism. Moreover, in a vibrant community such as Wikipedia, there will also be individuals putting forth effort to stop vandalism attacks.

[49] http://stats.wikimedia.org/wikimedia/pagecounts/reports/2012-12/most-requested-pages-2012-12-wikibooks-NO.html (Reading date 100216)

5.7 Individual knowledge-production skills

One important question is what individual skills are required to help ensure that the collective work is of high quality. The students' main concern in the group interviews was directed at their own level of individual learning. However, the students' expressed needs for individual learning is not the same as the *individual "knowledge-production" skills* required to succeed within collective work. The triangulation of new data makes it possible to further investigate what characterizes these skills that help ensure the work is of high quality.

5.7.1 Background knowledge

First, the group interviews show that a lack of sufficient background knowledge created difficulties in the group work. The students were even skeptical in regard to the quality of their own work. The workshop data show that especially the students who worked with the wiki page about musical instruments were concerned about their lack of background knowledge. There were several incidents in which students expressed this kind of uncertainty. For example, S8 said, "I think it is a bit difficult to assess it, because I don´t know anything about it from an academic perspective."[xxii] Very few of the students in the group had any specialized academic knowledge about music as a subject. This made it difficult to evaluate the quality of the video resources. Even in the third wiki assignment about the pedagogical use of wikis, the students experienced the lack of academic knowledge about the topic as a problem. During a plenary discussion in the last workshop, one student stated: "We don´t think we know terribly much about this topic."[xxiii] In both the first and third wiki assignments, one can question whether the level of background knowledge was too low to be able to actually improve the wikis.

5.7.2 Information skills

Second, the group interviews show that the students found it difficult to use the sources in the correct way. In one incident, two students, who are working together, reused music from the Internet that they had only limited right to access and display. They were not allowed to display the music publicly. It appears as though they had not read the terms of use, and they thought that one could freely copy and reuse the music.[xxiv] In another incident, some students showed that they had little knowledge regarding the difference between a copyright license and a Creative Commons license. As a consequence, one student uploaded a photo she had taken with both licenses. The photo was tagged with a Creative Commons license on the website, but the student had also put a copyright logo on the image itself.[xxv] In a third incident, some students uploaded images with the wrong licenses into the Wikipedia article they were working with, and once they also referred to the wrong name of the photographer. These images were later removed by Wikipedians.[xxvi] Furthermore, the students also received severe critique from Wikipedians when they published the first draft of their Wikipedia article. They had not cited their references properly. In addition, some Wikipedians raised concerns about plagiarism because of close paraphrasing. Some of the text in the body of the article was too similar to the original source.[xxvii]

Several of the errors made, show that the students lacked information skills. Although the students acknowledge the value of being able to copy and reuse digital information, both the workshop data and the wiki log data show that the students had too little knowledge about Creative Commons licenses. The students also learned that they need to cite sources correctly in the first draft if it is published openly. All these errors pose a significant threat to letting students publish their work on the Internet without going through a proper review, as student errors can create serious problems concerning plagiarism in an open environment. One solution could be for the teacher to make sure that all sources are used in the correct way. This would require that the teacher educator spend extra time and also have sufficient knowledge about these matters.

Likewise, Farzan and Kraut (2013) found that in some cases the students became very upset when their work was nominated for deletion. The main problem was usually that the students struggled in adapting to the norms for the encyclopedia as a genre. The most common conflict was related to the credibility of sources. Some of the comments from Wikipedians were also superficial and not very constructive. However, the difference in the current study was that the comments from the Wikipedians were fair even though some of them were viewed as quite harsh.

In the third wiki assignment, it should also be mentioned that the students emphasized the value of introducing source criticism to students in school; in the text they write: [xxviii]

> A Wikibook can be created by using a textbook as a source or the teacher can introduce a topic to the students and invite them to seek information on their own. With this second option, it becomes important that the students learn to be critical toward the sources they use. The teacher will also need to review the content. On the Internet there exists a large amount of information from many different sources. There is no guarantee that everything is trustworthy, and the students will need to learn how to evaluate the quality of the information they find. (Excerpt from the wiki article about “pedagogical use of wikis)

Here, the students highlight that children in school need to learn to be critical toward sources they find on the Internet. Interestingly, they suggest that the teacher should be involved in reviewing the content.

5.7.3 Revising your own work several times

Third, the wiki log shows that the students seldom made any second revisions of the text they had published on the wiki. Usually, the first wiki edit was also the final wiki edit. There were few further modifications of the first contribution in the wiki. For example, students in the “human body group” made separate individual edits before the workshop session, and this text was to a small degree changed during the workshop session.[xxix] Another example is the “musical instrument group,” who edited the wiki page only during the workshop. Therefore, they did not have enough time to do more than one round of revision. In the second wiki assignment, the students produced a completely new wiki resource page, but there was very little overlapping editing between the smaller groups who did their different parts of the total work. When the students met at the final workshop, the goal was primarily

to make sure that all the smaller groups managed to publish their work on separate wiki subpages. It was first in this workshop session that the smaller groups published their work in the wiki. Here, also, the first wiki edit was the final edit. It is obvious that one important reason why the students revised their own contributions only to a small degree was that they published their work just before the deadline. This made it impossible to use the wiki text as a potentially modifiable draft version. Likewise, a study in the review by Zorko (2009) also shows few modifications were made, because the work was done right before the final deadline. Most groups also published finished text versions because they disliked publishing unfinished work.

However, the challenge is that the quality in the wiki is connected to revision in several rounds. For example, Carr et al. (2007) claim that because the wiki is an asynchronous tool, it is most effective if students distribute their workload throughout the whole course so that they can edit their work several times. Other educational researchers also emphasize the importance of trying to improve or revise of your own work several times. It is only through several iterations that knowledge-production work can reach a sufficient level of quality (Sawyer, 2006). This implies that it is important that students try to revise and improve their work several times.

In the current study, it was only the group who worked with the Wikipedia article who improved their own work in several rounds. The reason was that they received harsh critique from Wikipedians. Before the workshop on March 20th, the wiki log shows that the students had initially published three separate contributions. However, when the students discovered the critique from the Wikipedians, they began a new round of editing work. The major improvement in the second round of revision was related to how the students had cited the references in the body of the article. Although the students had made a list of references in the article, none of the students used citations within the text. For example, when a student added a new source to the list of references, there was no direct use of this reference as a citation in the text itself.[xxx] After the students received critique regarding their lack of citations, the wiki log shows that they added new citations in the sections. These improvements were done from different IP addresses, which confirm that most of the students in the smaller group contributed to this work. In one incident, a student both inserted a citation in the text and also adjusted the list of references so that the author's name was mentioned correctly.[xxxi] In another incident, the students added three citations into the body of the article.[xxxii] A third student added a few new citations[xxxiii], while a fourth student made a major improvement by adding 13 new citations into the body of the article in sections where the same student had published text before. In addition, the list of references was improved when all the relevant sources were sorted in alphabetical order.[xxxiv]

It is quite obvious that this editing improved the quality of the wiki article. It was also viewed as necessary based on the harsh feedback the students received from the Wikipedians. However, in this second revision round, several of the students also tried to connect the article closer to the Wikipedia community by adding internal links to other Wikipedia articles. In one incident, a student added four new internal links[xxxv], and then another student added 13 new internal links. This was also primarily done within the sections with which the same students had previously worked.[xxxvi] In addition, a third student added two new links to other relevant Wikipedia articles in the bottom section of the article, which is

where external links are usually provided.[xxxvii] These incidents show that the students tried to further position their work as being a part of the Wikipedia community. Some of the work with the internal links also required that the student be able to locate other relevant articles in the Wikipedia universe.

Some of the improvements were also about *rewriting their own work*. In one incident a student rewrote a paragraph significantly. All the sentences were modified, and a new sentence was included at the end of the paragraph.[xxxviii] However, it was surprising to find that some of this rewriting indicated a reduction of the content quality. In one incident, a student completely removed a quote which was relevant for the content in the article but which was originally a bit too long. In addition, three sentences with highly relevant content were completely removed.[xxxix] Another edit made by the same student also indicated a reduction of the quality of the text. Two paragraphs with relevant information from one of the rock carving sites were completely removed.[xl] Because there was no written explanation for these edit, it is difficult to know the reasons behind these choices. It may be that the removal of some of the content was related to the critique the students received about their use of sources, but there is no obvious connection. An alternative explanation may have been an attempt to modify the original text to give a shorter description while still trying to keep the meaning in the content as it was. However, it is also possible that the students' lack of background knowledge reduced their ability to continue to improve the quality of their own work. The examples show that further revisions of students' own work did not automatically lead to a quality improvement.

5.7.4 Positioning the work within the broader knowledge community

Fourth, the student work showed the value of positioning a local contribution as a part of the broader knowledge community. In one incident, the students produced a lengthy explanation of their work with the Wikipedia article on the wiki discussion page. Here, the students explained how they produced the new article. The description shows that the students followed several analytical steps to ensure that they produced valuable knowledge for the community. First they read other Wikipedia articles about rock carvings, like the introductory article about rock carvings and another article about rock carvings from one specific area. This was done to better understand what relevant content they could include in their own article. They also wanted to avoid their own article becoming too general, since an introductory article about the topic already existed. Their main goal was to narrow the focus to the local region and describe only relevant information from this area.[xli]

This description of the students' working strategy is strikingly similar to the way much research is conducted. In research, a new contribution will often build on a review of other studies already performed. In a similar way, the students explain that they first read and studied other relevant Wikipedia articles. This helped them become familiar both with rock carvings as a topic and with the genre of Wikipedia articles. In addition, it was important to avoid including content that already existed in the introductory article about rock carvings. The logic is simple: if one tries to create something of authentic value, there is no point in doing the same others have done before. The students' explanation clearly shows that they think it necessary to read others' work to position their own work in a relevant way. Likewise, one of the Wikipedians also encouraged the students to compare the content in

the article with the same culture on the Swedish side of the border, as it is also possible to find literature about these areas.[xlii]

Furthermore, the authenticity of the student work is underscored in the students' description of how tourists are highlighted as an additional target group. The students explain that they have written about how one can get access to the rock carving sites so that it will be more relevant for tourists.[xliii] In this way, the contribution to the global wiki environment stretches beyond the formal educational setting of students and teachers.

5.8 Answering the first sub-research question (the value of student-produced collective work)

The first sub-research question addresses *how the value of student-produced collective work emerges in teacher education.* The triangulation of the data show that the quality dimensions can be described through (1) an increase in the production of multimodal learning resources; (2) an increase in local perspectives on knowledge; (3) the introduction of the voices of new knowledge producers; and (4) open publishing, which makes the student work available for a multitude of target groups. All these value dimensions are in some way connected to establishing the knowledge-production process as more diverse. However, there are no guarantees that the quality of students' collective work will be good enough. The four quality dimensions will here be summarized in a final attempt to answer the first sub-research question.

5.8.1 Creating multimodal learning resources

First, value emerges through *the collective creation of multimodal learning resources*. In the current study, the students transformed unimodal text sources into a rich variety of different multimodal texts. This included a compilation of video resources (first wiki assignment) and a comprehensive resource with images, videos, quizzes, and text (second wiki assignment). These digital learning resources offered access to information in new ways. While a printed textbook contains a limited amount of information, the wikis offer access to a large variety of resources, including additional external links. Although the quality of the wiki work varied, the large numbers of people who have watched the instructional video about rock carvings illustrate the potential value of this work. Videos are being used increasingly more in classroom teaching. However, there are significant challenges in relation to students' lack of information skills. There were students who violated copyright regulations because of a lack of training and knowledge about what type of information one can reuse. A negative consequence of this is that students may become more hesitant about openly publishing their work if they are unsure about the legality of what they have done.

5.8.2 Adding local perspectives to existing content knowledge

Second, value emerges through *bringing new local perspectives into existing content knowledge*. For example, the production of a learning resource about rock carvings from one specific region illustrates that it is possible to design something of local value. The student-authored Wikipedia article from this area can also be regarded as a supplement to the more general article in Wikipedia. Both the learning resource and the Wikipedia article illustrate how students can produce new multimodal resources in an online setting where few resources previously existed. Likewise, Ravid et al. (2008) claim that major publishers will often not be able to support the production of textbooks that have too narrow or local focus. By letting students produce learning resources with a stronger local value, one can also strengthen their experience of making societal contributions. If the student work is to be published in a knowledge-production community such as Wikipedia, the students will also learn to position their own contribution in relation to other work in the community. This can

be regarded as an important research skill that can help students create valuable knowledge for others.

5.8.3 Introducing the voices of new knowledge producers

Third, it is an inherent value in letting *new persons become knowledge producers*. For example, both the in-service teachers and preservice teachers made contributions, which they were not used to doing. While the wiki project highlighted the academic empowerment of students in teacher education, some of the students in the course also underscored the potential value of empowering pupils in school in the same way. For example, by letting children publish their work openly, their work could be valuable for both their extended family and other children in the online setting. In this way, the project work challenged the students to rethink who could potentially be knowledge producers. The inclusion of teachers, student teachers, and school children can be regarded as a way of democratizing the knowledge-production processes in the educational context. According to Ravid et al. (2008), open, free textbooks are part of the new culture of user-generated mass-collaboration. These new types of textbooks can potentially disrupt the traditional power structures in relation to the production of curricular material. In principle, today, any student or teacher can become a textbook author. Because the published text is modifiable, the reader can also, in principle, decide what content to include and what language to use.

Moreover, in the first wiki assignment about music, there were contributors both from students in the course and from teachers who were already working at different schools in the region. This shows that in the online setting, there is the potential of mixing together a community of knowledge producers in the local region that includes both the teacher education realm and local schools. As knowledge producers, students and teachers represent a group that has not yet been utilized in relation to this type of collective work. At this level, the student work in the current study can be interpreted as an attempt by a group of prospective teachers to produce professional knowledge within a specific subject area. Moreover, in the wiki, the teachers could choose to include the resources they found most relevant.

On the other hand, one can ask if the multitude of voices threaten the position of expert knowledge in a negative way. For example, in the current study, the students were not convinced that they could create something of high quality together. The students felt that they did not have enough background knowledge, and, what is more, they were not so interested in the topics they had to work with. For example, this was a challenge in the students' work with the page about musical instruments (in the first wiki assignment). The students also made only few revisions of their own and others' work.

5.8.4 Making the student work available for a multitude of target groups

Fourth, there is value in letting *the student work be available for a multitude of target groups*. The key with open publishing in an online setting is that the same work can create potential value for a variety of target groups simultaneously. Outsiders can be located both inside and outside of the educational context (e.g., teachers, student teachers, children,

extended family, or the general public). Additionally, resources produced and used in a local context will at the same time be of value for others outside that context. Two examples are the Wikipedia article and the YouTube video about rock carvings. At this level, the target group does not necessarily have to be predefined, because the work is, in principle, relevant for any user on the Internet. The large number of viewers of the video (several thousand views) indicates some success in terms of a broad outreach. It is likely that not only teachers or students have viewed the video but also others outside of the educational institution. As suggested by the student producers, this may include tourists as a target group. This shows that large online environments like YouTube can reach a "global" audience, giving added value to many unknown others on the Internet.

Here, one could claim that there is an element of "glocal" distribution of the student work, because there are different levels of outreach. For example, student teachers emphasize how the open publishing of students' work in school can more easily reach children's extended family, such as their grandparents and so on. At the same time, children in other schools can be inspired by the work that has been published. Value is created both within a local educational context and for others who can be regarded as a part of the general public. Although the primary target group is local, open publishing automatically adds value for a "global" audience, which can reuse the work in various ways.

6 Exploring “students’ shared responsibility” in teacher education

This chapter attempts to answer the second sub-research question that addresses how “students’ shared responsibility” emerges in teacher education. The first part will explore how students perceived the collective management of the project work in different ways. Here, data from the group interviews will be used and presented within the framework of five major areas.

- Dividing the tasks
- Unequal sharing of the workload
- Grading procedures
- Leading the project work
- A peer instructional model

In the second part of the chapter these findings will be summarized and triangulated.

6.1 Dividing the tasks

As one major area, students talked about *how they divided the tasks*. Most students found it difficult to get an overview of the collective work because of the lack of explicit coordination. Some students felt that this was easier in the first wiki assignment, because the group was smaller and they knew who was doing what—the roles and the different tasks were more clearly defined (GI 6). Some students underscored that it was much more difficult to get an overview of the collective work in the second and third wiki assignments, because the group was so large. The following statement illustrates the sense of frustration some students experienced: “I did not get an overview, and I still have the same feeling” (GI 3). Although the online tools in the course aimed to provide a better overview, this only happened to some degree. One student reported that they made a table with information about the different tasks in a Google document but that it was still difficult to know who was doing the various tasks (GI 2). When all the students began working in the same online document at the same time, one student explained that this created a mess:

> (…) the text just jumped up and down all the time when people were working. They were writing at different places in the text (…) People were writing. Then suddenly somebody was talking. You could see that things were happening everywhere. It is very difficult to cope with this when you are supposed to write something coherent and also stay updated on what others are doing. It is easier to sit together in a large group, where you can say like: “Hey, you over there, what are you doing?” or you can walk around and be physically present. (GI 2)

The first challenge was that the online tool did not give the students an overview of what others were doing in an effective way. Moreover, the students did not follow the same writing norms. While some were writing, others were chatting or “talking” to each other in the same document. As a solution to this problem, the students would instead have

preferred that the tasks had been divided in the offline setting. It would have been easier if the students could “walk around” and talk to each other.

One student also thought it was a mistake that they decided to delay the division of tasks in the third wiki assignment by doing it online at home after the workshop:

> That evening, I asked if we perhaps should divide some of the tasks we were supposed to do, but then they answered that we could just divide the tasks over the Internet. And then somebody agreed: “Let’s make a Google document and do it there.” But we didn´t actually do it. And I think many of us have not done that much. (…) Everybody had worked a little bit and was not quite sure. And then when we met at the “summary session” where everything was supposed to be finished, I think it was only then that people really began to work. (…) Collaborating in that document. It doesn’t always work that well. It would certainly be exciting to try and do it in the future, but we cannot replace it with us actually talking to each other. Because that was what happened. Everybody wanted to go home. And then I asked: “Perhaps we should talk about it?” But there were not many students who wanted to. (GI 1)

This student felt that something important was lost when the students replaced verbal discussion in an offline setting with online discussions. At the workshop session, she claims that most students just “wanted to go home” even though some students were unsure about what to do. There were no opportunities to discuss this issue. The result was a low commitment toward actually doing the tasks, because the groups did not follow up on the work they were supposed to do. When the class then met at the final “summary session,” many students had just done “a little bit” of work. Other studies from the review also show that students engage less in online discussions than offline discussions (Karasavvidis, 2010a; Zheng et al., 2015). Students in another group explained that the online communication maintained a distant relationship between the students: “It affects the ownership if you just send the information to a person who is supposed to ‘do it’ for you” (GI 2). Here, the use of the word “person” signals the presence of a distant relationship with other group members. The lack of ownership is here related to an overemphasis on online communication and a lack of verbal discussions. Likewise, Zheng et al. (2015) also found that students in an international project preferred to collaborate with peers from the same institution in an offline setting, because they were not acquainted with the other students in the online setting.

However, although some students recommended that tasks be divided in the offline setting, there were also students who felt that the online division of tasks was the best option. One student emphasized that since they just meet twice a week, it was easier to do the coordination work individually at home (GI 2). Some students also highlighted that the use of a Facebook group created some degree of overview and relationship between the students. The students made their own class page, and a student in one group said that she checked the Facebook page regularly and found updated information. She was also part of a smaller group that used their own Facebook page. However, there was disagreement on this issue. A student in the same group felt that Facebook did not add any extra benefits to the project work (GI 3).

One smaller group of students in the second wiki assignment also struggled to develop a good relationship, because most of the communication was done in an online setting. Additionally, some of the students in this small group joined the project late. As a result, these new students just received an email with instructions about which tasks they had to do from the other students in the group. This online communication did not work well, because they did not understand the purpose of the message. On the other hand, one advantage was that they were informed on what tasks to do. In general, they felt that the small group work ended up as individual work (GI 3). The other students in this group also suggested that the collaboration would have been easier if right from the beginning of the project they had sat down together and discussed what they wanted to do. Then the other students would have had more influence on the division of tasks. And if they had gotten to know each other better, it would have been easier to give and receive critique on how to organize the collaboration (GI 4).

These communication problems also illustrate that students dislike getting instructions from other students they do not know. The communication between students is reliant upon norms that are different from those in student-teacher interaction. While most students accept the teacher as a legitimate authority who can give instructions, it is unclear whether they accept instructions from fellow students. It was also not entirely clear which of the students coordinated the project.

It is worth noting that none of the students considered the wiki to be an effective project management tool. Instead, they tried to use other supplementary tools that were more appropriate for this purpose. The advantage with Facebook was that most of the students were using it already, and they knew how to use the different features in its online environment. This coincides with findings from the literature review where a teacher was also struggling to get an overview of the students’ collective work when they were using the wiki (Lund & Smørdal, 2006).

Furthermore, the online division of tasks increased the perceived unfairness in the project work. This coincides with several studies from the review (Dohn, 2009; Karasavvidis, 2010a; Wang, 2014). Two students in one group explained that it became more difficult to divide the tasks in a fair way when the groups were large. While it was quite easy to divide the tasks according to competence in small groups, in large groups many students will often have knowledge about the same topics and consequently wish to work with those topics. In addition, there will be other topics that few, if any, students know anything about. The students will be less interested in this kind of work, because they lack the necessary competence. As a consequence, some students will end up doing tasks that nobody wants to do (GI 4). Likewise, Karasavvidis (2010a) found that there were conflicts between the students, because they had to choose between a limited number of predefined tasks, and some tasks were considered to be easier than others.

For example, in the second wiki assignment, students were given the option to work with tasks that had been predefined by the teacher. The students addressed this challenge by using the principle of “first come, first served.” Several students reported that the tasks were assigned to the student who first signed up for the task. One student explained that the tasks were taken up quickly: “It was like, ‘this is my task and my task,’ and then they just did

it." After they finished the assignment, she just sat there like a big question mark (GI 2). This student complained about the lack of transparency concerning the division of tasks. The students who were quick to sign up got to do the most interesting tasks. The remaining tasks were left for others to choose between. As a result, several students complained that they did not get to pick the subtask they really wanted to work with in the second wiki assignment. Likewise, both Karasavvidis (2010a) and Dohn (2009) found that students "rushed to take" the tasks that were considered to be more popular or attractive.

The phrase "my task" also illustrates how most students still had a strong sense of individual ownership in regard to the separate tasks that were part of the collective work. When the students first signed up for "their tasks," there were fewer opportunities for collaboration around those specific tasks. Similarly, Karasavvidis (2010a) found that the students focused on doing their part, and then they felt they did not have to do anything else.

Several students felt it to be unfair that only a few students got to do the most interesting tasks. One student in the group explained that she would have instead preferred a more open process concerning the divisions of tasks and that they should have used more time to discuss this issue. For example, one student would have liked to do one of the specific tasks, but this task was never up for debate at a plenary level when the work was divided up. In this kind of collective work, she claims it is important that everybody has an equal opportunity to choose the most interesting tasks (GI 2). Likewise, Wang (2014) claims that it is necessary to have a strategy that avoids tasks being divided up according to the principle of "first-come-first-served." He recommends the use of the "lucky draw."

6.2 Unequal sharing of the workload

As a second major area, the students talked about the *unequal sharing of the workload*. Most of the students felt that the burden of the collective work was unequally divided during the project work. On one hand, several students felt that just a few students did most of the work in the whole-class assignments (GI 1, GI 2, GI 4, GI 6). Some of the students felt that the whole-class project actually ended up being collective work done by just a few individuals. According to one student, this happened because many of the students lacked sufficient technical skills. It was obvious that the technically skilled students would take charge, because they knew how to do the work (GI 6). Lisa said: “It ended up being a page thanks to those who know this stuff. “(….) It’s great that they have done much good work, but I cannot say that I have learned anything” (GI 1). Mona was of a similar opinion: “Especially when you let the whole class loose. Like, go ahead, start working. Then it is typical that the same persons take the initiative (…)” (GI 2). She explains that it is easy and convenient to just lean back and let the persons who are really skilled do the work (GI 2). The students here suggest that when certain persons are very active, the rest become more passive in the group work. On the other hand, the students are also grateful for the work these students have done: “Thanks to those who knew what to do, it ended up being something” (GI 1).

The time constraints in the project work seem to have been of importance. One student claimed that the short deadlines made it more convenient to let the skilled students do most of the work. It would have taken more time if the other students with little knowledge were to have done the same work. Another student in the same group also underscored that they only met twice a week (GI 2). The limited amount of time was also mentioned by another group as the reason why the students chose a strategy where they tried to do the assignment as fast possible (GI 3).

Some students who began later with the second wiki assignment complained that they had to do the specific subtasks that the other students had assigned to them. They were not especially happy about these assigned tasks, because they were very time-consuming. There were large differences in how easy or difficult it was to write about the topics they were assigned to work on. One student found only three sentences that were relevant, while another student in the same group wrote a couple of pages related to her task. On some topics it was difficult to find relevant information, and the students had to contact many different persons. They think this was not taken into consideration when they were instructed to the tasks. They explained that this lack of free choice had a negative impact on their motivation (GI 3). Although some students in this group did not write, they reported that they still spent a lot of time trying to find relevant information. Nevertheless, others who assess the work might not understand that the person had actually done a lot of work.

In general, most students felt it was unfair that some students were free riders. For example, several students were displeased with the fact that some of the other students did not even come to the sessions (GI 3, GI 6). One student was disappointed that some students received a grade without having done anything for it. Although there will always be somebody who tries to free ride, this student thinks other students in class were provoked by this behavior, because free riders get the same grades as the others when they had not even attended the

sessions. She explains that many of the students in the course have said to her that this is very unfair. Some students just receive a grade, while others need to work for it (GI 6).

One student chose to illustrate her negative feelings toward free riders by telling a story. At one point she collaborated with a colleague. They were supposed to create tests, text resources, and lesson plans together, but the colleague always ended up asking if he could copy the material from her. Finally, she had to hide her work. And that was when the colleague understood what was going on. She said that she does not mind sharing, but it is annoying if it only goes in one direction over a long period of time. It is demotivating to do lots of work that others can then use while you get nothing in return (GI 4). The same student claimed that the unequal division of work created similar problems when her students were doing project work in school:

> (…) In a school class, you will have everything from the weak to the super-smart children. It will be a big problem that the super-smart do three-quarters of the work, while the weak perhaps contribute with a few sentences. In itself this can be good because the workload is adapted to their individual level, but many children experience it as very unfair if they have to work much more than that and that person. (GI 4)

Here, the student acknowledges that an unequal division of work can be good for the students' individual learning, but it will still be viewed as unfair in the school class.

Furthermore, some students in the group interviews even admitted they did not contribute much to the project. In one group, one of the students disclosed that the skilled students had done most of the work. She explained that those students did the technical work that they are really good at but that she had a bad feeling concerning her own contribution. She had done some field work, but that was it. Others had done much more than she. In addition, the second student in the same group continued and said she had done even less work than the first student (GI 1). A student in another group also claimed that she "unintentionally cruised through one of the assignments" (GI 2). She would have preferred to do more work, but everything was already finished. So she just sat there, put on a nice smile, and then eventually her part of the task was done. She thinks many students had the same experience. She continued by explaining that things are being done, and you are just not part of it. Although you really want to contribute, there are other dominant persons who really know what they are doing. It is easy to just lean back and think, "Well, it will get done anyway" (GI 2). Another student in the same group added that it is not so easy in large groups if you are a bit modest and reserved (GI 2).

Several students explained that they really did not want to be free riders but that it just happened. In small groups, a student will usually become a free rider with intent. However, in large groups, the students might become free riders without intent. One reason in the current study was that nobody had a good overview of who was doing what. It was difficult for the students in the current study to find out what it was that they should do. Without explicit instructions and coordination, there will probably also be fewer sanctions against the free riders.

6.3 Grading procedures

As a third major area, the students talked about the *grading procedures*. In the current study, the groups were given the same grade for the collective work. As a consequence, all the students received the same grade in the whole-class projects in the second and third assignments. In line with other wiki studies (Carr et al., 2007; Hadjerrouit, 2014), group grades were used in an attempt to strengthen student motivation for the collective work. However, the group interviews show that several students instead criticize the group grades as being unfair. This finding coincides with several studies in the review reporting that group grades create feelings of unfairness (Carr et al., 2007; Hadjerrouit, 2014; Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014).

First, some students felt it was unfair that free riders got the same group grade as others, and nobody did anything about it (GI 6). Several other Wikibook studies show similar findings, where a few students do most of the work while many others do little work (Carr et al., 2007; Ertmer et al., 2011; Ravid et al., 2008). This is evident even when individual contributions are mandatory (Kessler & Bikowski, 2010; Kim, 2015; Zheng et al., 2015). Group grades are perceived as problematic when a few contributors do most of the work (Hadjerrouit, 2014). Likewise, one student in the current study viewed it as problematic that the whole-class projects were included as a part of the final individual grade each student received. This student’s main objection was the large differences in students’ levels of ambition. Some students just want the credit points, while others want a good grade. As a consequence, the ambitious students take control and do the work. It is easier for those who do not care to just sit there. On the other hand, the students who care about the work will let the others surf through the course, because they know that as long as they do a good job, the end product will be okay. Some of these students might take more control to make certain that the final product ends up being good enough, while those who do not care are less concerned about the end product (GI 2). This student’s active use of the verb “care” also shows the strong personal feelings connected to the collective work. The dichotomization of students between those who “care” and those who “don’t care” creates tensions in the group. The large difference in ambition levels is also unavoidable.

Another student, Jennifer, is also concerned about her limited influence on the overall group grade:

> In my honest opinion, if I had really wanted to get a good grade, this would have been a bit difficult for me. Throughout school I have never enjoyed being put in a group with students who are much weaker than me. Then I would have to be assessed together with them, because one doesn´t want to override others. You do not want to move into others’ territory and say: “There are a lot writing errors here, can I fix the whole package?” I do not want to be that kind of person, but at the same time you don´t want to get a grade that weakens your own individual grade. In upper secondary school your grades are decisive for further studies. If it had been really important for me to get a good grade in this course, I would have been more concerned. (GI 4)

Implicitly, here Jennifer describes collaboration where students are in charge of different "territories," or aspects. The formulation "You do not want to move into others' territory and say: 'There are a lot writing errors here, can I fix the whole package?'" illustrates that editing others' work is perceived as crossing into another's territory or domain. Jennifer experiences it as difficult to criticize others' work. The implicit collaborative norm is that one does not have the permission to move into others' "working area." The quote "I do not want to be that kind of person" also shows the strong feelings of impoliteness that follow such an action. At the same time, Jennifer fears that she will become a "victim" of an average group grade, because she cannot influence others' work. The conflict emerges because when Jennifer notices that someone else has done something wrong, she feels that she cannot do anything about it because that would be impolite. Likewise, several studies show that students dislike being held accountable for others' work (Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014).

The current study indicates that group grades given to large groups increase tensions, because students then feel that they have to be even more polite. In addition, the differences in student ambition levels become even greater, and the individual influence on the group's performance is reduced even more. As a consequence, the group grade becomes even more unfair.

Furthermore, these group grades become an even larger problem in courses where the grades are considered to be important for students' future work opportunities. Jennifer's comment on grades being "decisive for further studies" illustrates the strong perceived value of grades in some courses. They are considered to be important "tickets" to a good future life. However, in this specific course the grades were less important, so this made it more acceptable to use group grades.

Nevertheless, the use of group grades in the current study interfered with the students' perception of grades as something that can be used to rate and sort students by differentiating between their individual performances. The group interviews indicate that these grades did not lead to an increase in student motivation but that rather it is more likely that some students did less work than usual. The project created an imbalance between collaboration and competition with too strong a weight on collaboration. Likewise, several studies in the review also show that the wiki-mediated collective work has interfered with the well-established culture of individual assessment and competition between students (Carr et al., 2007; Hadjerrouit, 2014; Karasavvidis, 2010a; Naismith et al., 2011; Stafford et al., 2014).

6.4 Leading the project work

As a fourth major area, the students talked about *leading the project work*. Several students felt that there was a lack of leadership in the group work. Although a few students were considered to be the informal leaders, this did not necessarily make the communication easy. To some degree, students felt that the teacher’s authority was substituted by the authority of a few students. One student talked about the leader as the “administrator”: “(…) I knew Kelly, who was the administrator. I went over and asked her about something because I already knew her. Half of the students know each other, while the other half do not know each other (GI 2). Some students felt it was easier to communicate with the student leaders because they had known them from before.

Another student revealed a more negative experience. She said that some students took charge, but there was never anyone who stopped to ask if everyone was managing to keep up with what was being done. As a result, she dropped out (GI 1). In this specific course setting, there were preservice teachers who knew each other well from before the course and in-service teachers who did not know these students. As previously mentioned, this asymmetry between the sub-groups in the class might have increased tensions.

Moreover, some students claimed that it was difficult to identify free riders in large groups, because it was more difficult to get an overview of the work (GI 3, GI 4, GI 6). For example, one student questioned whether the teacher in the course actually managed to keep an overview of who made contributions or not. She noticed that many of the other students were concerned about the same issue. Nevertheless, she admitted that in the end you just ignore it, because your main focus is to finish your own task. (GI 6). It is suggested here that it is easier to be a free rider in a large group because you can “hide away” and that there was a problem with free riders that was not followed up on. The student here assumed that this was actually the teacher’s responsibility to follow up and not the students’ shared responsibility. Who was responsible for this issue was not clarified in advance before the project began.

Likewise, Dohn (2009) found that if the students were left to themselves, the teacher would be criticized for not doing his or her job because of the lack of involvement. Several students in the current study also expressed that they would instead have preferred more teacher involvement. One student thinks that the teacher should have provided better support in the first phase of the collective work. “In the beginning I struggled with what we were supposed to do. The teacher needed to divide the tasks. It needs to be directed by the teacher” (GI 4). The student here suggests that the teacher should have divided the tasks between the students. Another student also suggested that the problem of the unequal workload could be solved if the teacher were to divide the work. For example, the whole class can first brainstorm what needs to be done, and then the teacher can divide the specific tasks, as the teacher knows the students and can match the different task according to their skills—for example, some are good at writing, while others are good at talking (GI 4). Moreover, one student suggested that it is necessary to have a firm structure when the whole class is involved in a project (GI 2). Likewise, some studies in the review suggest that the teacher needs to actively support the development of a vibrant community of student learners (Elgort et al., 2008; Kim, 2015; Zorko, 2009).

However, in the current study, there were also some students who liked the idea of students sharing responsibility. Although one student explained that she would have preferred more teacher control and clear instruction ("Do this and that"), she still thinks it is a good thing to try to hand over more responsibility to the students (GI 1). Similarly, Arnold et al. (2012) found that most students reported that they enjoyed doing wiki work with less teacher intervention compared with regular group work. However, several of the students in the current study state that they would have preferred more teacher control during the project work.

6.5 A peer instructional model

As a fifth major area, the students talked about *the instructional model*. Some of the students in the group interviews also discussed alternative instructional models that could better support peer learning in large groups (GI 2). Mary thinks they should have focused more on learning than just the collective work. She disliked the fact that the skilled students did tasks that they already knew how to do. Instead she suggests an alternative principle that could have guided the division of tasks between the students: “I do not know how to do this, that is why I should try to do it” (GI 2). Jessica, in the same group, agrees with Mary and claims that the students, who knew how to do a specific task, just grabbed the task. She thinks others should have been given the same opportunity and that it just all happened really quickly.

Mary thinks it would have been better with a peer instruction model that lets students teach each other different skills. The students could have been divided into smaller groups, and then the more competent students could have been mentors for the others. The collective work would then have been guided by the following principle: “I know how to do this. Would anyone like to join me?” Student mentors would have to explicitly invite other students to collaborate with them. If a skilled student is assigned to do a specific task, it is very important that others are given the opportunity to join in (GI 2). Likewise Ravid et al. (2008) reported on an instructional design where each student made a contribution within his or her area of expertise. However, this study did not emphasize the mentoring dimension in the group’s work.

For example, Mary suggests that the student expert could teach three students with limited wiki coding skills. This could be a very fun way of working, because the students would acquire new skills. These three students could then teach the skill to the rest of the class afterwards. In this way, she claims all students would learn something new during the project work (GI 2). The basic idea is that students with proficient skills in different areas should train and help other peers. Although the peer feedback here is less symmetrical, it still builds on the idea of sharing responsibility, because the students have to be mentors for each other.

Mary continues to explain that the peer instruction model is inspired by her observations of how children collaborate. In school classes she can often hear kids say: “I know this, so I can teach it to you,” while the “motto” in this course has been more similar to the following phrase: “No, I know how to do it, so then I´ll do it” (GI 2). Here, Mary suggests that there has been too little focus on how students can help each other. Her reference to the child who says “I know this, so I can teach it to you” is used as evidence for the existence of a natural desire in humans to teach others what they know. She has observed that children enjoy showing others what they know. They do not “protect” what they know but rather give away their knowledge to others unconditionally.

This instructional model requires the teacher’s support. One student stated that it is important to be clear about the collaborative norms: “Be clear that one should do a task because one wants to learn how to do it, and not because it is supposed to be solved as fast as possible” (GI 2). The student suggests that the teacher could say: “I do not want the ones

who know what to do because then it is done fast. I would prefer that the ones who do not know how to do the task actually do it, because then they will learn something" (GI 2). In this learning environment, the role of the teacher is to ensure that tasks are divided according to students' learning desire and not according to the principle of "getting the work done as fast as possible." This learning model requires that students discuss the collaborative norms and fundamental values that should govern the work.

Nevertheless, Sarah, in the same group, warns against giving too much extra work to certain student experts in the project (GI 2). One alternative way of involving all students could therefore be to map the student interests at the beginning of the course:

> One could have used a questionnaire that assessed what the students could and could not do. And then one could have organized the groups according to interests or things the students want to improve. Then everyone will learn something specific that they did not know before. (GI 2)

This student even suggests that the teacher could let the students use the results to organize the work. They would then have had a better overview of what skills the different students had and what they were interested in doing (GI 2). Digital tools can be used to support this type of project management. In this case the teacher does not have to control the process by dividing the students into different groups; instead, they will manage to do this on their own if they are provided with the proper tools. Similarly, Zheng et al. (2015) also found that groups that were divided according to their interests increased their motivation.

However, even though several of the studies in the review also emphasize the value of peer feedback, some findings show that students dislike the fact that student-produced content is of lower quality than what the teacher could have presented (Wang, 2014). As reported by (Dohn, 2009), the perceived quality of student work creates a fundamental tension between letting students share responsibility for the collective work and letting the teacher answer student questions requests.

6.6 Summarizing the interview findings and establishing a triangulation strategy

The second sub-research question—*How does ‘students’ shared responsibility’ emerge in teacher education?*—covers five conceptual areas. In the table below, the student perceptions from these three areas have been categorized as either enabling or inhibitory conditions in relation to how they felt that they shared responsibility for the collective work.

Table 6.6.a Possible inhibitory and enabling conditions related to how students share responsibility for collective work.

	Possible enabling conditions	**Possible inhibitory conditions**	**Tension**
1. Dividing the tasks (between the students) with digital tools	- Easier to get an overview if the group is smaller (first wiki assignment). - Facebook gave an overview of the project work**.**	- Difficult to get an overview of the collective work in large groups. There is a lack of explicit verbal coordination in the offline setting. - Students have to work with predefined topics. - Division of tasks in online setting (e.g., Google Docs) did not work out well. Not all students felt that they got a fair chance to do the most interesting tasks. - Only a few students did the most interesting tasks.	- Overview vs. lack of overview - Strong vs. weak ownership of tasks - Free task selection vs. constrained task selection - Standardized (same) vs. Unstandardized (different) tasks
2. The sharing of the workload during the project work (The division of tasks between the students)		- Students become free riders because they do not know what to do. - Unfair that some students do most of the work. - Unfair that some students are free riders.	- The size of the contribution varies (equal vs. unequal size) - Most students do something vs. some do nothing
3. Grading procedures		Group grades result in less fair individual grading**.** - Group grades become less fair in large groups. - Presence of free riders**.**	- Individual grades vs. group grades - Students with high vs. low grade ambitions

4. The leadership of the project work (The division of tasks between the students and the division of tasks between the students and the teacher)	- Need more teacher control**.**	- Students were unsure who was in charge. Student leadership was unclear. - Lack of control and coordination by teacher.	- Role of student leadership is clear vs. unclear - Role of the teacher is clear vs. unclear (Student control vs. teacher control)
5. Peer instruction	- Instructional model built allows all students in class help each other in a systematic way. - Student interests needs to be mapped in advance before the project starts.		- "Doing something as fast as possible" vs. "learning how to do it" - Maximizing the collective performance vs. maximizing the improvement of individual learning skills

6.6.1 Inhibitory conditions

Concerning the question of students' shared responsibility, the group interviews reveal several possible inhibitory conditions. *First*, the students complained about an unfair *division of tasks*. For example, in the second wiki assignment the students viewed the tasks as different according to the following criteria: easy vs. difficult, time-consuming vs. not time-consuming, and interesting vs. uninteresting tasks. Moreover, some found it to be unfair that they did not get to choose to do the most interesting tasks. Because the tasks were divided in an online setting, there were few verbal discussions. The lack of face-to-face discussions around this topic even created a conflict in one of the smaller groups. In addition most of the students struggled in regard to getting an overview of all the collective work. Particularly in the second and third wiki assignments, it was difficult to coordinate the whole-class project work.

Second, the students reported that they felt that the *sharing of the workload during the project work* was unfair in that only a few persons did most of the project management. In addition, several students reported that they were displeased by the fact that some students did no work at all. Some students even reported that the lack of a clear overview turned them unintentionally into free riders, because they did not know what to do. These differences in workload were perceived as unfair, and the students found that this problem increased in the second and third wiki assignments.

Third, group grades were also perceived as unfair by several students. The high-performing students found it difficult to be part of a collective work of average quality. As the group size increases, their individual contributions become increasingly less important. In large groups it is also more difficult to comment or improve on other students' work. In the current study, the students felt that individuals had their own working areas that required "permission" to

enter. This amplified the feeling that some students had of a limited opportunity to influence the group work. Students who are used to getting better grades than their peers will had more to lose if the whole class got the same grade.

In addition, several students perceived it as problematic that some students received grades without actually doing anything. One reason for this is that the group grading of the whole class creates too much variation in regard to performance motivation. This demoralized the students. Those who wanted to get a good grade received proportionally less individual credit. At the same time, this kind of grading put more pressure on this group of ambitious students, because they felt that they had to do more work to ensure that they would earn a good grade. Although they viewed this division of labor as unfair, they still preferred to do more work to secure a good grade. While the students who had a larger self-interest in the collective performance did more work, the students who just wanted to pass the course could do less work.

These problems escalated with increasing group size. It became easier for the students who just wanted the credit points to “hide away” and free ride. In addition, the ambitious students felt that it became more difficult to improve on other students’ work. Although the students received a group grade for the whole group, this did not strengthen the student perceptions of a group identity for the whole class. These grades had a negative influence on student motivation and the work effort. In general, the students perceived that the quality of the work did not improve when they worked together in large groups.

Fourth, some students reported that they were unsure about *the leadership of the project*. The role of the teacher was seen to be unclear, and the students would have preferred that he had directed more of the collective work. The students also lacked collective strategies, because they were used to the teacher planning, monitoring, and evaluating project work.

6.6.2 Enabling conditions

Concerning the question of students’ shared responsibility, the group interviews give a few indications of possible enabling conditions. Most of the students emphasize that collaboration was easier and more effective in small groups. One reason is that the relationship was better, because trust emerges through close interaction. Another reason is that it was easier to get an overview of what was going on. Although the students used a Facebook group to get an overview of the work in the whole-class project, this was apparently not enough. One student suggested that they should have instead divided the whole class into two big groups. Then the group size would not be too large, and the project work would also include an element of grade competition.

Several students also reported that the teacher should be in more control, but it is not clear how this should be done. Interestingly, one student introduced a new “student expert” model that could better support peer learning in large groups. This instructional model requires that all students teach each other specific skills. The phrase “I do not know how to do this, that is why I should try to do it” (GI 2) illustrates that the maximization of individual learning should be the guiding principle for the division of tasks. The collective performance will then build more on student interests and less on maximizing individual abilities that

already exist. Tasks should therefore be divided according to students' learning needs or interests rather than their individual ability. The goal would then be to create a professional learning community of students. When students have acquired new skills, the collective work could then be organized according to the principle: "I know how to do this. Would anyone like to join me?" This would make the peer learning more relevant. In this case, the student recommends an apprenticeship model that builds on all students teaching each other different skills according to their areas of expertise. The goal, then, is not be able to do things as fast as possible but instead have a focus on maximizing the individual's learning. In this way, the collaborative model will not maximize the collective performance but will rather maximize individual learning by transforming the body of students into a community of teachers. This suggests a fundamental shift where the learners become teachers or mentors for each other, because students have to give each other peer feedback in a systematic way.

Moreover, digital tools can be used to map student interests before the project starts. The different tasks can then more effectively be divided and organized according to students' learning needs as well as their interests. In this way one can get information about student interests in a more effective way, which can then support the further management of the project.

6.6.3 Triangulation strategy

The second sub-research question addresses students' shared responsibility in the teacher education context. The group interviews showed that shared responsibility emerges as five different practices. These include dividing the tasks, sharing the workload, designing the grading procedures, determining the leadership of the project work, and designing an instructional model.

In relation to several of these practices, students are concerned about how the project work can be structured as fairly as possible. This involves the design of fair procedures for the division of tasks, fair sharing of the workload, and fair grading of the group work. Second, the project work also changes the role of the students and the teachers. This again has an influence on both the relationship between the students themselves as well as between the teacher and the students. Third, the project work challenges our notions of how we design teaching and learning in the teacher education context.

These issues will be further explored in an attempt to conceptualize students' shared responsibility. The table below gives a brief overview of how the new data will be triangulated in relation to the five major findings from the group interviews.

Table 6.6.b An overview of how new data about students’ shared responsibility are triangulated in relation to the findings from the group interviews.

New data (screen data and video data)	**Building on the following data from the group interviews**
Type 1. Dividing the tasks with a minimum of discussions	1. Dividing the tasks
Type 2. The problem with unequal contributions	- 2. Unequal sharing of the workload - 3. Grading procedures
Type 3. The student moderator	- 1. Dividing the tasks - 4. Leading the project work.
Type 4. Observing others work	- 5. A peer instructional models

These new data are used to further describe the complexity surrounding students’ shared responsibility as it emerges in the interplay between an offline and an online setting.

6.7 Dividing the tasks with a minimum of discussions

The group interviews showed that some of the students were disappointed with how the tasks were divided in the second wiki assignment, because they did not get to work with their first choice of tasks. These feelings became even more intense, because they viewed the process of dividing the tasks as unfair. First, the students experienced it as unfair that the tasks were divided according to the principle of "first come, first served." The students perceived some tasks to be more attractive or interesting than others. Only a few students got to work with these tasks. One student pointed out that those who knew how to do a task just simply grabbed it (GI 4). Another student also reported that she would have liked to do one of the specific tasks but that this issue was not discussed (GI 2). Some of the students think they spent too little time on verbal discussions and negotiations. Because the group interviews revealed significant tensions concerning the division of tasks, this issue will be further examined with supplementary video and screen capture data.

It was particularly in the second wiki assignment, that the students divided the tasks after the principle of first come, first served. The screen capture data show that the students who managed to quickly sign up for Google Docs and write their preferences into an online document were the ones who got to choose first what they wanted to do. With the exception of the mandatory Wikipedia task, the students quickly signed up for all the subtasks.[xliv] One reason might be that this subtask specified that the students needed to write a substantial amount of words about the topic.[50] Therefore, it was perhaps seen as more time-consuming to do this task. As described in the group interviews, the actions and screen operations confirm the experience of this process as being a race to sign up for some of the more attractive tasks and avoid the less attractive tasks. Another illustrative example is when a student said that she was first when she and another student accidently signed up for the same task simultaneously.[xlv] One possible element of unfairness here is that the students took different lengths of time logging on to Google Docs. Some students were more proficient than others in signing up, and they were thus first to choose the tasks they wanted to do. This episode illustrates that there were few explicit discussions concerning project management. Instead, implicit coordination like the principle of "first come, first served" was employed. Although this strategy was time-efficient, the lack of verbal coordination and explicit negotiations may have increased the perceived unfairness. The students avoided explicit coordination of the whole-class project work and instead used online tools that only to a small degree supported discussions around project management. In the group interviews, several students reported that they had expected that more time should have been spent to directly coordinate the tasks.

In total, the students used approximately seven minutes on dividing the tasks between each other in Google docs.[xlvi] Although there were a few discussions about some issues, these were primarily questions of clarification. As explained by a few students in the group interviews, plenary discussions become potentially much more time-consuming when the group size increased (GI 3). However, by following the principle of "first come, first served," the division of tasks becomes very time-efficient, because it requires few negotiations or discussions. This may have appeared as the best solution, because the students had a very

[50] See section 4.2.3.2, The second wiki case, page 71.

short time to complete the project. The teacher had also encouraged them to choose time-efficient solutions like Google Docs.

Compared with the group interviews, the audio and video data do not reveal any significant conflict around the selection of tasks. The feelings of perceived unfairness were much stronger and evident in the group interviews. One reason might have been that the students didn´t want to complain in front of the video camera or perhaps the feelings of unfairness came after the project was over. A second reason may be that the students first became aware of this unfairness at a later point in time. The feeling of unfairness is something some of the students experienced when after the workshop they later reflected upon what had happened. Another reason may be that the students did not want to openly disagree with each other and potentially create a conflict in front of the video camera. A third reason is that one of the attractive tasks, about the design and layout of the wiki page, was not discussed at the plenary level because it was created by the student moderator and just assigned to one of the students.[51] The group interviews revealed that one of the student got to this task, while other students also wanted to do the same task.[52]

One of the challenges in large group collaboration is the degree to which the best contributions from each group member can be utilized. For example, dividing the tasks according to the principle of first come, first served does not necessarily utilize the expertise in the group (division of different tasks). Digital tools like Google Docs and the wiki also failed to provide any useful support for online discussions. The review shows that there have been some attempts to develop better support for project management in environments like Wikipedia (Farzan & Kraut, 2013; Roth et al., 2013). However, Hadjerrouit (2014) suggests that the wiki needs to be used together with other Web 2.0 technologies, because the discussion page in the wiki is not designed to promote reflections. In relation to other project management issues, the students also used a Facebook group.[xlvii] Similarly, Zheng et al. (2015) found that students frequently used Skype, Google Talk, email, and Facebook to plan and discuss the wiki work. Another researcher (Kessler & Bikowski, 2010) suggests that students need access to an online environment where they easily can discuss different questions. This was not possible with the wiki. However, because the group was so large, any discussion would risk becoming too time-consuming.

[51] See section 6.9.5, Episode 4, page 193.
[52] See section 6.1, Dividing the tasks, page 163.

6.8 The problem with unequal contributions

One challenge with sharing responsibility is managing to let everyone contribute. The students either divided the work individually (e.g., first wiki assignment about human body) or in smaller groups (e.g., second wiki assignment). However, the group interviews show that several students were annoyed about free riders and that some students did more work than others. The new data reveal that there were three types of unequal contributions.

First, there were differences in the size of each student contribution. The wiki log shows that all students made individual contributions in the first wiki assignment about the human body before the workshop. However, there were substantial differences in the content descriptions.[xlviii] In contrast, the wiki log from the third wiki assignment shows that only half of the group had many contributions before they met at the workshop.[xlix] However, the wiki log gives limited information, because the contributors are sometimes anonymous. If the students chose to do this work in dyads, most of them might also have made a contribution in advance. However, there were still differences in the size of the contributions in this assignment too.

Second, the group interviews show that some students were annoyed about the students who did not show up at the workshop sessions. In addition, they found it difficult to get an understanding of which students were actually participating in the course. The video data also show that some students did less work because they did not show up for the third, fourth, and fifth workshops (whole-class projects).[53] Perhaps the students thought it would be easier to "hide away" in the whole-class project compared with the groups of eight and nine in the first wiki assignment. There is some indication that the group size is important. A study by Arnold et al. (2012) in the review indicates that the problem of free riders is non-existent when students were organized to collaborate in dyads. These researchers suggest that distant and anonymous relations make free riding more tempting.
Nevertheless, these sessions had higher attendance than the traditional lessons, because many students seemed to perceive these sessions as mandatory.[l]

Third, free riding will also manifest itself through students being actually being present in the classroom but not doing what they are supposed to do. This was evident in the fifth workshop session, where many students were doing other tasks or talking about non-academic topics.[li] Because the students struggled to coordinate the work, it was easier to be a free rider. In the workshop, the wiki also failed to provide any efficient support for simultaneous work. As a consequence, it ended up that a few persons did most of the work on the wiki page. In this way several of the students became free riders involuntarily, because they had to wait for others to finish their work. For example, some of the students were preoccupied with doing other wiki work that they had not yet finished. Because the teacher did not make any comments in regard to this, the students must have felt this was allowed.

The video data also show that the problem with unequal contributions became even more intense because of the grading system. This became very clear during a discussion between

[53] See section 4.4.3.2, The data collection period, page 96.

the students and the teacher in the fifth workshop.[lii] Initially, some of the students discovered that the teacher had changed the content of the final course lesson, which was to be held a couple weeks later. Instead of giving a lecture that summarized the course, the teacher wanted to arrange a workshop with the students writing notes together as a part of their preparation for the final individual oral exam. The teacher wanted to use this final session to mobilize the students to begin sharing exam notes with each other as a part of their preparations. In accordance with the basic ideas in the wiki assignments, the idea was that the students in this way could continue to collaborate in a wiki after the project period.

When the students found this out, they were not happy about these changes. Note that the teacher had not provided the students with any oral information about the matter. The students had only been notified on the course web page with a brief description of the plan. The students addressed this issue two times during this fifth workshop. The first time they discussed this issue with each other without the teacher being present in the classroom, they realized that this new situation meant that they would have to do all the work in the final session.

Later in the workshop they addressed the issue when the teacher was present. One student started the discussion at a plenary level by informing the teacher that the other course instructor had already promised them a handout covering the relevant exam topics. They felt this to be important since not all of them could attend all the lectures. This would ensure that everyone had equal and fair access to the information. The teacher reassured them that they would get the handout when it was ready in two weeks’ time. He also gave a brief presentation of how the final oral exam would be organized and mentioned a few topics that would be relevant for the exam.

The discussion then moved on. Some students expressed that they were tired of working with wikis and did not want to use them anymore. Because of these complaints, the teacher decided to change the final session according to the original plan. He offered them a traditional lecture about the most important academic topics relevant for the final exam. During this discussion, the students also explained to the teacher why they thought it was a bad idea to share exam notes, as is depicted in the following table:[liii]

Table 6.8.a Excerpt - Students do not want to share their exam notes.

Turns	**Verbal interaction**
1.	Teacher: I just thought you loved everything that had to do with individual or collective work (talking to all the students).
2.	Jenny (S1): I think people are tired of working with the wikis.
3.	Nina (S4): The problem is that someone will perhaps do a lot of work with the exam notes. They do a solid job and publish it. And in a way one doesn´t get something back to the same degree as what one has given away. And then somebody else gets everything for free. It’s completely wrong. It’s perhaps only in the group you have been working in that everybody contributes equally. Otherwise it will be very unbalanced.
4.	Teacher: Okay, so you are actually saying when working in a large group or the whole class the degree of unbalanced division of work becomes…

5.	Nina (S4): … very obvious.
6.	Teacher: It's more obvious compared with smaller groups. So one of the main challenges with working in a large team is that it becomes ...
7.	Nina (S4): Yes, especially in relation to the exam. Then people want to be on their own. The exam notes are in one way a bit special. They are your special thoughts, which you in a way feel that, this is what I have found out and the others have not. And then suddenly you are supposed to share this with others and you get nothing in return.
8.	Teacher: Okay, in relation to the preparation to the exam then?
9.	Sally (S3): And then you can leave collective intelligence out (Sally is being ironical).
10.	Monica (S2): And then it is the level of ambition that is very different. Some want to get a top grade, while others just want to get through it.
11.	Student: Yes (supportive comment)
12.	Monica (S2): A common problem in a large group is that there will be goal differences. Some just want to get through it, while others want to learn and work hard.

First, the excerpt shows that the students did not want to share notes with each other. One reason is that exam notes are considered to be important papers that can increase a student's probability of getting a good grade. Nina claimed that such notes are "a bit special," because they are your "special thoughts" (turn 7). The quote: "this is what I have found out and the others have not" shows that protection of one's own knowledge is an important part of the strategy of getting a good grade. The notes contain valuable information that gives the student a competitive advantage over other students in the class. This competitive advantage may result in better grades, but when this knowledge is shared, the advantage is lost.

Likewise, other studies of student work in higher education also show that a competitive culture is incompatible with a collaborative approach. For example, in a study of peer instruction, one strategy was to use an absolute grading scale. This made it possible for the students to track their progress and determine their final grade. It is only when students know that no one's grade will go down because others have done better that students will collaborate with each other in an open way (Crouch, Watkins, Fagen, & Mazur, 2007).

None of the students in the dialogue supported the idea of sharing exam notes with the whole class before the exam. Moreover, both Nina and Monica emphasized that one of the problems with sharing in large groups is that the contributions are unequally divided (turn 3 and turn 10). That is, someone else will get "everything for free" without doing anything for it. The problem with free riders would also be present if the students were to share their exam notes. Nina even described this sharing as "completely wrong" (turn 3). This adjective illustrates the strong sense of unfairness that a collective approach can create in relation to the grading of students. Monica was also concerned about the large differences in grade ambitions (turn 10). Some will do more work in the exam preparations than others, because they want to get a good grade and so they will "work hard" (turn 10); alternately, other students "just want to get through it" (turn 10). Because of these huge motivational differences, collective preparation in a large group would inevitably become unfair.

Moreover, the phrase “Then people want to be on their own” (turn 7) shows that individual ownership over this kind of work is also strong. Nina here emphasizes that the exam preparations should primarily be considered an individual activity. This is why it does not fit the collective work very well. Even if everybody shares, there is still the perception that there will be differences in the quality of the contributions. Some will do a “solid job” (turn 3), while others might not have the same level of background knowledge. This is because the students who just want to pass the course will not work as hard as those who want to get a good grade. As a consequence, some students will get less in return if they publish their exam notes openly.

It is evident that the students associate exam notes more closely with the principle of reciprocal sharing because of the underlying competition norms. The students felt that, before the final assessment, they were in a competitive situation. This is why Nina emphasized that one should get something in return that is of the same value as that which one gives away (turn 3). The students do not want to share these notes without getting something in return. This is why Nina suggests that this is possible in smaller groups, but not in a large group like the whole class. (“It´s perhaps only in the group you have been working in that everybody will contribute equally. Otherwise it will be very unbalanced”—turn 3.) Sharing in smaller groups can more easily be based on a norm of reciprocity. This is because one can make certain that everyone contributes equally in a smaller group. This coincides with a study from the review that found there were no problems with free riders in dyadic collaborations (Arnold et al., 2012). The group interviews also showed that most students were skeptical toward open unrestricted sharing, because they perceive that it gave little return value. The students were perhaps more critical toward sharing exam notes because they also felt that the workload was unequally divided during the wiki work. Since the exam notes were experienced as directly relevant for one’s grades, the students felt the problem of unequal contributions to become even worse.

This resistance against sharing their notes illustrates how the value of collective work is in conflict with students’ experience of being in an individual competition before the exam. Many students were involved in this discussion about writing collective exam notes—all the students, and there was no disagreement. This shows that the students were more or less unanimous on this issue. The statements from the students showed that the value of getting a good grade is considered to be more important than sharing work with others. The competition norms make it difficult for the students to identify with the whole class as a “community of open sharing” (e.g., Johnson, Johnson, Holubec, & Roy, 1984).

Second, the students were more interested in getting “expert notes” from the teacher instead of making their own collective notes. Because of the assessment system, it is perhaps not so surprising that the students wanted the teacher to tell them what topics were the most important. The teacher had been responsible for the exam in previous years. The students knew that the teacher could provide them information about important exam content. Within this assessment system, the teacher still had the key to what the most relevant knowledge in the course is. Likewise, studies from the review show that most students primarily do what is required of them in order to get good grades (Melissa Cole, 2009; Ebner et al., 2008). In this case, a hand-out from the teacher was viewed as highly

relevant, because the students knew that those items would be directly relevant for the exam and would also help the students save time. This is a much more time-efficient way of finding out what is important compared with the students trying to determine this by themselves.

At another level, there seems to be some tacit expectations concerning the division of labor between the teacher and the students. In the project work, the students felt that they had done all the work. This is very different from the traditional lecture where they perceive that the teacher does the work and gives the students the important information. The students were now eager to let the teacher give them directions again. They still considered the teacher's knowledge to be more valuable than the group's knowledge. This is perhaps not surprising when the students know that it is the teacher who defines what is important in the final exam.

6.9 Reducing teacher control

6.9.1 Background

In the group interviews, some students complained about the teacher being too passive. The workshop data also show that there was very little interaction between the teacher and the students in the online setting. The students used different digital tools like Google Docs and Facebook to manage the project, but the teacher did not interact with the students in these online environments.[liv] Since the students were expected to do most of their work on their own (i.e., without the teacher), the lack of online interaction was not considered to be a problem because part of the instructional strategy was to reduce the amount of teacher involvement.

However, the workshop data show that the teacher was present most of the time. The interaction with the students was primarily through verbal interaction at a plenary level, and it varied between the different workshops. The teacher gave brief presentations of the assignments to the students, but the students received little direct academic feedback on the students’ work.[lv] Sometimes the students also received guidance from the assistant teacher on how to use the wiki and start the screen capture data. In the following episodes, the emphasis will be on how the students managed the whole class project when the teacher reduced his control over the project. Four episodes will be presented from the first workshop in the second wiki assignment.

6.9.2 Episode 1

At the beginning of the workshop, the teacher becomes gradually more impatient with the students. The table below gives an overview of the teacher’s verbal statements about the pedagogical ideas behind the second wiki assignment. In addition, some issues about project management are also presented.

Table 6.9.a. Selected statements - The teacher introduces the second wiki assignment.

Action, time	Teacher statements	Main function
1 (01:56)	(…) Within creativity research and research on collective intelligence, a major issue that one needs to learn, groups need to organize themselves. The group needs a strategy on how to divide the tasks. The group needs to agree upon what they want to work with. The group needs to decide how they want to work together. There are general challenges you meet independent of how big the group is. You can say that this even increases in the whole-class (projects).	- Explaining about pedagogical idea
2 (07:22)	Collective intelligence, it is instead about you working within a limited area and then several of you will try to work with it to make it as good as possible. So it is not about doing as much as possible; it is about making a good little resource that others can enjoy.	- Explaining about pedagogical idea again

3 (10:36)	I think you perhaps would need to eventually appoint a moderator. I will not decide, because the point is that you should do it yourself, so it is not certain that you have to do this. But in some way or another, you will need to organize it. (…)	Encouraging student action
4 (11:58)	And then you will eventually need to begin to organize yourself. It is obvious that it is important with management. (…)	Encouraging student action
5 (16:07)	You all, somebody needs to take responsibility. Do you want me to leave? Then I will not need to… It is wrong that I do it.	Encouraging student action

The verbal statements show how the pedagogical ideas were briefly explained several times during the first workshop. After two minutes into the workshop, the teacher introduces collective intelligence as a concept and connects it with the group's ability to organize their work (statement 1). He emphasizes that the students need to agree upon a collective strategy and that they need to figure out how they want to work together. The statement illustrates a part of the pedagogical idea behind students' shared responsibility in the project. Five minutes later, the teacher makes another statement about collective intelligence as a pedagogical concept (statement 2). The teacher underscores that the students need to concentrate their collective work on a small area, because this will make it easier to create something of high quality. Students' shared responsibility is emphasized in an expression such as "several of you will try to work with it." The teacher tries to reinforce the idea that the project work is about them being able to work together as a group in an effective way. These two statements show that the teacher is trying to give the students some practical advice on what to do.

However, the next statement three minutes later signals a turning point (statement 3). The teacher gives the students specific advice on how to organize their project work. He recommends that the students appoint a student moderator. This suggestion appears contradictory to the idea of shared leadership, where many students are involved in making the decisions. In addition it constitutes specific advice from the teacher on what the students should do. The advice is contradictory to the previous advice that they have to find out what to do by themselves (statement 3). The phrase "I will not decide (…)" appears contradictory. In the first statement, the teacher underscored that he did not want to make any decisions and that "The group needs to decide how they want to work together." Part of the reason why this happened can be regarded as a response from the teacher to the fact that none of the students responded to the challenge posed by the teacher in the two first statements. The students had not taken any initiative to begin to organize themselves.

Only one minute later the same message is repeated again (statement 4). The teacher encourages the students to organize themselves, but the students do not take any initiative. The teacher is talking to all the students while they work on solving some technical issues related to the project work (encouraging action). Four minutes later the teacher repeats the same message once more (statement 5). The teacher explicitly tells the students that they need to start organizing their work, but nobody takes action. He again underscores that he

does not want to direct the process related to how the project work should be organized (encouraging action). He even suggests that he can leave the classroom.

In total, the teacher here gives the same message that the students have to begin organizing their work four times (action 1,3,4 and 5). This is done within quite short time intervals (after 1, 10, 11 and 16 minutes). The teacher gives advice on how they can organize the process, but this is done with a strong level of ambivalence. At one point he gives specific advice, but he withdraws the statement moments later as being unimportant, because the students need to decide on their own. The data show that the teacher gradually became more impatient, because he wanted the students to begin to organize themselves. At the same time, the students were not given many different alternatives concerning how they should organize their project work. The teacher promoted only one solution, the appointment of a student moderator.

While he emphasizes that the students are expected to collaborate in new ways, the students are not offered any training in team skills or software skills. They are expected to find this out on their own. The short talk about collective intelligence offered little practical advice on how to collaborate. The students received some technical guidance from the assistant teacher, but the primary support is given through the quite detailed instructions related to each wiki assignment. Further, there was no discussion of these issues during the short teacher talks.

6.9.3 Episode 2

The second excerpt shows how the teacher enforces the appointment of a student moderator. This happens later in the same workshop (7 minutes after the fifth teacher statement in Episode 1).

Table 6.9.b. Excerpt - The teacher appointing a student (S2) to be the student moderator.

Turns (time)	**Verbal interaction**	**Video, audio, and screen capture data**
1 (23:24)	S2: We can in a way divide the tasks.	Low voice. Teacher standing close to S2
2	The teacher: Yes.	- Low voice
3	S2: For example, within these six topics …	- Low voice
4	The teacher: Yes, you can divide the tasks. Correct. You can do whatever you like. What … (raising voice) you need to discuss the tasks, and then I think somebody needs to direct the conversation a bit. Appoint themselves to be a moderator or something like that. Or do you want me to do it? Is that what you are waiting for?	- Interrupts - Raising voice during the statement
	(2 seconds of silence)	Some students are mumbling

5	The teacher: Okay, can you be the moderator?	- Loud voice
6	S2: Yes, that would …	- Low voice
7	The teacher: That's great; you are sitting in such a central position.	- Interrupts - Loud voice - Other students sitting close by are laughing
8	Student: It's a good thing you chose to sit down in this spot.	- Ironic comment - Student speaking to S2 with a low voice
9	The teacher: Then you will moderate the discussion. And then the others will give comments. And then if you do some brainstorming, you can use Google Docs to find out what people want to do or think. In line with the goal of gathering more comments. If not, you can just raise your hand. Try to being a discussion. And now I will go out and make some coffee. Because I notice that when it becomes quiet, I talk all the time.	- Loud voice - The teacher leaves the room after this statement

This excerpt begins with a student (S2) posing a question to the teacher about the division of tasks (turn 1). This is an issue about project management. At first S2 invites the teacher to a private conversation by using a low voice, but the teacher quickly transforms the one-to-one conversation into a public conversation for the whole class (turn 4). The teacher does this by raising the voice while he is talking to the student. In this way the comment in a dyadic conversation is transformed into a plenary statement that everybody should listen to (turn 4). This happens during the turn itself. On one level, the raising of the voice signals the importance of addressing the division of tasks as a project management issue.

However, the teacher interrupting the student shows that the teacher is also becoming impatient. At turn 4, he shows that he wants to define how the students should organize their work by telling the students that they should appoint a student moderator. At the same time he is telling the students that "You can do whatever you like" (turn 4). The statement in this turn shows an inherent tension between doing whatever you like as students vs. doing what the teacher wants you to do. Interestingly, the teacher does not wait for the student to comment on his questions. The pause between turn 4 and turn 5 is only a few seconds long. Instead, the teacher rapidly asks S2 if she can be the student moderator. This shows that the issue of having a student moderator was not open for discussion. The teacher really wants the students to pursue this management strategy. In reality, the students are left with little other choice than to follow the teacher's recommendation. At turn 6, the teacher doesn´t even let S2 finish her comment on being a student moderator. Instead he interrupts and seeks to get a confirmation from S2 that she is now a student moderator (turn 7).

Turns 4 to turn 6 can here be regarded as decisive, because the students are left with few options other than having a student moderator. In this way the teacher enforces a management model that lets one person be in charge. This decision is made by the teacher and appears to be contrary to the idea of students sharing responsibility together.

In addition, the last comment in the excerpt (turn 9) shows that the teacher is instructing the students on how they should collaborate. The verbal language is dominated by imperatives like “then you will moderate the discussion. And then the others will give comments.” The teacher here explains to the student that she will have to moderate the discussion. In addition, he recommends using Google Docs as a tool if they want to brainstorm. The teacher also defines one specific goal, which is to gather more comments. By using a loud voice, the teacher addresses the whole class and not only S2. It is clear that he does not open up for any discussion around the project management model. Instead, he leaves the room after the statement.

Note also that the teacher suggests that the students can organize collaboration in the face-to-face setting by raising their hands (turn 9). This recommendation is similar to a traditional student-teacher interaction, where the students are required to raise their hands to get permission to speak. At the same time, someone needs to give this permission, and it is indirectly communicated that the student moderator must coordinate this at a plenary level. The students are here encouraged to also reproduce the bodily gestures from the classic interaction pattern in the classroom in their own student-student interaction.

This excerpt illustrates that the teacher did not always facilitate the students’ shared responsibility. Instead one could claim that he promotes the quite opposite behavior. It becomes very difficult for the students to do anything else, because the teacher is still in control. Both episode 1 and episode 2 reveal that the teacher really wants there to be a student moderator. The teacher repeatedly tells the students that they should choose a moderator and ends up actually enforcing this solution. There is a lack of free choice and no invitation to engage in an open discussion.

6.9.4 Episode 3

The two following episodes (3 and 4) take place a couple of minutes later. They illustrate how the student moderator is now in charge of the group.[lvi]

Table 6.9.c Excerpt - The student moderator (S2) is in charge.

Turn (time)	**Verbal interaction**	**Video, audio, and screen capture data**
1 (24:19)	S1: Hey, you moderator …	
2	S2: Yes?	- Using an ironic tone of voice
3	S1: We would perhaps like to make a smartboard lesson …	
4	S2: Hmm, that can be published, yes?	
5	S1: Like a task in relation to the …	
6	S2: That is a good idea.	- Interrupting

7	S1: I can't see your name.	- Apologizing - Referring to the name badge S2 has
8	S2: My name is Mary.	
9	S4: You had to check your name badge.	- Laughing
10	S5: Are you sure your name is Mary?	- Making a joke
11	S2: Yes, we can (raising her voice). By the way. On the Wikispaces page that T1 (name of the teacher) has made, the one about rock carvings (name of region), he has published an example of how to divide the tasks that we can use as a basis. There are six topics. There are text resources about rock carvings, student stories, and video resources, images, and rock carving sites and a Wikipedia article. Then we can perhaps divide us according to which people want to work with what based on these six. And then perhaps add that with the smartboard as a seventh topic.	
12	S1: hmmm (or…)	- Supporting S2. The others are quiet
13	S2: If you can write in our document (Google Docs) what you want to work with, for example, among those six topics.	

This third excerpt shows that the student is now in charge in the classroom. In the beginning of this sequence, S1 is asking S2 for permission to make a smart board lesson (turns 1–6). By posing the question directly to S2, she assumes that S2 now has the power to decide what tasks the students should do. She is indirectly communicating to S2 that she has to approve. This interaction pattern is strikingly similar to how a student usually asks the teacher for permission to do something. With the comment "That is a good idea" (turn 6), S2 approves that the students can do the tasks. Although the comment is short, the phrase "good idea" indicates that she has now entered the role of evaluating the quality of suggestions that other students make. She makes the decisions as to what kinds of topics the students should work with.

Moreover, when S1 says that she cannot read the name of the student moderator (S2) on her badge, this indicates that the students do not really know each other that well (turn 7). At the same time, the comment shows that S2 is more important than the others in the group, since S1 thinks it is necessary to know her name. Indirectly, the comment can be interpreted as an acknowledgement of S2 as the legitimate leader of the group. However, from the perspective of sharing responsibility, one can question whether the ideal solution is to let one person be in charge of the decisions. It is possible to claim that the role of the teacher has now been replaced by the role of the student moderator.

Some of the turns from the student moderator bear similarities to the turns of the teacher in excerpt 2. First, S2 does not invite S1 or others into further plenary discussions. The comment "That was a good idea" can be regarded as a brief evaluative comment that does not open up for more discussions. Second, the student moderator suggests that they should follow the teacher's plan quite closely (turn 11). Since the student was appointed moderator

after asking a question about the division of tasks, it is perhaps not surprising that she follows up on the same suggestion at a plenary level. She is here following the advice from the teacher and also referring to the authority of the teacher through the example that he has made (turn 11). It is difficult to oppose this when she refers to what the teacher has said.

She also moves quite quickly over to actually beginning to divide the tasks at a plenary level (turn 13). There is a paradox with these hasty moves. For example, the teacher in excerpt 1 emphasized that the students should take time to discuss the issues at a plenary level. However, the teacher still did not open up for any substantial discussion with the students. One example is when the teacher appointed student 2 to be student moderator in excerpt 2. This happened very quickly. Likewise, there are several examples of S2 imitating the same communicative style that the teacher used. For example, the students spend little time discussing the tasks they want to do. It is possible to claim that here the student moderator is imitating the role of the teacher of being in charge. The priority is on making fast decisions instead of facilitating discussion.

6.9.5 Episode 4

A later incident also illustrates how the student moderator to some degree reproduces the previous teacher actions. The fourth excerpt is about a task one of the students thinks should be done. The brief verbal interaction is between the student moderator (S2) and two other students.[lvii]

Table 6.9.d Excerpt - The student moderator (S2) appointing a student to do a task.

Turn	Verbal interaction	Video, audio, and screen capture data
1 (28:31)	S6: Do we need somebody to administer the page or?	Low voice. Sitting beside student 2.
2	S2: Yes, you can do that.	
3	S3: I have already appointed you.	S3 is sitting beside S2. These two students are close collaborative partners.

This excerpt starts by S1 asking S2, the student moderator, if it is okay to do a task. She assumes that S2 can make a decision about whether she can do the task or not (turn 1). S2 replies by giving S1 permission to do the task with the utterance “you can do that” (turn 2). The key issue here is that this decision is not made at a plenary level. None of these students inform the others about the possibility of doing this specific task. It illustrates one way in which the student moderator enacts her leadership in a private way with less focus on students’ shared responsibility.

S3, a close collaborative partner of S2, joins in and confirms that S1 gets to do this task (turn 3). One could claim that here S3 and the student moderator reproduced the role of the teacher in excerpt 2. First, S1 reproduces the same interaction pattern by asking the student moderator for permission to do a task. One person is still in charge, but instead of the teacher, it is now the student moderator making the decisions. Second, S3 even uses the

phrase “appointed,” which the teacher previously also used. The role of the student moderator is here interpreted as one of appointing students to do different tasks in much the same way as the teacher did in sequence 2. It is possible to interpret these turns in relation to how a student moderator to a large degree imitates the role of the traditional teacher.

6.10 Observing others work

The group interviews revealed that the instructional model was not very successful in supporting students’ shared responsibility. For example, one student recommended that all students should acquire some skill they could use to help others in the class. The workshop data also show some examples of students were able to help others because they had some specific skills. It was particularly one incident where one of the students spent a significant amount of time guiding two other students. This specific episode took place soon after the break in the first workshop with the students who were working on the first wiki assignment about musical instruments. Initially, some of them were discussing an issue across the table at a plenary level. The excerpt below shows how this discussion ends up with an invitation to observe one of the student’s work.[lviii]

Table 6.10.a Excerpt - One student inviting two other students to move over and observe how she uses the wiki.

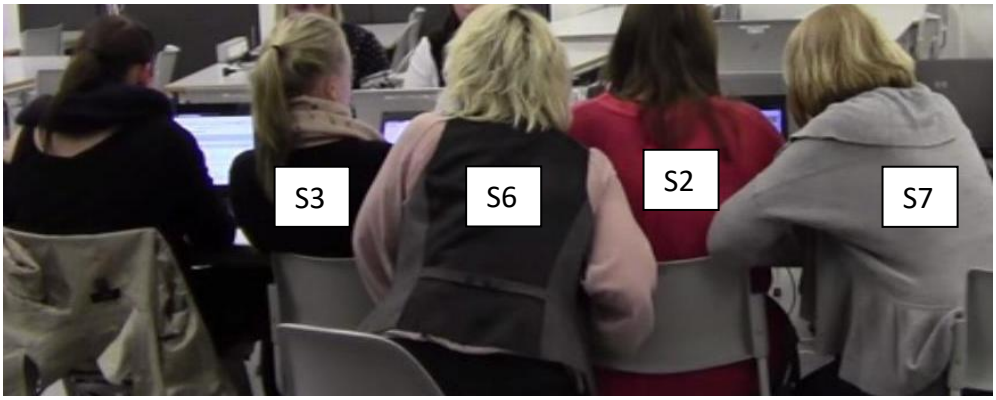
Turns	Verbal interaction	Video, audio, and screen capture data
1	S7: “Written introduction.” This is not how it should have been displayed.	S7 is reading aloud from her laptop screen. Some of the students are talking about an external link on the wiki page that they want to remove.
2	S2: But who will do something with it? Because we could move that link and put it on the bottom [of the web page], for example.	S2 is talking to S7 across the table.
3	S6: Yes, stringed instruments. The link.	
4	S2: Yes.	
5	S6: “Read more about stringed instruments.”	S6 is reading from the laptop screen.
6	S2: Yes. Like it is written on that (…) Like it is written, yes. Go for one of the options.	S2 is encouraging S6 and S7 to do some wiki editing.
7	S6: I haven´t got the slightest idea on how to do it.	
8	S2: I can do it.	
9	S6: Yes, you can tell, can I see how you do it?	
10	S7: Yes, you could do that.	Overlapping talk with turn 9. S6 is still talking.
11	S2: Yes.	Overlapping talk. S6 and S7 have not finished their utterances (turns 9 and 10).
12	S7: If not, we won’t learn how to do it.	
13	S2: No, just come over and have a look. No problem.	Video data show the two students (S6 and S7) move across the table and sit down next to S2.
14	S2: Now, I will have to “try and fail” a bit.	S6 and S7 are now sitting next to S2.

This excerpt covers a time period of approximately thirty seconds and shows how a student (S2) invites two other students (S6 and S7) across the table to receive guidance on how to do a specific operation in the wiki. The request for help is initiated by S6, who explains that she hasn´t got the "slightest idea on how to do it" (turn 7). At first, S2 offers to do the task for S6. S2 suggests that she can do the work with the utterance "I can do it" (turn 8). This utterance is similar to the statement in the group interviews where S2 claims that most of the students divided the work according to the principle "No, I know how to do it, so then I´ll do it" (GI 2).

However, S6 rejects the offer and instead asks if she can observe S2 while she does the operation on her laptop (turn 9). Both S6 and S7 want to learn how to do the wiki operation by themselves, so they instead suggest that S2 show them how to do it (turns 9–12). This episode illustrates that some of the students still feel that individual learning is more important than maximizing the collective performance according to the existing set of skills. S2 accepts this and invites both S6 and S7 to come over and watch her doing the work (turn 13). The two students move over and stay there for approximately twelve minutes. The episode is exceptional in the sense that one student spends a significant amount of time guiding other students who are not sitting in close proximity to the student. This emphasis on individual learning was also underscored in the group interviews when a student suggested that one should divide tasks according to the following principle: "I know how to do this. Would anyone like to join me?" This ensures that everyone will learn something new in the project (GI 2).

The excerpt also illustrates how the students first gave each other feedback at a plenary level. When a problem needed to be solved, the students reorganized their seating positions to make the peer feedback more effective. S6 and S7 moved across the table and sat down at another place in the classroom to receive help from another student (S2) for a sustained period of time (turn 13). The image below shows how the students are seated.

Figure 6.10-a Image - Two sitting next to another student and receiving guidance on how to use the wiki.[lix]



Here, S6 and S7 are observing S2s work while she is informing them on how they can edit the wiki page by doing different operations on her laptop screen. The image shows that when the two students are sitting close to S2, they also have visual access to her laptop screen and can easily observe how she is doing the task. It is worth noting that S6 not only moves over

one time but two times. At a later point in time in the workshop, she walks over to S2 once more. The difference this time is that she does not ask for permission to move over. This illustrates a more flexible embodied interaction in the room, where students moved around, observed each other’s work on the laptop screens, and asked each other questions. Note that this was an exceptional episode during the workshop in the way that it deviated from mainstream practice. Most of the time the students remained seated in their chairs not moving around. During all the workshops, very few of the students moved around in the classroom. When this was done, it was only for a short period of time. Many of the students also preferred to sit beside the same students they knew from before in all the different workshops.

In this sense, the episode also shows a new relational interaction pattern that emerges between some of the students. The two preservice teachers that are guiding the in-service teachers do not know these teachers from before. The incident can therefore potentially create a closer relationship between students who have not talked much to each other before. This was probably easier to establish in the smaller groups in the first wiki assignment. Likewise, one of the statements from the group interviews indicates that there are some useful qualities in being able to move freely around in the classroom. One example is the student who says: “It is easier to sit together in a large group, where you can say like ‘Hey, you over there, what are you doing?’ or you can walk around and be physically present” (GI 2).[54] Giving guidance on how to use the wiki would usually be easier when the students had visual access to the same laptop screen. One way of doing this would then be for the student to physically move over to the person who offered help.

It is also worth noting that S3, who to some degree participates in the guidance process, is the same person who later in the group interviews proposes a radically new instructional model based on peer teaching.[55] It is possible that this specific episode has influenced on her thoughts on how one can improve the instructional design.

Moreover, the students who asked for help in this episode are experienced in-service teachers (S6 and S7), while the student (S2) who gave help is a preservice teacher. Here, the roles are switched in the sense that it is usually the in-service teachers who are mentors for the preservice teachers in their practicum period. In this case, the less experienced teaches the individuals with more experience what to do. Interestingly, this issue was also mentioned by S3 in the group interviews, but her focus was on the idea that kids can be teachers for each other. She had observed kids enthusiastically say, “I know this, so I can teach it to you” (GI 2).[56] On the other hand, it is less clear whether this time used on helping others interferes with the group’s attempt to maximize its collective performance. The teacher originally emphasized that this was the main goal of the project work. As mentioned in one of the group interviews (GI 2), another potential disadvantage is that some students have to spend too much time and expend extra work guiding other students.

[54] See section 6.5, A peer instructional model, page 173.
[55] See section 6.5, A peer instructional model, page 173.
[56] See section 6.5, A peer instructional model, page 173.

6.11 Answering the second sub-research question (students' shared responsibility)

The second sub-research question addresses the way *"students' shared responsibility" emerges in teacher education*. The triangulation of data has been done within four different areas of practice that all address this question. The findings show that the collective work needs to be simplified to get the work done and reduce the complexity of students' shared responsibility. However, the data show that this process creates several challenges related to what can be labeled as both a *fair student-student interaction* and a *fair student-teacher interaction*.

6.11.1 Fair vs. unfair student-student interaction

First, the data in the current study show that students' shared responsibility emerges through *the challenge of dividing the tasks in a fair way*. In a traditional lesson, this challenge has already been "solved" by the teacher before the students enter the classroom. However, now the students had to find a solution to this issue as a new type of student-student interaction. In the second wiki assignment, the students divided the tasks in an online setting with a minimum of discussion. The tasks were primarily divided according to whomever was first to sign up for the different tasks. This principle of "first come, first served" was very time-efficient, but it lacked some of the advantages of more extensive verbal negotiations. The students tended to avoid spending too much time on the more complex synthesizing discussions at a plenary level. Although the workshop data show few observable negative reactions, the group interviews indicate that most students would have preferred more verbal discussion. Some students did not feel that they shared in the responsibility concerning the division of tasks because the process was unfair. The dilemma is that in complex and open-ended group projects, it is unavoidable that students will need to work with different subtasks. If the procedures for dividing the tasks are not accepted as legitimate by all the students, there is a risk that this may create conflicts later and reduce student motivation.

Second, shared responsibility emerges through the *challenge of sharing the workload in a fair way*. The group interviews indicate that a few students did more work than the others in the project. The students did not feel that they had divided the work equally between each other. Because the students were to do different tasks, this division is difficult to do in a fair way. The students were concerned about how everyone could make equal contributions in the project work. This is why one student recommended that each student in the group should be a mentor for the rest of the group in one specific area. This design would, to a large degree, integrate the improvement of individual skills with the goal of maximizing the collective performance. This was important, because the group interviews showed that some of the students were spending much more time than others. For example, one student warned against giving too much extra work to the few students who functioned as mentors for the rest of the group. The peer instructional model solves this problem by letting all students be teachers for each other.

6.11.2 Fair vs. unfair student-teacher interaction

Third, students’ shared responsibility emerges through the *challenge of grading the student work in a fair way*. In the current study, the students were given group grades for the project work. One of the episodes shows the problem with unequal contributions escalate in a competitive culture where group grades are given in relation to whole-group projects. The students primarily perceive that they are competing against each other in relation to getting good grades. They are not necessarily negative toward sharing and publishing their student work, but they find this difficult to do in a competitive assessment culture. Instead, they are primarily concerned with earning good individual grades. They question whether it is fair that the free rider gets the same grade as one who has worked a lot on the project. When competition is such an important norm in the course, it becomes even more important that it is done on fair terms. The teacher must therefore design a grading system that students perceive as fair to facilitate students’ shared responsibility. Even if the teacher is not as strongly involved in all of the student work, he still needs to address the question of how to make an instructional design that creates the maximum amount of fairness. For example, the teacher needs to make sure that the student enactment of a peer instructional model emerges in a fair way. This includes both the division of tasks and the division of the workload during project work. Tasks can then be divided in many different ways, such as according to existing skills, learning needs, or interests, which will have different influences on how the collective work will be done. The perceived benchmark will always be traditional instruction, which students usually experience as very fair because the teacher is in control. Then the students are given equal responsibilities and opportunities in relation to the work they are doing.

Fourth, students’ shared responsibility emerges through an *attempt of reducing the amount of teacher involvement*. In the current study, one episode shows that the teacher does this by appointing a student moderator. The teacher does this quite rapidly, and the students are given relatively little time to solve this managerial challenge by themselves. The teacher also interrupts the student several times (turn 4 and turn 7). The intention of the interruptions is to define how the work should be organized. It shows the asymmetry in the relation and how the teacher uses this power to enforce his agenda. The teacher actually chooses the preferred collaborative model for the students and there is little, if any, opening for any further discussion.

This strategy was not particularly effective, because it resulted in just a few persons taking charge. It decreased the students’ sense of shared responsibility and did not support a new way of organizing the work. Even though the explicit goal was to strengthen students’ shared responsibility, the data indicate that this specific teacher action was counterproductive to this ideal. Although the teacher says, “You can do whatever you like,” most of the speech shows that the teacher is still to a large degree in control. There is a lack of free choice. The issue of having a student moderator is not open for discussion. The data also indicate that the student moderator to some degree served as a replacement for the teacher in a more “traditional” division of roles where one person is in charge in the classroom.

The episode illustrates how the challenge of utilizing shared leadership was actually solved by appointing a student moderator. However, this was done by the teacher although the

group interviews leave no doubt that the students actually perceived that they were in charge of the project. As a pedagogical practice, shared leadership requires that both teachers and students enter new roles. However, it is not clear what role the teacher should have in this new setting.

Another aspect is that the student leaders were required both to coordinate the work and do an ordinary subtask, too. In this sense they took on a larger amount of the total workload. One can therefore question whether it was fair to appoint one person to be a student moderator. This may be one of the reasons why a student suggested that one should instead develop an instructional design based on all students helping each other. The transferal of responsibility to students needs to be viewed as fair if it is to be perceived as legitimate.

6.11.3 Summary

The workshop data show that the students responded to the complex challenges of sharing responsibility in a large group by utilizing several different “simplifying strategies.” This involves issues related to the leadership of the project work and the degree of control of the project work, For example, the question of shared leadership between the students was simplified by letting a few students coordinate the work and by letting some students do more work than others. Some of these actions, like the appointment of a student moderator, were also supported by the teacher. The teacher simplified the group work by intervening when the students found it difficult to get started in the second assignment. The students also chose time-efficient simplifying strategies like dividing the tasks according to the principle of “first come, first served.” Furthermore, the students avoided spending too much time on the more complex synthesizing discussions at a plenary level. However, the problem of being able to get a clear overview of the project work did not disappear but instead became a challenge for the students. In combination, these strategies created tensions between equal vs. unequal contributions among the students and interfered with the perceived fairness of the collective work

7 Exploring peer learning in teacher education

This chapter attempts to answer the third sub-research question concerning peer learning in teacher education. The first part will explore how students perceived peer learning in different ways. Here, data from the group interviews will be used and presented within the framework of three major areas.

- The peer relationship has an influence on the quality of the peer learning
- The size of the group has an influence on peer learning
- Anonymity has an influence on peer learning

In the second part of the chapter these findings will be summarized and triangulated. The analysis will then include both peer editing and peer feedback processes. Here, the term *peer editing* refers to writing activities where students in class modify or change each other's work as a part of the collective text production. The term *peer feedback* describes processes where students comment on each other's work either verbally or in written format.

7.1 The peer relationship has an influence on the quality of the peer learning

As one major area, students talked about how *the peer relationship influenced the quality of the peer learning*. Several students felt that it was difficult to change or criticize others' work. This includes both the editing of other students' work and giving negative peer feedback (GI 3, GI 4, GI 6). One student found the peer editing to be especially difficult when one did not know the peers well (GI 6). Several students reported that the collaboration in large groups was hard, because they did not know each other well enough (GI 2, GI 4, GI 5, GI 6). The distant relationship made it difficult for them to express what they really meant to each other (student, GI 5). One student claimed she would have been more open if she had known the others better (GI 4). Another student expressed a strong feeling of being alienated in the group work: "One didn't even know what the people who one was collaborating with looked like" (GI 5). There is a feeling of not knowing some of the other peers at all. This finding coincides with several studies in the review (e.g., Zheng et al., 2015).

A third student, Jennifer, addressed the same issue but was primarily concerned about the honesty of the peer feedback:

> (…) but it is a bit of an issue that you do not know people well when you criticize what they have done. Mona and I know each other well because we have previously done assignments together. I do not have any issues with her, and she doesn´t have any issues with me either. We have an open dialogue, and she knows that I won't get upset if she changes something I have written (…). I did not know Thelma in advance. One time she asked me: 'Who wrote this text? Will anybody get offended if I change it slightly?' Not at all. I won´t. Absolutely not. But he couldn´t know that. I might have been insulted. (GI 4)

Jennifer explains how the collaborative writing process differs depending on how well you know your peers. Her dialogue with Mona is open because they "know each other well." They have worked together before and have a close relationship. Critical peer feedback between them is therefore no problem.

However, Jennifer's peer relationship with Thelma is different, because they do not know each other. There is a risk that negative feedback could insult the other person. The dialogue is significantly more constrained, as they need to ask each other for permission before they can make minor changes to each other's work. According to Jennifer, Thelma asked for permission to change her text with the question "Who wrote this text? Will anybody get offended if I change it slightly?" Thelma's use of the phrase "offended," which Jennifer here recalls, indicates the emotional risks that are attached to peer editing between students with a distant relationship. If one edits others' work in class without asking for permission, there is a possibility that they may get offended. One plausible reason is that any modification of another students' work can be perceived as a critique of the work not being good enough. So, even if the peer editing is not followed by critical verbal feedback, it might still be experienced as an indirect critique. On the other hand, Jennifer argues that she is an open person, because she did not get upset when Thelma wanted to edit her text contribution. However, she underscores that there is a risk of insulting others even if she is not that kind of person. Still, her explanation shows that one needs to be careful in criticizing others' work when you do not know these persons well. The norm of asking each other for permission is closely associated with the attempt to reduce the risk of offending others.

The comparison of the peer relationship between Mona and Thelma also makes it very clear that students operate according to different collaborative norms in a class. These norms differ in regard to the possibility of criticizing others work and depend on how well the students know each other. A study in the review shows a similar finding, where the students did not feel that the relationship was close enough for them to be honest in their critique (e.g., Kim, 2015). Two students in another group also emphasized how a distant peer relationship ends up with students afraid to touch each other's work.

> Sally: You have to give and take when you collaborate with others.
> Rebecca: And in the end you have to quit.
> Sally: Yes, as we discussed in the sessions, one obviously doesn´t want to step on someone's toes. It can be somebody who writes really bad Norwegian but who in fact has tried really hard. They are just not able to express themselves in a good way according to my standards. And then you have to acknowledge what others are doing; one cannot change others' work all the time.
> Rebecca: Because in a way it is something they have achieved. (GI 2)

Both students address how important it is to respect others' effort independent of the actual quality of the work. Sally illustrates this dilemma with a student who has poor writing skills ("bad Norwegian"). In this case, she feels she cannot edit the work because she needs to respect that the person has "tried really hard." The argument is that one has "to acknowledge what others are doing" and the contribution they have made. Sally also underscores her fear of "stepping on someone´s toes." These expressions illustrate the existence of "personal textual territories" and the strong sense of ownership the students

have over their work. This needs to be respected, and the act of peer editing is experienced as an act of trespassing. Peer editing is also perceived as an indirect critique of others' work and personal achievement. It is therefore difficult to give critical peer feedback, because one needs to respect others in regard to their skill level. The dilemma is that the lack of peer editing has a negative influence on the quality of the final text product.

Furthermore, some students said that they should have spent more time discussing the collaborative norms. One student suggested that everybody needs to agree "that what I write can be changed" and "nobody can be upset if somebody makes a change." It is not enough that the teacher just informs the students; rather, the group needs to reach an understanding (GI 2). Likewise, Arnold et al. (2012) suggest that the group would benefit from discussing issues like whether it is acceptable to correct grammar mistakes or how to add to or delete others' work. Moreover, Lin and Kelsey (2009b) found that students began to write together only after they had discussed their different roles in the collaboration. If students have different writing styles, this issue will need to be discussed. If not, it is more likely that the students will dislike it when others modify their work.

7.2 The size of the group has an influence on peer learning

As a second major area, the students talked about how *the size of the group influenced on peer learning*. While most of the students emphasized the importance of having a close relationship with their peers, they found this difficult to establish in the large groups. Several of the students found the peer discourse at the plenary level in the whole-class project to be difficult. The large group size had a negative influence on the collaboration in several different ways (GI 2). First, one student claimed that it was not possible to give critical feedback to others:

> What is difficult with a large group is that everybody has their own views of how things should be done. And then you sit there and think 'no, you cannot write that' or 'you cannot use the text as it is now.' But then I just have to leave it, because I am not responsible for this task when there are so many persons in the group. (GI 2)

This student felt it to be pointless to give feedback, because so many were responsible for different tasks. In such a large group, the student felt it to be even more important to just tolerate the situation: "When we are 26 students who are part of the same exam, with 26 different opinions about how it should be, you will in fact have to endure"(GI 2). The paradox is that the presence of a large diversity of opinions makes it even more inconvenient to disagree in an offline setting. According to the same student, it was not as scary to make a statement in the group of eight in the first wiki assignment. It was also much easier to give feedback in this group (GI 2). When somebody noticed that the text needed to be revised, someone just went in and revised it. Because the group was smaller, everybody could just sit down around a table and discuss the issue:

> You do not have to leave things, you can raise your voice if you disagree. If there are 26 students and one student begins to oppose—'I don't think so'—then another doesn't think so, and then another, and then you have to start all over. (GI 2)

If there are too many people, there will be too many different opinions, and it will take a lot time to reach an agreement. As a consequence, there will be fewer disagreements in the large groups even though many more might disagree. The important issue is if students feel they can raise their voice if they disagree. For example, another student in the same group felt that the collaboration in the first assignment was better because the group managed to make the necessary adjustments if someone had any questions or comments. The coordination was easier, because they were fewer students and they were sitting around a table. On the other hand, this became a problem in the whole-class projects (GI 2).

Furthermore, this student emphasizes that she wants all her work to be solid, but this did not happen in the wiki work. Making contributions to the collective work became complicated. This is why she does not like the fact that her name is included in the work. She also thinks that it is wrong that these assignments are a part of the final exam (GI 2). When the student denounces "her name" as part of the work, she disclaims her ownership over the work. Another student in the same group followed up on this comment and agreed that it is difficult to put your name on something you would have wanted to be different and that is also "graded" as part of the final assessment (GI 2). This comment shows that the feelings

of ownership are closely connected to the expectation that the students will receive individual grades for the work. The students feel that the collective work is in conflict with those who are interested in earning a good grade according to their individual motivation and performance.

Several students in the other groups also had a similar feeling of decreased ownership over the project work in the large groups (GI 1, GI 3, GI 4). Some students in one group reported that because they did only one of many tasks in the project, they did not experience a strong feeling of ownership over the whole work. They performed their task but were not aware of what the other students were doing (GI 1). Another student referred to the first wiki assignments and claimed that it is better to contribute as one out of nine to the project instead of as one out of 30 (GI 4). The relative contribution of the individual student became very small in the whole-class project in the second and third wiki assignments. This student felt that his individual voice became much less significant when the responsibility was shared in such a large group. Another group suggested that the whole class could have been split into two relatively large groups with their own independent projects. The groups would then still be large but have a more effective size. One reason is that the whole-class project ended up as work in smaller groups anyway. The class divided the work, and when everyone had done their share, that was it, nothing more (GI 3).

In addition, some students experienced the class as being split into two sub-groups. For example, one preservice teacher found it difficult to establish rapport with the experienced teachers in the class. She felt that the class was split into the preservice teachers and in-service teachers as two different groups. However, in the first wiki assignment, she felt that these age differences actually did not really create many problems, and she dared to express her own opinion in the group. She discovered that these teachers were not so “scary” after all when they got to know each other better (GI 2). It is worth noting that several students felt that the peer relationship was better in the first wiki assignment when either 8 or 9 students worked together. The relationship was closer compared with the whole-class projects in the second and the third wiki assignments where approximately 20 students sat together. According to one student, it is difficult for all the students get to know each other if the teacher doesn’t actively organize the groups. If not, students will prefer to collaborate with students they know in advance if they can choose their own partners freely (GI 2).

Other students claim that the course design inhibited peer learning in the whole-class projects. One student claimed that the group met too seldom:

> The group taking this course is very diverse. And when you attend the course only two evenings each week, I must admit that I did not get to know the other students very well. Then it will always be more difficult to collaborate compared with if you are together with the same students daily over a longer time period. That would be something completely different. You can see that the students who are here in the daytime have a closer relationship with each other. That is if you, in a way, compare these students in the course with us. (GI 6)

This student emphasizes that they did not have enough time to establish the necessary proximate relationships required for successful peer learning. As an in-service student, she

visited campus only a few times a week during this specific course. When the students see each other so seldom, there is not enough time for everybody to get to know each other. Instead she suggested that frequent face-to-face contact on a more daily basis is a necessary condition for the development of good working relationships. This is why it would be easier for preservice students to establish the necessary high-quality peer relationships in the daytime. A student in another group who had recently finished the teacher training program also made the same suggestion:

> Kelly: (…) I think this instead should have been done in our class in the teacher training program. We actually had very close bonds and were good friends. A large part of the class. We went on trips together, and we arranged parties. We studied a lot of subjects together. We had drama. We had math. We had Norwegian. We were together so often. Usually we were here four to five days a week from nine to three. We got to know each other well. Then it would have been easier to do a large assignment together.
> Interviewer: Easier then?
> Kelly: Yes, instead of shouting "You, in the yellow sweater!" You do not know anything about who they are. So this makes it a bit difficult to communicate. (GI 4)

Kelly suggests that it is easier to do this kind of project with the daytime students she went through the program with, because this group has already established good relationships. She assumes that this process takes time in a large group.

Furthermore, most students found it easier to become acquainted in the first wiki assignment, because the groups were smaller (GI 2, GI 4, GI 6). It was experienced as easier to discuss issues because the relationship was good and everybody knew what was going on and who was doing what (GI 6). One student also suggested that it is easier to get to know new persons if you know others from before:

> I knew Jennifer, Jane, and Jodie from before. When you know someone from before, it is not so difficult. Then you have a network, and it is very easy to extend to others if you are open. As long as one knows one or two persons, it is much easier to connect with others. Then nobody will sit by themselves and just do their own work. (GI 4)

On the other hand, some students also reported that they did not feel that they had actually collaborated together as a whole class (GI 4, GI 6). One student mentioned that she did not feel that she had collaborated with all 30 students in the group, because the students ended up dividing the work into separate tasks to get the work done (GI 4). Students in another group were of a similar opinion when they mentioned there was little dialogue over the table. They helped each other within their own group, but primarily observed what the other groups did (GI 6). Two students in this group agreed that nobody actually collaborated in the project:

> Rebecca: I often think that one needs to talk together in order to collaborate and perhaps introduce some ideas. "Should we do this or this? Or perhaps it is better to do it another way." But nobody did that. Everybody just sat there.
> Susan: And got their task.

Rebecca: And then they ran off. Nobody collaborated.
Susan: They didn´t.
Rebecca: At least not with us. (GI 6)

These students report that there was a lack of discussion and exchange of ideas. Instead, the students were more focused on doing their separate tasks. According to another student, they only had plenary discussions when something was wrong or did not work (GI 2). Another student also complained that when they met at the workshop and had finished the work in smaller groups in the second wiki assignment, they did not even discuss what they had done with the others in the group (GI 3). This statement indicates that the plenary level was not used to review the collective work or improve ideas but rather mainly to solve problems. Likewise, a study in the review recommends the development of spaces where students can exchange ideas and do major revisions of their collective work. Using such a space would also reduce the risk of students offending each other when they do overlapping editing (Arnold et al., 2012).

The comments suggest that good peer relationships are a necessary prerequisite for successful peer learning in large groups in the offline setting. It is worth noting that none of the studies in the review have a focus on the relationships between students. One obvious reason is that few of these wiki studies have been designed to let students collaborate closely together in whole-class projects.

7.3 Anonymity has an influence on peer learning

As a third major area, the students talked about how *anonymity influenced peer learning*. In the offline setting, a few students report that they dislike that someone can make changes to their work anonymously. For example, one student noted that the final published text in her group was different from what she had originally written. She thinks the group should have discussed these revisions with each other instead of someone just changing the text (GI 3). However, it is also worth noting that some students found it to be easier to edit and revise text if it was done anonymously in the offline setting. One student shared about an incident when she was finishing the third assignment. She had discovered some odd sentences when scrolling through the student-produced wiki pages. She made some minor changes to the wiki text even though this was not part of her assigned task. The interviewer followed up and asked her how it felt:

> To some degree I feel I am violating others' text. And this was very easy to do when in a way it was done covertly. But I don´t know if I had wanted to tell anyone … I could very well have mentioned it, but it is much easier to do covertly (…) I think much of it is about us not knowing each other. In a way, it is so convenient to do it covertly instead of bringing it up. I think it is difficult to know who has done what (…) We tried to make a table, but what we wrote there was of mixed quality. It was difficult to know whom to ask about the different tasks. Then it is just easier to do it yourself perhaps instead of making a comment and letting others look closer at the text. (GI 2)

Even though the student only made minor revisions, she still thinks she violated another person's text. Interestingly, this work was found to be easier when it was done covertly or anonymously. Because the students did not have an overview of who was working with the different parts of the text, it seemed more convenient to make the changes anonymously. The student underscored that it is easier and more time-efficient to just edit the text instead of trying to find out who had done the work or just make a comment.

On the other hand, none of the students expressed any concerns about the editing of the collective work that previous students had done in the first wiki assignment (GI 2, GI 4). According to a student in one group, this was not a problem since one did not know who these students were. Since the work was done a year prior, there was no risk of stepping on anyone's toes (GI 4). Likewise, a study in the review showed that most students enjoyed revising previous students' work, and they did not experience this as emotionally difficult (Baltzersen, 2010).

However, a few students in the current study were concerned about what would happen with their text in the future after they had finished their work. One student thinks it is okay that the students in class can improve each other's text, but she found it more difficult to accept that someone else could change or even remove their final product when the project was over (GI 6). This student was concerned about a possible negative development to their work. There is a fear of vandalism. This quote also illustrates a sense of loss of control and ownership over the work. She is not ready to accept the premise that knowledge is dynamic and needs to be changed and modified. This finding coincides with a few of the Wikipedia

studies in the review. Students felt a similar loss of ownership over the work. However, in one study, the students claimed that they would continue to monitor their published work (Roth et al., 2013, para. 44). At the same time, these findings show the strong sense of ownership that students have over their work. On the other hand, there were also a few students in the current study who experienced a stronger sense of community ownership over the work. For example, one student who was active in writing the Wikipedia article framed it as making a contribution to the Norwegian social democracy (GI 5).[57] Likewise, there were students from studies in the review who felt that their work was part of something much bigger. For example, one student said: "It's almost a fun experiment to see how the world reacts to something you create and what parts get edited and what don't" (Roth et al., 2013, para. 30). Although there was little peer feedback between the students in the offline setting, some of the students were astonished by the comments they received from outsiders on the Wikipedia article they had worked with. One student said: "I am so fascinated that people can just go in there, read it so thoroughly, and write such a comment" (GI 3). These students experienced the critique from anonymous outsiders as both relevant and constructive. The comments were useful in the further improvement of the article. However, some of the students found it strange that some of the Wikipedians remained anonymous. One student would have really liked to know who had actually written the comments, because these persons were anonymous (GI 5).

In general, all these comments show that anonymity can have a significant influence on peer learning. Both peer editing and critical peer feedback become much easier to perform when done anonymously.

[57] See section 5.3, Producing knowledge for a "global" audience, page 138.

7.4 Summarizing the interview findings and establishing a triangulation strategy

In relation to the third sub-research question—*How does peer learning emerge in teacher education?*—the findings from the group interviews cover three broader conceptual areas: (1) the peer relationship has an influence on the quality of the peer learning, (2) the size of the group has an influence on peer learning, and (3) anonymity has an influence on peer learning. In the table below, the student perceptions from these three areas have been categorized as either enabling or inhibitory conditions in relation to peer learning.

Table 7.4.a Possible inhibitory and enabling conditions related to how peer learning emerges.

Aspect of peer learning	**Possible enabling conditions**	**Possible inhibitory conditions**	**Tension**
1. The peer relationship has an influence on the quality of the peer learning.	- The relationship is better between the smaller groups within the whole-group project. In these groups, students feel comfortable criticizing each other's work. - Some students recommend that they should spend more time discussing collaborative norms.	- It is difficult to change (peer edit) or criticize others' work (peer feedback) in the offline setting, because the relationship is distant. The students also feel a strong sense of ownership over their personal contribution. - If students can choose, they prefer to collaborate with persons they know from before.	- Becoming vs. not becoming acquainted - Text products as individual property vs. collective property
2. The size of the group has an influence on peer learning.	- Smaller groups develop a good relationship more easily. - Students need to meet more often to get to know each other well enough. - Students need to feel that they can raise their voice if they disagree, daring to express their own opinion in the group.	- In a large group, the size itself makes it difficult to establish a good relationship among all the students (e.g., whole-class project). - There are few discussions of student work at a plenary level in large groups. Too many opinions make coordination difficult. - Students experience decreased ownership over the task, because the relative individual contribution decreases when the size of the group increases.	- Becoming vs. not becoming acquainted - Using much vs. little time available to establish a relationship between the students - Microtasks vs. comprehensive tasks

3. Anonymity has an influence on peer learning.	- Anonymous revisions of others' work do not create intense negative feelings. - Extended peer editing is easier to perform over time. New students have few problems editing the work that previous students in the course have done. - Anonymous others in a global online environment (Wikipedians) give high-quality feedback on student work.	- Some students experience a sense of strong personal ownership over their contribution. They dislike that anonymous others can change this work in the future. - Students feel a sense of violating another person's work in the offline setting.	- Personally identifiable contribution vs. anonymous contribution - Trusting vs. not trusting feedback from unknown others.

7.4.1 Inhibitory conditions

Concerning how peer learning emerges in teacher education, the findings from the group interviews show that students perceive the existence of several possible inhibitory conditions. *First*, the findings show that they feel *the peer relationship can have a negative influence on the quality of the peer learning*. A major challenge is that the students found it difficult to both criticize (peer feedback) and edit each other's work (peer editing) in the offline setting. First, they dislike both changing others' work and letting others change their own work if the peer relationship is not close. In a distant peer relationship, it becomes much more important to respect the individual student's contribution and their ownership over the different parts of the collective work. It is even viewed as impolite to criticize others' work. Students did not want to change others' text without asking for permission. Most of the students felt that this type of peer relationship dominated the whole-class project.

Second, the group interviews revealed that the students feel that *peer learning is influenced negatively by a large group size*. The students reported that there were few discussions and a lack of exchange of ideas at the plenary level in large groups in the offline setting. It was more difficult to disagree with each other because of the group size. The students became more cautious about saying something, because they thought their comment should be of high importance if the whole group had to listen to them. This was more evident in the whole-class projects compared with the first wiki assignment when the group was smaller. The discussions were more formal and less spontaneous and free flowing in the whole-class group. As a result, more students became passive.

Another reason for the difficulties was that the large group size made it more difficult and time-consuming for all students to get to know each other better. In addition, the large group had a negative influence on the students' ownership over the work. Several students complained that their individual ownership over the collective work decreased when their relative contribution to the assignment became smaller. The individual ownership over the

tasks was weakened, and students perceived that they had only a small degree of influence on the collective work. The collective ownership was experienced as negative, because it reduced the students' perceived influence on their individual grades. The students found it difficult to treat the work as a collective property. Several students also claimed that they did not actually collaborate in the large group, only in small groups. Most of the collaboration in large groups ended up being a compilation of contributions from individuals and small groups. The students did not actually work together as a whole class.

Third, the group interviews showed that students feel that *some elements of anonymity can have a negative influence on peer learning*. For example, some students who experienced a strong personal ownership over their contribution disliked the idea of anonymous others changing their work in the future. Anonymity is also related to the students having distant relationships with each other in class. This is illustrated by the statement where the student explained that she does not even know the names of her peers. At the same time, students state that it was easier to modify another person's text if this work is done covertly or anonymously.

7.4.2 Enabling conditions

On the other hand, the group interviews also describe several possible enabling conditions related to peer learning. *First,* students feel that *a close peer relationship can have a positive influence on the quality of the peer learning*. The students felt that peer learning was easier in the smaller groups. One important reason was that the peer relationships were closer in the smaller groups. This made it easier to criticize each other's work. Most students assume that a certain level of trust is necessary to collaborate efficiently in the offline setting. Smaller groups make it easier to develop a good relationship in a shorter span of time. The students recommended that project groups should spend more time discussing collaborative norms that could strengthen the peer relationship. One needs to create a better balance between what kind of text revisions require a discussion in advance between the students and what kind of revisions one should be able to make without asking for permission. The disadvantage with asking for permissions all the time is that it will inhibit the flow of the collective reflection.

Second, concerning the size of the group, the interviews showed that students feel that *"smaller" large groups were viewed as more effective*. The peer relationships were also better in the first wiki assignment compared with the second and third assignments where the students had to work in whole-class projects. The group dynamics and coordination in small groups is also perceived as more flexible and thus better. Students can raise their voice if they disagree, and they can dare to express their own opinion. However, because it takes more time to create a good peer relationship in large groups, the students suggested that they would have to needed to get together more often. High-quality peer learning depends on students knowing each other well enough to interact successfully. However, in the current study, most students did not expect that they would have to invest extra time in becoming acquainted with the other students. Because many students had already known each other, they were not so interested in becoming acquainted with new students. This is why the teacher needs to facilitate and organize the group in such a way that they develop good relationships with each other.

Third, the interviews showed that students feel that anonymous *peer editing can be very effective when it is done anonymously*. For example, the students reported that it was perceived as emotionally relatively easy to edit the collective work that students had done in previous years. This coincides with findings from a study in the review that examined time-extended peer editing.[58] Second, concerning peer feedback, the students were quite positive toward the comments they received from Wikipedians in the online setting. They enjoyed the praise, but they were also ashamed about the critique they received. However, students reported less peer feedback and discussions at the plenary level in the workshops.

7.4.3 Triangulation strategy

The main purpose of the triangulation is to enrich our understanding of peer learning as a complex practice in the teacher education context. Although the interviews revealed important findings, they provided a limited amount of data about peer learning. Compared with the two previous chapters (5 and 6), this makes it necessary to utilize a relatively large amount of new data to answer the third sub-research question. Three major findings from the group interviews will here be used to direct the further selection of which new data should be included. The new data will therefore to a greater degree build on the "student voices" from the group interviews rather than being a part of the researcher's preselected categories or themes.

The main focus will be on what has been labeled as enabling conditions, but a few of the more important inhibitory conditions will also be further analyzed. In accordance with the research question and the review, the further analysis will center on *peer editing* and *peer feedback* as the most important concepts. The data will also be analyzed as they emerge in the interplay between an online and an offline setting. The table below gives an overview of how the new data will be used as a part of the triangulation strategy.

[58] See section 2.4.5, Time-extended peer editing, page 37.

Table 7.4.b An overview of how findings from group interviews about peer learning are used to triangulate new data.

New data	**Building on the following findings from the group interviews**
1. Peer feedback through raising your voice (peer learning at a plenary level). Most of the new data are from one of the workshops in relation to the first wiki assignment.	- "Raising your voice if you disagree." (enabling condition) (2. The size of the group has an influence on peer learning.)
2. Peer learning as the verbalization of ongoing thoughts and actions. Most of the new data are from one of the workshops in relation to the first wiki assignment.	- "Dare to express your own opinion." (enabling condition). (2. The size of the group has an influence on peer learning.) - "Smaller groups develop a good relationship more easily. Students feel comfortable criticizing each other's work in small groups." (1. The peer relationship has an influence on the quality of the peer learning.)
3. Peer editing between students in the whole class.	- "It is difficult to change (peer edit) or criticize others' work (peer feedback) in the offline setting." (Inhibitory condition) (1. The peer relationship has an influence on the quality of the peer learning.)
4. Extended peer editing (extension in time).	"Anonymous peer editing is more effective."
5. The peer as an outsider (extension in time)	"Feedback from anonymous outsiders can be relevant." (3. Anonymity has an influence on peer learning.)

The new data will be used to study *peer learning at a plenary level*, which involves the whole group of students in different ways. *Raising your voice above normal* will be further analyzed as a specific type of interaction that plays an important role as an enabling condition. This is feedback that involves all the students in the sense that they are encouraged to listen to what is going on. The primary purpose of the triangulation will then be to enrich the data from the group interviews. At the plenary level, *peer editing between students in the class* will also be further investigated as an inhibitory condition. The purpose of introducing new screen data from the wiki logs is not only to validate the findings from the group interviews but also to distinguish between the different types of peer editing that were in use. In this sense, the triangulation serves the purpose of enriching the data from the group interviews in this area, too.

In addition to peer learning in large groups, it will be important to analyze different types of *dyadic collaboration and screen-mediated peer feedback* in more detail. The statements

from the interviews show that collaboration in small groups was perceived as easier. The students explain that one reason was that they knew each other better, but we know less about other qualities at this level of collaboration. According to some of the students, small-group collaboration was also the dominating working mode in the project. It is therefore important to triangulate the group data with new data that can better capture the detailed micro-interaction that characterizes peer learning in these smaller groups. The new data from the workshop context include both video and screen capture data.

According to terms described by Jordan and Henderson (1995), all types of interaction in the current study will also be investigated as a specific type instrumental interaction, which lasts much longer than conversation-driven interaction. In instrumental interaction, the requirement for talking "on topic" is suspended for long stretches of time. The group interviews give no information about the more informal peer feedback practices in the smaller groups. Although some students highlighted the value of collaborating in small groups, the statements were not specifically related to the feedback between the students. One needs to analyze interaction data from the workshop setting to better understand this micro level of peer learning. The workshop data will here be used to deepen our understanding of peer feedback by zooming in on more detailed aspects of the interaction. These data can be used to analyze how both peer editing and peer feedback constitute combined parts of the same collective work. Peer learning will here be analyzed as a part of the ongoing interaction between the students in the workshop.

The group interviews also gave very little information about the importance of artifacts in the learning process. According to Jordan and Henderson (1995, pp. 64-66), a complex work setting will often be constituted by multiple overlapping activities, documents, screens, or other informational resources that need to be consulted before a turn-at-talk can be taken. Both the screen capture data and video data from the workshops in the offline setting will be used to collect data that can inform this perspective. These data will help direct more analytical attention toward *peer learning as a part of the ongoing discourse*, which here will be analyzed as a screen-mediated practice (screen-mediated peer learning).

Finally, peer learning needs to be further analyzed as a *new practice in a global wiki environment*. The group interviews showed that students interacted with persons outside the course in different ways, but they give few details about what happened. While peer learning in small groups and the whole group emerged in an institutional setting, it was different with peer learning in global environments that emerged within an online setting only. These practices are important to explore, because they point to a set of new types of peer learning that participation on the Internet now offers. The current study shows that peer editing can be done in several different ways when students do their work in a global wiki environment. On one hand, the students in class can edit each other's work. On the other hand, because student participation in an online global environment extends both in time and space, this also creates new types of peer editing and peer feedback. First, this involves students doing work on the same wiki pages over several years. These new data will be used to construct indicators that attempt to capture *extended peer editing* as a phenomenon. Second, this involves both editing work and feedback from *persons who are located outside the class*. These findings will be discussed in further detail in the following section.

7.5 Peer feedback through the raising of your voice

In the current study peer feedback at a plenary level in the offline setting was often given by students *raising their voice above normal*. In most of the episodes only a few students were involved in the discussion at a plenary level, but anyone could potentially join in. It was necessary to use the sound level of one's voice to reach out to all the students as a group. Likewise, conversational analyses, like that Schegloff (2000), have found that one strategic maneuver to get others' momentary attention is to talk loud or get others' attention by showing acoustic force. However, in the current study the sound level varied with the group size. The smaller groups in the first wiki assignment (8 and 9 students) could use a softer voice compared with students in the whole-class projects, who had to use a louder voice to address approximately 20 students (second and third wiki assignments). The data show that students raised their voice to give *peer feedback in several different ways*. Five selected episodes will here be analyzed in more detail in an attempt to deepen our understanding of this pedagogical practice.

7.5.1 Asking for a short answer

It is possible to raise your voice at a plenary level to obtain *different types of answers*. One type of peer feedback can be initiated to get a quick and short answer from other students. In the following excerpt the student raises her voice in the workshop where the group is working with the first wiki assignment about musical instruments.

Table 7.5.a Excerpt – Raising your voice to ask for a short answer.

Turns (time)	Verbal interaction	Video, audio, and screen capture data
1	S8: It was these three which were there. "Ben Kramer plays on a big drum set." That was not very academically correct. To put it that way. What is the name of such a large drum set?	S8 is reading aloud a sentence from the wiki page on her own screen. She informs S9 by referring to some of the different links in the wiki.
2	S9: hmm	S8 only gives S9 a few seconds to answer the question. The student gives a supportive comment with "hmm" but no verbal reply.
3	S8: You all. What is the name of that large drum set? I don´t think it´s academically correct. It just says "Ben Kramer plays a large drum set."	S8 raises her voice to address the whole group and reads aloud from her laptop screen with an ironic and humoristic tone of voice.
4	TA (teaching assistant): Drum set.	The body gestures of S6 and S7 indicate that they are not paying attention and are busy with something else.
5	S8: Is that it?	S8 turns her face toward the TA, who is sitting behind her. Her tone of voice indicates that she is surprised. She repeats the question to make sure that the first answer is correct.

6	TA: Yes.	
7	S2: Yes, but the different drums have different names. But it is just called drum set.	The student gives the same answer, but with some additional information.
8	S8: Oh yes. By the way, they have written that.	After turn 8, the plenary conversation ends, and the students continue with their dyadic collaboration or individual work.

This excerpt begins with S8 reading aloud a sentence from the screen (turn 1). At the same time as she is reading, she is assessing the quality of what she is writing. This is shown in the comment, “That was not very academically correct.” She is unsure if “drum set” is the correct term to use, but she does not know what the right answer is. Her comment is at first only local and limited to the dyadic conversation. It refers to a specific sentence on the laptop screen that is not accessible for the others in the rest of the group. The discussion will not give full meaning to the others who cannot observe the text on the laptop screen.

Although S8 does not receive any proper answer from her partner (S9) in the dyad, she receives nonverbal confirmation (”hmm”) that the question is interesting (turn 2). As a consequence, she repeats the question, but now she addresses the whole group at a plenary level (turn 3). She not only raises her voice, but she also uses a humoristic tone in an attempt to get more attention to what she is saying. Both the teaching assistant (TA) and S2 respond to her question (turns 4, 6, and 7), while the rest of the students continue their work. This illustrates that only the persons who think they know the answer take the time to stop their work and give feedback. The other students are not expected to stop their work when such an incident happens (e.g., like S6 and S7 at turn 4).

Moreover, S8 is surprised by the answer she receives—that it is okay to use drum set as a term. She replies with a comment that is formulated as a new question: “Is that it?” (turn 5). It shows that she is still uncertain about the correctness of the answer from the TA. She therefore receives another confirmation from the TA (turn 6) but also another answer from a student across the table. The two replies from different students strengthen the perceived correctness of the answer. S2 also supplements with additional information (turn 7). After this, S8 is content with the answer, and the conversation about this topic ends (turn 8).

One should notice some of the advantages of raising a question at the plenary level. In this excerpt the student asks the same question twice because she needs to be certain that the answer is correct. In this way she invites others to join into the discussion in a second round if they disagree. Because more than one person confirms the answer, this strengthens the reliability (trustworthiness) of the answer. As we can see, the level of outreach is much larger than in the dyad. This increases the likelihood of receiving a correct answer and illustrates the significant value of being able to use the plenary level. The student even tries to give a short explanation of the answer (turn 7). This shows that at the plenary there is an increased chance of getting a more detailed and nuanced answer that contains more information. From one perspective, S8 is here utilizing the intelligence of the whole group by posing a question at the plenary level. In contrast, the dyadic collaboration is constrained, because one can receive an answer from only one person.

Moreover, turns three to eight last only 20 seconds. This shows that this type of feedback is time-efficient, since it does not require any additional screen support or visual display of the information. None of the laptops are moved into any new positions. The rapidness of the peer feedback illustrates the flexibility of sometimes using the plenary level to pose questions that require a short answer.

7.5.2 Asking for a long answer

In the current study, there is also an example of a student who raises her voice to ask other students at a plenary level for guidance on how to use a digital tool (Hot Potatoes). She asks for extended support, which will require a *longer answer* and greater involvement from the helper. The two excerpts below are from a dialogue between this student and another student sitting across the table who replies to the question. They take place at the end of the first workshop in the second wiki assignment. In total, the instrumental interaction that covers the time period of both excerpts is about five minutes long. The first excerpt (episode) lasts approximately one minute and is described below.[lx]

Table 7.5.b Excerpt – Raising your voice to ask for a long answer.

Turns (time)	Student	Verbal interaction	Video, audio, and screen capture data
1	S1	Is there anyone who is good at using Hot Potatoes?	Raising her voice so other students can hear her request.
2	S2	Don't, just in that …	S2 is talking about something else. Not finishing the sentence, inviting another person to finish the sentence.
3	S1	I wonder how I could publish it. In some way.	
4	S2	If you visit YouTube, I have made one such screencast.	
5	S1	Okay.	
6	S2	I don´t remember, I need to watch it myself if I am going to show it to you. But go and visit YouTube.	
7	S1	Yes, because now I have made one of these. But it is now saved in my folder, right.	
8	S2	Yes, then you would need to… You can get, you can produce. Well, I had a purple background and images and a lot of stuff.	
9	S1	Okay.	
10	S2	You can make it much more child-friendly that way, too.	
11	S1	Okay, that's good.	
12	S2	But…	
13	S1	Can it be found, what do I then search for? Do I search for…?	S1 is talking about the quizzes she has made in Hot Potatoes.
14	S2	Eh, search for Hot Potatoes on YouTube. I know how or what it looks like, so to speak.	
15	S1	Yes.	
16	S2	I don't remember if I did it like that, but you can get it published here. You need to be here on the local Internet.	

17	S1	Okay.	
18	S2	You can talk to the people at the helpdesk.	The helpdesk is a local service for students on campus where one can get technical support.
19	S1	Yes, but I am only here in the evening. Eh, let's see.	
20	S2	We'll find a solution. I did in my practice period (laughing). So I think we will manage here, too.	

The excerpt shows that the student (S1) seeks help from her peers by raising her voice and posing a question to the whole group (turn 1). At first, S2 does not answer the request from S1, because she is preoccupied with something else (turn 2). When she eventually addresses the question (turn 4), it shows that had she noticed the original request from S1 (turn 1). She (S2) answers the question by referring to a video resource she has made, which is available on YouTube (turn 4). She encourages S1 to look at the video (turn 6).

This example also shows that the peer feedback has extended across time and space in a new way. S1 can receive feedback from S2—not from a live person but from the same person in a recorded video format that had been published several years ago. This is made possible because S2 had published an instructional video in the online setting, which is still openly available for anyone to use. An obvious advantage is that S1 can receive an answer to her question anytime later to solve her problem. In addition, S2 also recommends that S1 use helpdesk, which is a resource that exists in the offline setting (turn 18). This shows how the online and offline settings interplay in new ways to answer student questions.

The next excerpt shows what happens three minutes later. S1 gives her laptop to S2 so that she can find the instructional video S2 had made previously. While S2 is trying to find the video on YouTube, she is at the same time describing what is happening on the laptop screen she is using.

Table 7.5.c Excerpt – Finding a video that can answer the question.

Turns (time)	**Verbal utterances**	**Video, audio, and screen data**
1	S2: No, you know what. You can't. You can't find mine anyway. It's insane. Yes. There! There I am as number… It lasts… Number 3, 4, 5, 6. Number 6.	S2 is verbalizing her screen operations so that S1 can hear what is happening.
2	S1: (interrupts) Can you just press "add?" If you press on it, then you can press "add to favorites," and then I will have it. Then you can just press ok.	
3	S: It lasts for 10 minutes, but I can't remember…	
4	S1: I will manage 10 minutes (laughing).	
5	S2: Yes, yes, yes. Then you will be watching me.	

6	S1: Yes, that will be nice.	
7	S2: It really is a coincidence that I made it. Like that. Now I've put it in favorites. It takes a long time to update itself. Because then I could have looked at it, you know.	S2 is saving the video on S1's laptop screen.
8	S1: hmm	
9	S2: The last minutes. If I published it or what I did.	S2 has made an instructional video several years ago, but doesn't remember if she said something about how to publish it on the Internet.
10	S1: But anyway, I can perhaps get help from someone here next time.	
11	S2: Yes.	
12	S1: Getting it published, if I am not able to do it.	
13	S2: I don't remember, you know, it's such a long time ago.	
14	S1: Cannot hear what she is saying. (talking at the same time)	
15	S2: I made it as a first year student, you know. It's over two years since I made it.	
16	S1: No, I haven't done it since … When did we do it? 2006? Or 2007?	
17	S2: Yes, Hot Potatoes. And I also have a screencast about Tuxpaint, but it isn't that relevant, though.	
18	S1: Yes	
19	S2: But anyway, there it is.	
20	S1: Awesome.	
21	S2: Yes.	
22	S1: Thank you. (S3 leaves the room.)	

Interestingly, S2 claims that she has forgotten a significant amount of the content in the instructional video (turns 3 and 13). She does not have the full set of skills anymore. As a person in the present offline setting, she can no longer provide the necessary help. However,

the video of her “person” from years back in time can provide sufficient support for S1 to acquire the relevant skills.

From one perspective, S2 acquired skills that were “offloaded” into the online setting when she made the video. It is not necessary for S2 to remember the specifics of how to operate the software program, because she can just go back and watch the video later if she needs to do the same operation again. If she later needs to use the program (Hot Potatoes) in the offline setting, she can first watch the video in the online setting to update her skills. Her expert skills in using the software are not complete without the additional resource from the online setting. In this way, her offline skills become distributed and extended into an online setting.

At another level, the help continues to live on independent of “the helper” as an offline person. This happens because the student provides her peer with the link to the “the helping resource” in the online setting. Then S1 can receive help from S2 as an online person without actually having to disturb her. In this sense, the person continues to be present through digitalization. This is indicated by the phrase, “Then you will be watching me” (turn 5). The reference to “me” shows a perception of a digital version of the person in the online setting. Although it is just a screen capture video, it may be that it is the voice that personalizes the video.

Note also that this interaction is mediated by the physical movement of one of the laptop screens. During a short time period, one student gives her laptop to another student, who then uses this laptop in an attempt to find relevant information on the Internet. This example illustrates that the laptop as a personal material artifact can also be shared such that the same laptop is used by two different persons. This shows that the student did not experience a sense of ownership and feel the need to protect her own device, because another student could use it for a short period of time.

7.5.3 Involving oneself in another conversation

In the current study, there are also examples of students who *receive critical feedback from other students in their surroundings* because they use a loud voice when they are discussing an issue. According to Schegloff (2000), parties to a conversation can be sensitive to speech in other conversations while they are talking. Simultaneous speech happens in separate but geographically near conversations that are within earshot. The speakers can also involve themselves in the other conversation. This is one way in which student dyads in teacher education can inform the others in the group about what they are doing. One such incident happened in the first workshop about musical instruments. S8 and S9 are primarily discussing an issue in the dyad, but at one point other students begin to involve themselves in their discussion. S1, S6, and S7 join the discussion for a very short time period. In total the episode lasted approximately 40 seconds before all the students continue their work. The interaction sequence is described in the table below.

Table 7.5.d Excerpt – Involving oneself in another dyadic conversation.

Turns	Verbal interaction	Video, audio, and screen capture data	Comment
1	S9: Yes, there the movie is.	Screen data: S8 navigates the screen operations while S9 observes what is being done.	S9 informs S8 about what the external link contains.
2	S8: African drum.	S8 reads aloud a text fragment on the screen.	
3	S8: 7 minutes!	S8 raises her voice significantly compared with the sound of her voice in turn 2.	S8 refers to the length of the video, which she reads on the screen.
4	S9: Oh, my gosh!		
5	S1: 7 minutes on one movie.	The sound of the voice is from across the table. It is either S1, S2, or S3. Probably S1.	This is the first utterance that involves other students outside of the dyad (S8 and S9). S1 here supports S8's statement.
6	S9: Yes, but we still have to review it, but…		
7	S1: It is perhaps a bit long.	Low voice	S1 supports S8's statement one more time.

8	S6: But it doesn't mean that you have to show all 7 minutes.	S6 is directing her face toward S8 and S9.	S6 is also involving herself in the discussion. She is suggesting that the length of the video is not a problem.
9	S9: No, but then it says that one needs to specify what sequences one should watch. But we will just have to talk about it afterwards. Because in a way we are talking about it now.	S9 is talking to S6. S6 says yes, yes several times when S9 is talking.	S6 supports S9 by saying yes, yes.
10	S6: But haven't they written? I think they have written a lot about what we are watching: "After 40 seconds there is a solo part played on contrabass."	S6 is looking at her screen and reading aloud the text on her screen.	
11	S8: Oh no, are we doing that, S9?		S8 misinterprets the comment from S6 as being about the group strategy.
12	S9: Oh.		
13	S6: No, not us, actually. It's not us that have…		
14	S8: We didn't see that now.		
15	S6: But it was there from before		S6 explains that she is talking about the text that was already there.
16	S7: Before ...	S7 is stating very quickly after S6's comment (turn 15). (overlapping talk)	Repeats one key word so one can underscore the message.
17	S8-S9: Okay.	Both students are saying the same word.	
18	S8: No, we didn't		S8 explains that they have not noticed what S6 is referring to before.
19	S9: We haven't seen that, but…	Talking at the same time as S8. (Overlapping talk with S8)	
20	(Here the discussion ends.)		Turns 10–20 are characterized by rapid overlapping talk.

In this excerpt, both S1 (turn 5) and S6 (turn 8) involve themselves in the discussion after S8 (turn 3) begins talking with a louder voice. This new sound level differs significantly from the normal sound level. It is possible that one trigger here is the raising her voice to a higher sound level compared with her normal level in the dyadic conversation. One could claim that she uses her voice to indirectly seek attention from other students. This raising of one's voice beyond the normal level of the group dialogue can communicate to the whole group that certain information is relevant for others to listen to as well. Because the sound of the voice is quite loud, it is easy for the students sitting around the table to hear what the students are talking about. In addition, emotional statements like "Oh, my gosh!" (turn 4) draw the attention of the others around the table concerning what the dyad is doing.

In the smaller groups of eight and nine students in the first wiki assignment, the size of the groups made it relatively easy for students to notice what other students were discussing in the dyads around the table. Although these other conversations are treated as events in the environment, they can be competitive with the original conversation. One example is when the volume of the other conversation drowns out the original (Schegloff, 2000). This may to some degree happen here because one of the students raises her voice. However, in general, the students regulate the volume of their discussions at a level that does not disturb others too much but still gives them access to what is being discussed. On the other hand, this became much more difficult in the whole-class project, because the sound level of this dyadic conversation would usually be too low to reach all the other students.

Since several students are involved in these discussions across the table, it is possible to interpret this excerpt as an example of informal peer feedback at a plenary level. Particularly S6 tries to contribute with relevant information to the work S8 and S9 are doing in the dyad (turn 10). However, this peer feedback is given without any intentional request. It is primarily the raising of the sound of the voice that serves to initiate the peer feedback. The feedback is also short and illustrates how it can be given in a flexible way that does not disturb the ongoing flow of the work too much.

Moreover, the peer feedback is mediated by the laptop screens, because the students are reading aloud relevant information to each other. For example, S6 reads aloud from her screen. She reads something that she considers to be a best practice example (turn 10). The students need to read aloud relevant information from the screens because most of the students in the surrounding area do not have visual access to the screens.

7.5.4 Showing one's work to the rest of the group

Although it did not happen often, the students sometimes raised their voices *to inform the rest of the group about something they thought to be important*. This could be done either with or without screen support.[lxi] In the following episode, a student shows her work by holding up her laptop screen. The excerpt below is from the first workshop with the group who improved the wiki page about musical instruments. This is an example of instrumental interaction (Jordan & Henderson, 1995), which stretches over two minutes, in the sense that the students address a topic several times before the verbal interaction begins. The interaction in the table below is therefore transcribed as actions and not as turn-taking, which is usually built around "adjacency pairs" (Sacks, Jefferson, & Schegloff, 1992). Eventually, a dialogue between S3 and S6 across the table begins.

Table 7.5.e Excerpt - A student moves the laptop screen to show her work to the rest of the group.

Actions (time)	**Verbal interaction**	**Video, audio, and screen capture data**
1 (49:36)	S3: It's a little big (laughs).	S3 laughs because her image ends up being very large in the wiki when she saves it on the screen. Other parallel dialogues are also going on (for example, between S2 and S6).
2 (50:05-50:27)	(…) - S3: Where do I need to place this line? - S3: And then one more line or?	S3 is receiving help from S1 on how to make the image smaller. S1 helps S3 for a shorter time period. Otherwise, S1 does most of the work on her own.
3 (50:42)	- S3: Look, how nice. Yes (laughing). I am saving it.	S3 raises her hands above her head and signals both with her verbal utterance and her body language that she is very happy with her achievement. The screen data show that she manages to make a small image on her screen. She then saves the wiki page. She is cheering, but she still doesn't receive any attention from the others in the group. S2 continues to her dialogue with S6 while S3 is talking. At the same time the teaching assistant guides S1 on an issue related on how to use the wiki layout.
4. (50:51-51:02)	- S3: But S1, will you fix the URL on the titles then? On Wikipedia. Or will you find images? - S1: No, I will find them on Wikipedia. (last part of sentence is not possible to hear.) - S3: Have you been at the "read more"? Okay, then I will continue with the images.	S3 is talking with S1 on what tasks they should continue to do. The screen data show that the utterance "read more" refers to the title of an external link that directs the students to a relevant Wikipedia article.

5 (51:16)	- S3: Look here now. Do you want to see? Now it turned out like this on percussion instruments.	S3 interrupts the students (S6 and S7) working across the table and calls for their attention concerning her work. She turns her laptop screen toward S6 and S7 but primarily toward S6. She shows a small thumbnail image of the drum set. The teaching assistant continues to talk with some of the other students at the same time as S3 initiates this dialogue.
6 (51:21)	S6: Yes, only one image on each. Yes, I think that was a good idea. S3: (making a short comment which is difficult to hear) S6: Yes, exactly.	S6 is looking at S3's screen, which she has turned around. The teaching assistant is continuing to talk with S1 while this is happening.
7 (51:26)	- S3: Don't you think I am skilled? After one hour with fiddling around, I think. - S6: Yes, no, I think it is really good.	S6 smiles.
	(The verbal dialogue ends.)	S6 turns her head so that she is looking down at S7's screen. S6 shows with the movements of her head that she wishes to end this conversation.

The excerpt shows that the student has to actively ask for peer feedback on her own work. At first, the student does not receive any attention to her work. She is cheering and raising her hands above her head, but still no one comments on her work (action 3). The image below shows the gesture as it was performed during one second only.[lxii]

Figure 7.5-a Image – Student raising her hands over her head to show happiness (action 3 from the excerpt).

The image shows how S3 uses a combination of utterances and gestures to signal joy in front of the others by raising her hands. The raising of her hands to manifest her performance

demonstrates that the individual work is part of a larger collective work, which has a public dimension. Such gestures may make others curious about the work that this student has done. However, although the student tries to call attention to her work through her gestures, nothing happens.

This illustrates that it can be a challenge to draw attention to the work one is doing in groups. One reason is that many conversations are going on at the same time. All the students are busy with their own work. None of the other students will automatically be interested in one's work when they are preoccupied with something else.

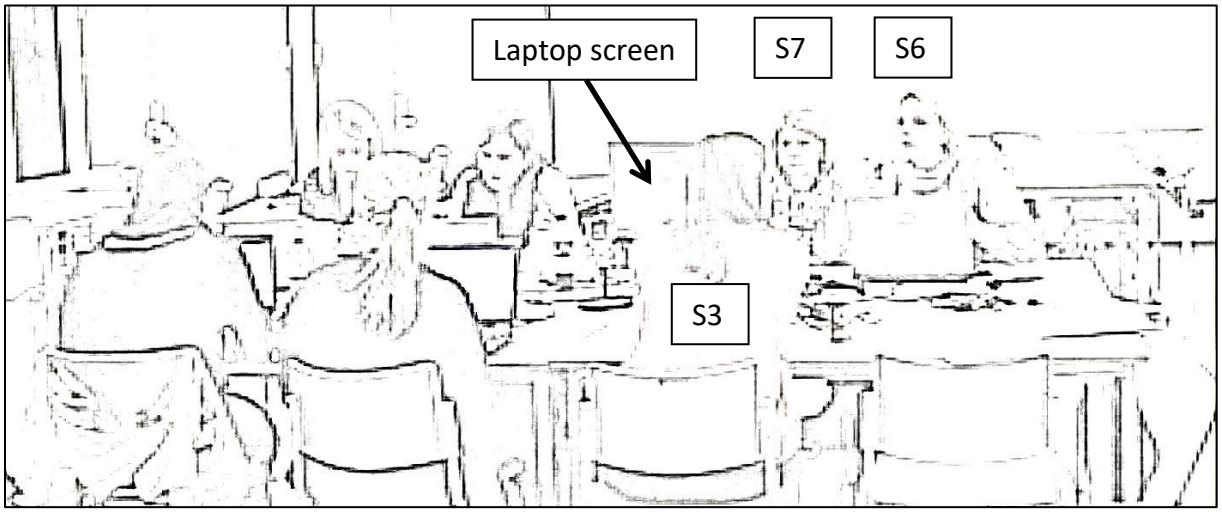
Approximately 30 seconds later, S3 changes strategy and tries to more explicitly call attention to her work. She begins to make a comment while at the same time standing up and turning her laptop screen toward S6 and S7 (action 5). S3 does not even wait for the answer to the question, "Do you want to see?" (action 5). Instead, the question is primarily used to get the attention of the other students across the table.

In this way she manages to interrupt S6 and S7 in their work and get their attention. Her previous behavior (action 3) indicates that she is primarily seeking acknowledgement for her work. The verbal utterance "Don´t you think I am skilled?" (action 7) is a leading question and confirms that she is both proud of her work and wants praise as feedback. The comment shows the pleasure of having accomplished something that she has struggled with. Now she wants to share this joy with others. In this incident, the pleasure and wish to show her work overrides the risk of provoking others when she interrupts their work. The earlier comment "Look, how nice" (action 3) indicates that she is primarily seeking praise for her work. On a more general level, the episode also illustrates the importance of utilizing peer feedback where students can give each other praise in this type of collective work.

At the same time the act of merely giving praise requires much less use of time than actually giving a more detailed and substantial response. Since the interaction is so short, it does not appear as though S6 experiences it as intrusive. After S6 has given her praise, the students continue with their work. This shows that interruptions are acceptable as long as they are short.

Moreover, the attempt to garner praise is also mediated by the student's bodily movements and the positioning of her laptop screen. The image below shows how the student lifts her laptop screen and turns it around to draw attention to herself and her work.[lxiii]

Figure 7.5-b Image - The student turning her laptop screen around to show her work (action 5)



By combining specific verbal utterances and bodily movements, S3 manages to interrupt the ongoing conversation, and in this way she manages to center her attention on her screen. The image shows that S3 can easily turn her screen around and show other students across the table what she has done. The students sitting close to S3 have already seen her work, but the image shows that she also wants to share her work with the others across the table. These students do not have immediate visual access to her laptop screen. This also shows some of the flexibility of the laptop screen, because it can be used as a portable visual display that others not sitting beside the student can gain access to. By turning the screen completely around, as shown in the image, the student shows how the visual display can reach others. However, the small screen makes it difficult for all the students across the table to see the content on the screen. This is also why S3 needs to turn the screen completely around and move it as close as possible to S6. In this way, she gets the attention of S6 by both raising her voice and turning her screen around and pointing it toward S6. Although the interaction here involves only two students, it can be categorized as being on the plenary level, because it happens across the table with students who were not collaborating in dyads. The raising of the sound level of the voice also makes it possible for other students to join the discussion.

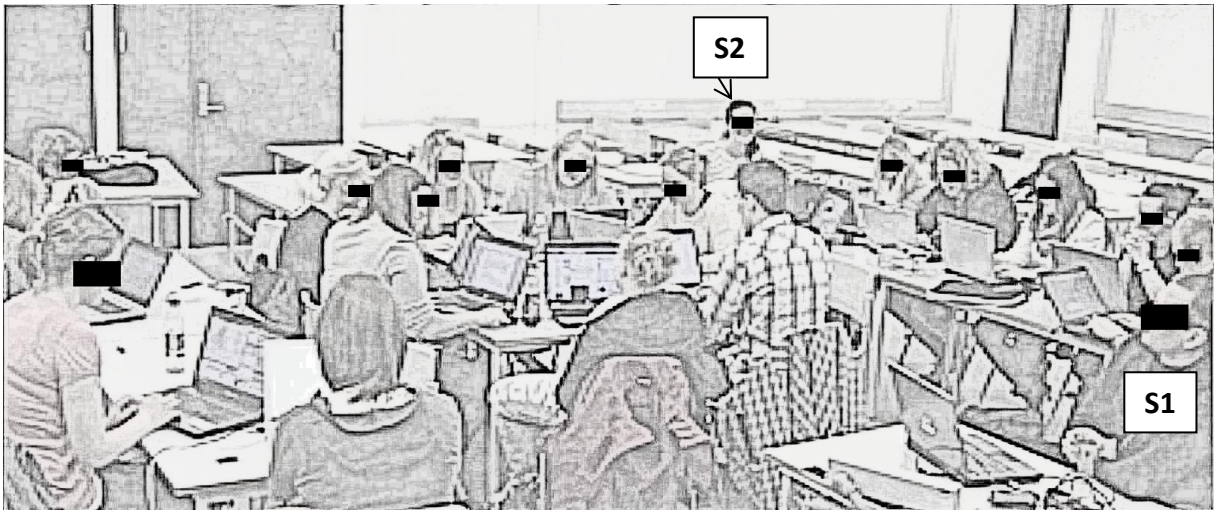
Notice also that the verbal description of her work is short (actions 5 and 7). Instead, S3 relies on the visual display of her work on the laptop screen, which makes it possible for others to see what has been done (action 5). Because the work has been done on the laptop screen, it is easier to share it with others compared with handwritten notes that would usually more require more effort to read. For example, S6 takes only a few seconds to look at S3's work and then praise it (action 6). In comparison, it would have required more time to read handwritten notes. If the students had used such notes instead, it would have required a more significant interruption of the other students' work. S3 would then have needed to hand her notes over to S6, and S6 would have had to physically take them to read them. It is likely that bodily interaction with the use of artifacts in the form of paper could have easily been experienced as more invasive. Instead the excerpt shows that the praise, which lasts only 10 seconds, constitutes a short and flexible part of the ongoing discourse (action 5 and action 7). Also, the student is showing an image on her laptop screen so that S6 does not need to ready any unimodal text to be able to comment on the work. The work is

visually accessible to others to a large degree and requires a much shorter attention span than if it had been written on paper. This illustrates the flexibility of the laptop screen as a tool that can be used to give visual access to ongoing work.

7.5.5 The voice in a specific table arrangement

The specific table arrangement also influenced how much the students had to raise the sound of their voice when they addressed the whole class. The students did not talk much about the table arrangements, but at the end of the fifth workshop the teacher asked the students how they felt about the table arrangement. One student said that she was able to get a better overview of the students compared with the fourth workshop and that it was easier to see all the other students. Several of the other students agreed.[lxiv] The excerpt below has therefore been selected from a dialogue between two of the students (S1 and S2) in the fifth workshop when the students were working on the third wiki assignment. S1 and S2 are sitting at the far ends of the table arrangement, but they remain seated in their chairs throughout their discussion. The image below shows where the students are sitting. [lxv]

Figure 7.5-c Image showing where two students (S1 and S2) are seated who discuss an issue across the room.



It is worth noting that the students raise their voices only slightly compared with the normal level in this group work. There is no need for a strong increase in the sound level of the voice even though the two students are sitting far away from each other in the table arrangement. One important reason is that all the students are sitting closer to each other in a "cross formation." The image above documents that the students are positioned at the far ends of this specific table arrangement. It is the students who are sitting farthest away from each other who are talking with each other across the room. The "cross formation" makes it possible for any of the students to talk to each other quite effectively without disturbing the other students too much. While the other students can hear the dialogue between S1 and S2, they continue doing their work and do not seem to be very disturbed by the conversation. Part of the flexibility in this seating environment is that the students do not have to raise their voices too much to reach the whole group. This is an important quality, because it increases the likelihood of addressing the whole group with questions. The excerpts also shows that this is vital if peer editing is to happen in the class, because the norm is that one needs permission to make any change to others' work. [lxvi]

Table 7.5.f Excerpt - Two students discussing an issue across the room.

Turns	Verbal interaction	Video, audio, and screen capture data
1	S1: Is there anyone from town L?	- S1 is referring to the name of an external link to a Wikipedia article that is accessible through the student wiki. - The screen capture data show that the article about town L is short compared with town H, which is recommended in turn 4.
2	S: No.	
3	S2: It was the best we could find. (some laughter)	S2 and S1 begin a discussion with each other that is accessible by sound to all the students.
4	S1: Go and visit the article about town H on Wikipedia. It is much better.	
5	S2: What is it about?	
6	S1: No, it's where I come from, from certain others. (laughing)	Making a joke.
7	S2: Oh, it was rather coincidental actually because no one … (cannot hear the last part of the sentence)	Explaining why they chose the article about the place L.
8	S1: Yes, but look, this one is much better.	
9	S2: We tried to find an article about place A, but we didn't find that much.	
10	S1: Then I will publish the one about town H instead. Because it is better.	
11	S2: Instead?	Her tone of voice indicates that she is surprised and somewhat insulted.
12	S1: Okay, in addition then. You won't be hurt?	
13	S2: No.	
14	S1: No, you won't go home and cry when you go to bed.	S1 makes a joke, but S2 does not laugh.

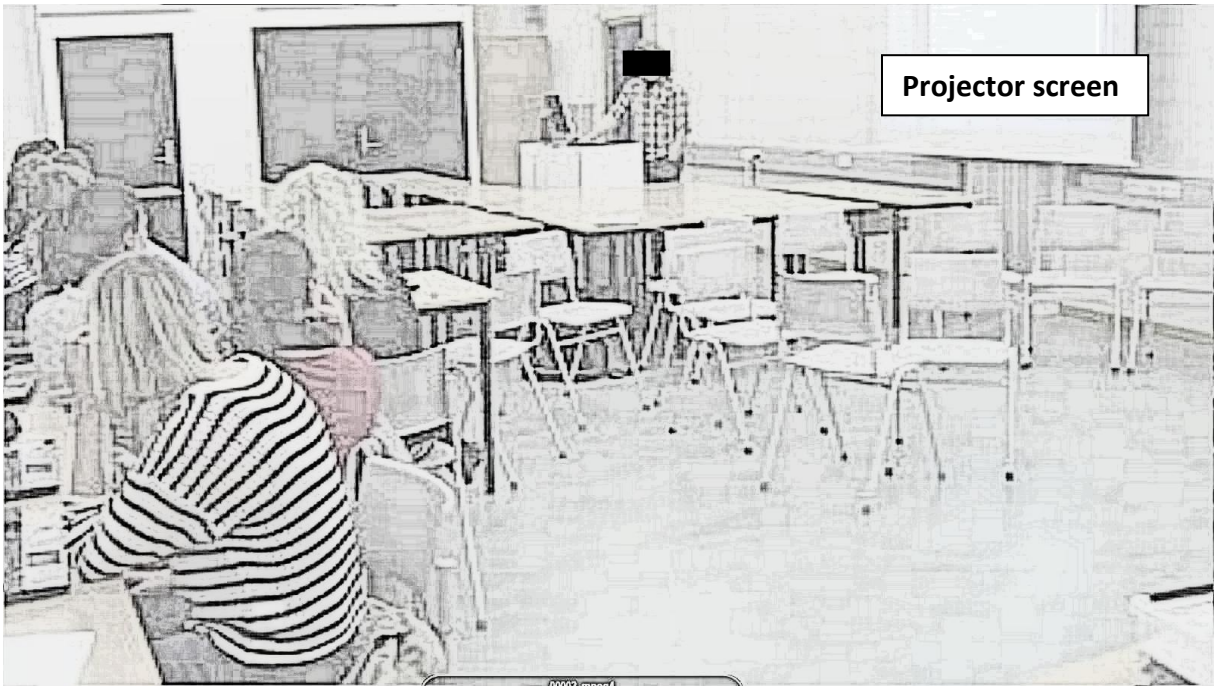
In the beginning of this excerpt, S1 addresses the whole class by posing a question about a link to a Wikipedia article about a specific town that has been published on the wiki page (turn 1). The question shows that the student is struggling to get an overview of which students are doing what tasks in this assignment. The student initiates a plenary conversation to find out who has written a specific part on the wiki page. In the first turns, the discussion centers on the quality of some of the external links to Wikipedia articles on the wiki page (turns 4–8). This peer feedback interaction is followed by S1 asking for permission to remove S2's work (turns 10–14). The discussion has moved to the issue of actual peer editing. However, S2 rejects this proposition (turn 11). She sounds a bit surprised and insulted when S1 suggests that her contribution should be removed. S1 responds by making a joke afterwards about her emotional attachment to her work, but S2 does not laugh (turn 14).

From one perspective, this dialogue illustrates that students need to discuss the issue with the original contributor before they can begin with any peer editing. It shows that it is more difficult to remove another student's contribution compared with merely adding text. It is quite obvious that S1 wants to remove certain text (turn 10), but she ends up not doing it for fear of being impolite. The comment "No, you won't go home and cry when you go to bed" (turn 14) is meant as a joke, but it also illustrates that peer editing can be experienced as a sensitive issue. S2 does not want her external link to an article to be removed even though the quality of the article would be improved by the new suggestion. Instead, it ends up with S2 just adding new content to the existing content. This shows that respecting every student contribution presents a significant threat to the quality of the collective work when students collaborate in an offline setting.

It is also worth noting that the students have quite a long informal dialogue at the plenary level. There is no indication that the students perceive that they are disturbing the others when they are having this dialogue. This shows that this table arrangement also allowed for more informal conversations between students beyond the usual small groups. However, the students have only a brief discussion about the quality of the content, and there are few attempts to elaborate upon this issue. S1 simply claims the article is better and offers few substantial arguments (turns 8 and 10). This indicates that the discussion at the plenary level is still somewhat more constrained compared with those in the dyads.

To further explore the influence of different table arrangements, the plenary discourse in this specific table arrangement will be compared with a plenary episode from the fourth workshop (second workshop in the second wiki assignment). Throughout the fourth workshop there are few student-initiated plenary conversations. The exception is the last part of the workshop when the group attempts to summarize and review the work. One student moves in front of the other students and directs most of this plenary conversation. [lxvii] The image below is from this verbal interaction sequence which lasts approximately seven minutes. [lxviii]

Figure 7.5-d Image of a student standing in front of the whole group talking to them.



The student has moved in front of the other students. This is the position where the teacher usually stands in front of the students in the classroom. If we compare this image with the cross formation image, one can observe that the students are seated quite differently. While the cross formation gave some support to less formal and spontaneous verbal interaction at a plenary level, this image shows that there is now more distance between the students in the room. This may also be one of the reasons why the student moves to a central position in the classroom: to be able to reach all the students by sound. Even in this position the student must still raise her voice to a greater degree than in the fifth workshop setting. This is illustrated by the student moderator, who has to ask the students to repeat what they are saying because their voices are too low.[lxix] The table below compares the student interaction from these two episodes which take place in two different table arrangements.

Table 7.5.g Comparison of the student interaction in two different table arrangements.

	Episode 1 (fifth workshop)	**Episode 2 (fourth workshop)**
Table arrangement	"Cross-formed".	Rectangular table structure placed behind in the classroom.
Who is talking to whom? (Paying attention)	Two students are talking to each other across the room. The rest of the students are doing something else. Some are talking.	One student is talking to the whole group. The other students are quiet.
Movements in the classroom. Bodily position	Students remain seated in their chairs while they are talking to each other.	One student moves up in front of the rest of the students where the teacher usually stands.
Response from students	Only very short comments with no deep elaboration.	Only very short comment with no deep elaboration. Short yes and no answers.
Turn-taking	Anyone can respond to questions that are posed. Symmetrical dialogue (rapid interchange)	One student, standing in front of the others, responds to most of the questions. There are only a few other students following up on the issue.
The sound level of the voice	Because the students are sitting close to one another, they do not need to raise the sound level of their voice much more than in the dyadic collaboration.	- The student moderator standing in front of the rest of the student speaks with a loud voice (raised voice to a substantial degree). - The student moderator needs to ask one student to raise her voice, because her voice is too quiet.
Screen-mediation interaction	Verbal reference to specific pages on the screen.	Student moderator uses a projector to visualize the work.

In both episodes, a student raises her voice to give peer feedback. The sound level makes the message accessible to the whole class, but there are still significant differences. In episode 1 it is unclear whether any of the other students pay attention to the discussion between the two students. There is no involvement by the other students, and some of them are also talking about other issues—nor are they looking at the two people involved in the discussion. In contrast, most of the students in episode 2 are quiet and have their faces directed toward the student standing in front of them. More of the students also participate in the discussion, indicating that they are paying attention.

However, while the verbal interaction in episode 1 consists of a balanced contribution from both students, the student in episode 2 does most of the talking and takes on the role of

being a moderator. Nevertheless, both episodes show that the comments from the other students are short and that there are few elaborations around the questions. In most of the turn-taking sequences, it is the moderator who replies to the student comments.

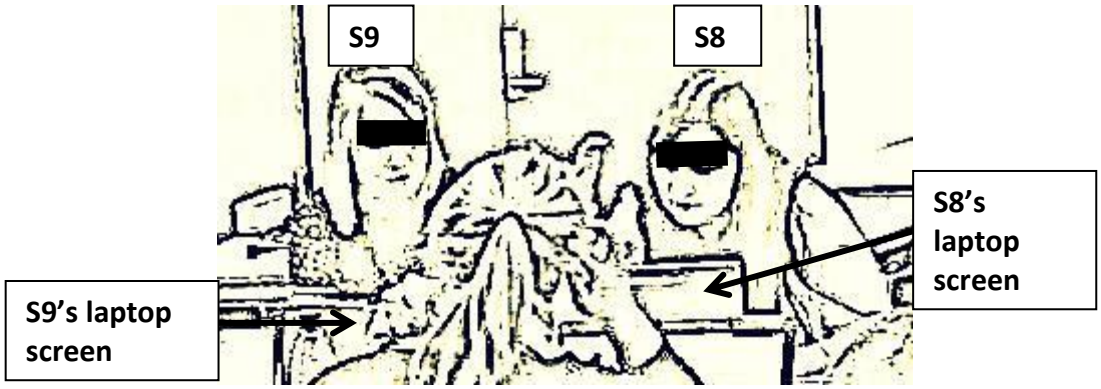
Both episodes 1 and 2 are different in their focus on peer editing. While the student in episode 1 asks for permission to peer edit another student's work, the student moderator encourages the students to revise and edit the work themselves. The moderator does not ask for a general review of the work but instead poses specific questions about the wiki layout and design. She explains that she is going to fix some images. In addition, she states that information is missing about how to open a Notebook file. She does most of the talking. Here, only one student moderates the discussion. Although this student does not make all the decisions, her influence lies in the selection of which topics the students should talk about. There are very few topics brought up by the other students at a plenary level. There is one suggestion from the students that they should make a link to the Wikipedia article that a group of students have been working on. However, the plenary level is not used to present the work that the students have done; rather, the main purpose is to address issues concerning the wiki layout and design.

7.6 Peer learning as the verbalization of ongoing thoughts and actions

From one perspective, peer learning can be viewed as an inevitable part of the ongoing discourse. This interaction between students will involve both peer feedback and peer editing. However, the peer feedback is more closely connected to the peer editing activities because it happens while the students are working on their laptops. In the current study, there were many incidents in the dyadic collaborations where students verbalized their ongoing screen-mediated actions and thoughts while they were working. These informal types of peer feedback will be further analyzed in this section. While the review did not emphasize this perspective, peer learning will here be studied as the *verbalization of ongoing screen-mediated thoughts and actions*.

It is primarily workshop data from one specific dyad that will be analyzed. The students usually chose to either work individually or in dyads during the group work in the workshops. In the first wiki assignment about musical instruments, as many as six of nine students chose to collaborate closely in dyads during most of the workshop. The remaining three students worked individually but also collaborated in a more loosely connected triad. One dyad in this workshop is composed of S8 and S9, who sat close to each other and collaborated closely throughout the workshop session. They worked on one of the subtasks together and sat with their faces directed toward each other's screens during most of the workshop. In addition, they used the pronoun "we" during the verbal interaction (e.g., "What are we going to look at?").[lxx] This indicates that they looked upon themselves as a basic collaborative unit in this workshop setting. Moreover these two students also sat next to each other in two of the three other workshops. It is also worth highlighting that the collaborative work between S8 and S9 in this specific workshop was to a large degree centered on one screen that both students focused their attention on. The image below show how these two students were positioned in relation to each other during the first workshop. [lxxi]

Figure 7.6-a Image that shows how two students have visual access to each other's laptop screens during the project work.



The collaboration centers around S8's screen a significant amount of the time, and S9 only uses her own laptop screen for shorter periods of time. When this happens, the students usually operate both screens at the same time while they are doing different activities on each separate screen.

Compared with the students who worked individually, the major difference in the dyadic collaborations is that there was much more use of verbal language. The students often verbalized what they were doing. However, the intensity and frequency of verbal interaction varied. There were also periods of silence when the students worked quietly. The dyadic collaboration can be described as an example of instrumental interaction (Jordan & Henderson, 1995). However, the episodes that are presented in the following section involve a significant element of verbal language use.

7.6.1 Verbalizing specific screen operations

In the current study, the students often verbalized specific screen operations when they were collaborating in dyads. This type of verbal interaction will here be interpreted as a specific type of informal peer feedback. The excerpt below is from the dyadic collaboration between S8 and S9 in the first workshop about musical instruments. This specific episode begins when S8 clicks on the "editing function" in the wiki application on her own laptop screen. The following interaction lasts approximately one and a half minutes.

Turns	**Verbal interaction**	**Video, audio, and screen capture data**
1 38:15-38:18)	S8: Let's see. "Edit." Now you need to help me. Wow! I have never been here before. Where do I go now?	S8 clicks on the "edit function" in the wiki application on her laptop screen and enters this page. When S8 says "edit," she reads aloud a specific word from the area where she is moving the cursor on her screen.
	(Pause. 6 seconds without any verbal discourse)	
2 (38:24)	S8: All of it. That was the second.	Talking about one of the videos they are reviewing.
3	S9: Yes, and then you only write the headings.	S9 is referring to what S8 should do when she is working on her laptop screen.
4	S8: There.	S8 is mumbling while she is reading something fast on the screen.
5 (38:30)	S9: Start there.	S9 makes her comment when S8 is operating her mouse in a specific area on the screen. She uses her hands to point towards one specific area on S8s screen.
6	S8: If ... let´s see. "If the video can be used in classroom teaching, comma, it is enough to watch the first minute." Okay. And then I press?	S8 is reading aloud the text she is typing (writing) on her laptop screen. She leaves out one of the words while she is typing (relationship). This utterance is slower compared with the rest of the dialogue, because the student is typing while she talking.
7	S9: But are we, yes. (cannot hear the last part of the utterance)	
8	S8: We need to assess everything. Save the page.	S8 saves the wiki page and what she has written.

9	S9: Yes.	
10 (39:14)	S8: Let´s see. Are we here now? There. "If the video is to be used in classroom teaching it is enough to watch the first minute."	S8 is reading aloud a sentence from her laptop screen.
11 (39:17)	S9: Yes, and then we have to assess the two…	
12	S8: There it is, it's that wiki page. (S8 clearly interrupts S9)	S8 has navigated over to the Wikipedia article about the Djembe on her laptop screen. She does not follow up on S9's comment.
13	S9: Yes, that one is okay.	
14	S8: Yes, you don't need to comment on this one, because I think this one should be included.	S8 is navigating on the Wikipedia article about Djembe. She explains that it is not necessary to disagree about this issue.
15	S9: I agree, because one doesn't know what it is.	S9 supports S8 because the Wikipedia article gives relevant information about the music instrument.
16 (39:40)	S8: But the question is, should we do the same? There it is. Should we have one on drums that is placed before that?	S8 is suggesting that they should add more external links. She is pointing to an external link on the screen with the mouse. She has navigated back from the Wikipedia article to the original wiki page.

In general, the excerpt is characterized by S9 giving S8 practical advice on what to do. This help is mediated by the specific screen operations, which are verbalized in several different ways.

First, the verbal interaction shows that the students *invite each other to engage in peer feedback*. At first S8 invites S9 to focus her attention on the screen and help her give directions with the utterance "Now you need to help me" (turn 1). S8 has not used the editing function in the wiki before and wishes for support from her partner while she does this for the first time. She explicitly invites S9 to tell her where to navigate on the screen with the utterance "Where do I go now?" (turn 1). To some degree S9 follows up on this request. For example, she says: "Yes, and then you only write the headings" (turn 3). Both this utterance and "Start there" (turn 5) show that S9 gives S8 specific advice on the next screen operation move. This is done by carefully observing the concrete screen operations performed by S8. Although a comment like "Start there" (turn 5) is formulated as an imperative, it can also be interpreted as a suggestion on where to navigate on the screen. The comment shows that the screen is not only shared but that the verbal discourse is used to pinpoint a focus toward specific operations on the laptop screen. The feedback is so closely connected to what is happening on the screen that it does not make any sense independent from the screen operations.

Second, the students are here also entering into *different roles in the screen-mediated dyadic collaboration.* While S8 navigates the screen, S9 gives verbal instructions on the next moves. By dividing the roles in this way the moves can become more efficient, because S8 will also

receive direct advice from S9. Although S9 is not operating the screen, one could claim that she is still participating actively in the screen operations. The direct instructions can also be interpreted as a way of "thinking aloud" about the actions S9 would have followed if she had been in control of the laptop screen. From this perspective, the verbal interaction can also be interpreted as a specific type of *peer editing.* However, the editing is not a direct revision of what the other students had done; rather, it should be regarded as a co-construction, which happens in the ongoing discourse.

However, because S8 is operating the laptop, S9 is still dependent on consent for her advice to be followed. The messages are of a practical nature and can also be interpreted as reminders of actions that are important to do when working in the wiki. These "screen commands," which are part of the ongoing work, can also be interpreted as one type of informal peer feedback.

Third, verbal language is used to *direct attention toward specific information on the laptop screen*. For example, S8 directs attention to a specific part of her work by reading aloud the text on the screen (turns 1, 6, and 10). For example, at turn 10 she reads aloud a sentence on the screen once more ("If the video is to be used in classroom teaching, it is enough to watch the first minute"). The verbal utterance here serves the purpose of pinpointing the area of focus on her screen. The feedback frames the area of shared interest. S8 and S9 are primarily collaborating and looking at one screen together at the same time. Because there is a lot of wiki text in the editor, it is also necessary to use verbal language to pinpoint the attention to a specific area on the screen. This supports the collaboration. In some cases, the students also use their hands to help direct attention toward a specific area instead of just verbalizing the content on the screen. For example, S9 uses her hand to show where on the screen S8 should begin to work. The utterance "Start there" illustrates that when the hand or finger is used as a pointer, it is unnecessary to explain everything through verbal language.

Fourth, the *screen operations direct the conversation*. For example, when S9 introduces a new topic, she is interrupted (turn 12). Here, S8 continues to discuss what is happening on her screen. She has clicked on one of the external links and navigated over to a Wikipedia article about the topic. In this case, it is the screen that mediates which topics are most relevant to discuss. Since S8 navigates the laptop screen, she also directs the conversation through the pages she visits on her screen.

When S9 interrupts S8, she is simply commenting on the screen operation (turn 12). She calls S8's attention to the Wikipedia article that is now at the center of their attention. These turns illustrate that the verbal conversation here is to a significant degree aligning itself with what is happening on the screen, and is less a result of screen-independent verbal discussions. One could therefore claim that it is the switching of "screen scenery" that mediates the interruption. When something new happens on the screen, the norm is that this should "enforce" the attention of the students. Even it is somewhat impolite to interrupt, it appears to be acceptable here, because the screen displays new information. The feedback then builds on the new information that is displayed on the web pages. This is what happens when S8 does not want S9 to make any comment on the Wikipedia article

displayed on her screen. One could therefore claim that it is the screen operations that call attention to the feedback or the new topics that need to be discussed.

7.6.2 Peer feedback as the co-construction of one single utterance

7.6.2.1 Background

In the current study, the verbal interaction would usually build on turn-taking with separate turns. However, there were also instances in the dyadic collaboration where students supported each other through the co-construction of single utterances in the ongoing work. This overlapping talk was characterized by one student initiating an utterance but not completing it. The second would then co-construct the utterance by filling out the rest of the sentence or utterance. This was done by listening carefully to what the initial speaker was saying. From one perspective, the attempt to complete the utterance can be regarded as a specific type of informal peer feedback taking place at a micro level of interaction. The further analysis will investigate how this co-construction of utterances was done in several different ways.

First, one should note that conversational analysts have been aware of this specific phenomenon for some years. Schegloff (2000) labels it as "conditional access to the turn," while Learner (1999) calls it the "choral co-production of talk." These researchers describe it as a specific type of simultaneous or overlapping talk that is very different from other phenomena like interruptions or simultaneous start-ups of a turn by more than one speaker (Lerner, 1999; Sacks et al., 1992; Schegloff, 2000). The co-construction of a single utterance is instead characterized as an orderly and warrantable start-up by a second speaker while the other is still talking. The most distinct characteristic is that the initial speaker does not intend to produce a separate turn at speech, with one person speaking at a time. Instead, the aim is to simultaneously co-produce part or all of a turn-constructional unit (henceforth TCU) together with another participant. Nevertheless, the second speaker who enters the turn cannot simply say anything but must attempt to build on what has already been said. Moreover, this phenomenon is normally not treated as a "rude" interruption by the speakers but rather as something appropriate. This co-construction is regarded as non-competitive and non-problematic (Lerner, 1999; Schegloff, 2000).

Likewise, in some of the student dyads, this phenomenon emerges as an important part of informal peer feedback. Here, the co-construction of an utterance will be based on a second speaker making a verbal contribution as a part of a collective reflection. In this sub-chapter, three different examples will be described from the first workshop about musical instruments. They involve the same two students, who co-construct these utterances in two different episodes. The two students (S8 and S9) are sitting close to each other and have visual access to the same information on both laptop screens while they are doing their work. The co-construction of these utterances is therefore also mediated by specific screen operations.

7.6.2.2 Episode 1—Giving support

In this *first episode*, the students are trying to find out what sequences in a video about musical instruments are the most relevant to watch. Both students lack background knowledge about the topic and the task is therefore not experienced as easy to do. Both

students use verbal language actively to regulate the ongoing wiki editing on the laptop screen. The excerpt lasts approximately one minute. Here, the transcription of the conversation is more detailed using the glossary of transcript symbols in the Appendix.[59]

Table 7.6.a Giving support through the co-construction of a single utterance.

	Verbal interaction	**Video, audio, and screen capture data**
1	S8: I will stop it.	S8 is stopping the YouTube video on her screen.
2 3 4	S9: Parts of the videos that have been published in the book are too long. For example 28 minutes. I think it was- (.)	S9 is reading some of the written instructions from the teacher on her laptop screen.
5	S8: Terri:b[ly long]	
6 7 8 9 10	S9: <[I don´t] think I would have bothered watching it for thi:rty minutes (1.0). And then it says that one should assess what kind of time sequences are the most relevant to use. For example, that one specifies that the sequence- (.). Try that.	S9 continues to read aloud from the written instructions on her laptop screen in the last part of this statement.
	(5.0)	
11 12	S9: What I think is most important with this video is that he plays drums a bit. And that he shows his legs.	S9 is looking at the video on her laptop screen.
13	S8: Too lo::ng. Move the legs forward.	S8 is talking about a video on S9's laptop screen. No activity on S8's laptop screen.
14 15 16	S9: What he therefore wants to show then, is really that he plays a bit drums. And that he films his legs. I [think]	
17 18 19 20 21	S8: <[I guess it is] that he is playing a complete song then. I guess that´s how it is made. That he is playing a complete song. But excuse me, that was really dull (laughing). Just listening to the drums. The entire song.	S8 clearly interrupts S9, which makes it difficult for S9 to continue to talk.
22	S9: Yes, it was terrible. I hate drums, too.	
23	S8 laughs.	
24 25 26	S9: But is this the purpose? Because I don´t know if the others are doing this now. But I am just thinking we should follow this a little bit.	

In this episode, S9 first states that one of the videos is "too long" (Line 3). When she continues with the phrase "I think it was," she suddenly stops (lines 3–4). S8 then joins and completes this specific utterance with the phrase "terribly long" (line 5). In this example, S8 uses the co-construction of a single utterance to repeat and reinforce the same opinion that

[59] To a large degree, the transcription symbols follow the conventions from Jefferson (2004). See Appendix 1.

S9 mentioned previously (line 3). By using the adjective “terribly” (line 5), S9 adds an even stronger emotional component.

Because S9 stops in the middle of a sentence (line 4), this is not an ordinary interruption. It might be that S9 takes a short break to reflect on what she wants to say, but this pause can also be interpreted as an invitation from S9 to S8 to actually complete the utterance. Likewise, conversational analysts like Lerner (1999) and Schegloff (2000) claim that utterances can be initiated in two different ways. Usually, recipients of an emerging turn’s speech will join in without specific elicitation on the part of the speaker. This is done by matching the words, voicing, and tempo of the other speaker, like in episode 2 (between lines 3 and 4). On the other hand, it is possible for the initial speaker to elicit recipient co-participation. This is done by giving an indirect invitation to another person to speak in his turn’s space by stopping in the middle of an utterance. The initial speaker will then often be triggered to continue to speak and build upon what has been said (Lerner, 1999; Schegloff, 2000). The stop creates an urge to finish the utterance as a part of the necessary turn-taking in dialogues. Because of the short pause in this example (lines 4–5), it is plausible that this co-construction was elicited as an invitation by S9. Schegloff (2000) labels this type of overlapping talk as “collaborative utterance construction,” since one participant initiates an utterance and also provides for another to complete it.

As a specific type of informal peer feedback, this example also shows how one student supports another student’s statement. When one student states an opinion, the completion intends to reinforce the same opinion. According to Lerner (1999), the co-production of utterances represents one way of strengthening mutual participation in activities. It shows that the speaker’s sole entitlement to voice the utterance is weaker. There is a stronger degree of shared entitlement to construct the utterance together, which is based on a co-authorship or co-ownership of an experience. The appreciation of the contribution from the co-participant will on one level be present in the construction of the utterance in itself. The students here show that they agree with each other on the matter they are working on. There is an element of confirmation in the co-construction.

Although S8 does not let S9 finish the turn, it is S9 who afterwards continues to state her opinion about the topic (lines 6–10). After receiving support from S8, S9 is triggered to further reflect on the same issue. She is even so eager to continue that she slightly interrupts S8 before she has finished (line 6). However, she stops quite abruptly without explaining her thoughts in a precise way (line 10). Instead she changes topic and asks S8 to try something on the screen (line 10). These reflections also illustrate how unfinished thoughts are shared that are not necessarily coherent, nor is it certain that they will be followed up.

From one perspective, this type of verbal interaction can be regarded as a type of validation of the decisions that are made. Because both students have a limited amount of background knowledge, it is likely that this way of “thinking together” increases the feeling of making well-founded decisions about the difficult

7.6.2.3 Episode 2—Finding the correct answer

In this *second episode*, the students are still trying to find out what part of the video is most worth watching. The excerpt lasts approximately one and a half minutes.[60]

Table 7.6.b Finding the correct answer through the co-construction of a single utterance.

Line	Verbal interaction	Video, audio, and screen capture data
1	S8: Dance	S8 is reading aloud what she is writing down on a piece of paper.
	(3.0)	
2 3	S8: But if we are to find the best sequence that is best to watch we have to-	
	(2.0)	
4 5	S9: Yes, then I think it is best to watch those who play drums and dance.	S9 is searching through images she has from taken from a stay abroad on her laptop screen while she is commenting on S8's reply.
6	S8: Yes, but it´s during the who::le ((Laughing)).	
7	S9: Oh ((Laughing)).	
8 9 10 11 12 13	S8: Yes, that was it. And then the last one there. **Content: ◦Grandmaster◦. Do not need see all of it. Some dance.** But here they have written- **Playing Djembe in Senegal. Ladies dancing. Do not need to see all of it. Some dance.**	S8 has finished watching the video and returns to the wiki page. She reads aloud some of the text on the wiki page from her laptop screen.
14 15	S9: But what about here? Here they haven´t written anything.	
16	S8: No, then we can write afterwards.	S8 is opening an external link to a new video about African drums.
17 18	S9: Mmm. About percussion instruments, yes.	
19 20	S8: This is made by the same person, then. The same blue-	S8 has opened the new video, and she is now making a comment on the blue background, which is part of the introduction to the video.
21	S9: Fantastic	Being ironic.
	(6.0)	
22	S8: 10 MINUTES	
23 24 25	S9: Oh, my God, then you can write that you don´t have to see anything. (.) Because you have enough on the other.	S9 is talking about the other video they have watched.
	(3.0)	
26 27	S8: Excuse me. By the way, I think. Instead. it is about- It will fit a lot better unde::r-	S8 and S9 are both looking at the video, which is played on S8's laptop screen.

[60] To a large degree, the transcription symbols follow the conventions from Jefferson (2004).

28	S9: Culture?	
29 30	S8: Yes, learning about other cultures. Almost more than music.	
31	S9: I know. I am just going to check=	
32	S9: =if I have anything about [drums.]	S9 is checking if she has any relevant video files on her own laptop.
33 34	S8: [Of course it´s] music though	Overlapping talk.
	(2.0)	
35	S9: Oh, what is [happening here?]	S9 is looking at her own laptop screen.
36 37	S8: [You are not allowed to] publish that anyway, ◦S9◦.	Overlapping talk. S8 is looking at an image on S9's laptop screen.
	(3.0)	
38	S9: No, I know. I haven´t really asked them.	

Here, in the *first example* of a co-construction, S8 stops speaking before she has completed the sentence. This happens when she says, "But if we are to find the best sequence we have to-" (lines 2–3). There is a silent pause that lasts two seconds before S9 follows up (lines 4–5). The clear pause shows that this is not an interruption. It can rather be interpreted as a way of signaling to the other student that help is appreciated. S8 is thinking aloud and now wants S9 involved in the discussion. This complete stop can be interpreted as a clear invitation to the other student to continue the elaboration. The degree of perceived invitation here will also depend on the pace of the conversation. Perhaps this creates a stronger urge to complete the sentence inherent in the use of verbal language in itself.

From a peer feedback perspective, one could claim that S8 chooses not to complete the utterance because she is a bit unsure about the decision. This is one way of talking that lets the students co-construct ideas as a part of the ongoing work. They can easily build on and elaborate upon each other's thoughts.

Although this attempt to co-construct the utterance is not grammatically correct (lines 4–5), the initial use of the word "yes" indicates an attempt to build on what is being said. However, S9 paraphrases what S8 just has said in line 1 and lines 2–3, and she also adds some more information (lines 4–5). For example, S9 uses words like "best," "watch," and "dance," which confirm the verbal connection with what has been said previously by S8. Even though the student does not use grammatically correct words to finish the sentence, she tries to build on the specific content and words that have been used previously.

The *second example* of a co-construction from this excerpt is different, because it illustrates word guessing. Here, it is less clear whether S8 stops speaking or not ("It will fit a lot better under-") (line 17). The reason is that S9 continues to complete the utterance at once without any pause. Since it is likely that S8 would have continued to talk if S9 had not intervened, this instance is more similar to an interruption. The co-construction can therefore be regarded as less of an invitation. Instead, it shows that S9 to a larger degree "jumps" into the utterance.

This example of a co-construction of a single utterance is also grammatically correct. S9 mentions “culture” as the last word in the sentence (line 28). According to Schelgoff (2000), the word search is a common way of co-constructing an utterance. In this instance, there is a search for the correct answer. However, the tone of voice does not indicate that this is a final answer; rather it is more of a suggestion with a question mark behind it.

Although this co-construction is not very sophisticated, it gives S8 an extra independent opinion about the choice of action before she makes her preference explicit (lines 26–27). At line S8, she responds to the suggestion and confirms that she agrees. It is therefore likely that she would have said something similar. However, S9 shows a stronger support by completing the utterance instead of waiting until S8 has completed the utterance by herself.

The students are here engaging constructively in each other’s ideas. It is also likely that this increases the experience of reflecting together. There are also two examples of overlapping speech as interruptions (Example 1 [lines 32–33]; Example 2 [lines 35–36]). In both examples, S8 begins talking before S9 has finished her utterance. Interestingly, these interruptions are not experienced as impolite. Although the students are to some degree competing for “the floor,” the main mode is still collaborative.

Both excerpts in this sub-chapter show that the co-construction of a single utterance can serve different purposes. The initial speaker can seek a correct answer (word guessing) or a more open-ended answer that requires further elaboration on ideas. There will always be an element of unpredictable thinking that is created when the other person attempts to fill in the rest of the utterance or the sentence. On one hand, the utterance construction can be more explorative, opening up for a larger degree of unpredictable peer feedback. On the other hand, the completion can primarily be about finding the correct answer. This peer feedback is usually quite predictable.

The complete episode also shows how the co-construction of utterances is mediated by the shared display of the laptop screens. As the students do the wiki work, they are both able to raising issues and share thoughts more or less spontaneously because they can access the same visual information. It is likely that the students choose to work in this way because they are unsure about how to solve the task. The co-constructing of single utterances, illustrates one effective way in which the student dyad can help each other and strengthen their feeling of making good decisions.

7.6.3 Posing different questions about the ongoing work

In the current study, the workshop data revealed that the act of questioning played an important role in the facilitation of the ongoing discussions in the dyads. Many of these questions centered on different screen operations. The excerpt below is from a dyadic collaboration in a workshop related to the first wiki assignment about musical instruments. Two students (S8 and S9) are working together, and the dyadic collaboration centers on S8's laptop screen. It addresses how questions are posed in several different ways to support the peer feedback in the dyadic collaboration. The excerpt covers a time period of approximately fifty seconds.[lxxii]

Table 7.6.c Excerpt – A student poses different questions about the ongoing work.

Turns (time)	**Student**	**Verbal interaction**	**Video, audio, and screen capture data**	**Comment**
1	S2?	After 10 minutes? (slightly humoristic tone of voice)		Talking about the length of a video.
2	S8	Even eight minutes before she begins to dance.	S9 begins to talk before S8 has finished talking.	
3 (32:22)	S9	But how do they have permission to publish that when they are showing so many people?	Interrupting—talking at the same time as S8.	Talking about the content in the video. Introducing a new topic while S8 is working with something different.
		(Approximately 10 seconds of silence)		
4 (32:33)	S9	Yes, but do you understand how have they done it? Have they asked all of them about permission?	S9 is commenting on the number of persons present on the video on S8s laptop screen. She repeats the question from turn 2.	S9 is observing another issue on S8's screen while she is working.
		(S8 does not give any reply.) (Approximately 5 seconds of silence)		
5 (32:38)	S9	What are you writing now?	S8 is writing notes on a paper. S9 is observing S8 writing. The YouTube video on S8's screen is still running.	S9 poses a new question after not receiving any response to original question. (turn 3 and turn 4)

6	S8	Just look after eight minutes. Music. Dance.	S8 is writing notes on a piece of paper.	S8 is reading aloud what she is writing on a piece of paper.
7	S9	But then you can't see that many who are playing drums.	S9 is looking at S8's screen.	S9 now makes a comment on what S8 is doing. She has adjusted her dialogue to S8's work. She is disagreeing on the relevance of the time period.
8	S8	It's enough.		S8 refers to the time period at eight minutes as being a sufficient estimate of what one should view.
9	S9	But then I think that you should remove that video. I do not understand why we need it.		S9 is here referring to the other video about the same music instrument that they have recently reviewed and she wants removed.
10	S8	Not really. I also think …		S8 doesn't finish the sentence but instead gives S9 the opportunity to co-construct the sentence.
11	S9	Then we can choose one of them that we want.	S9 interrupts S8.	
12	S8	But, shall we, are we supposed to sit here and reach an agreement?	S8 is asking only S9 and not the rest of the group.	Changing topic, S8 is unsure about what kind of decisions the students should make. Asking S9.
13	S9	No, we will just have to do it separately, or we will never finish. We will just have to trust each other. Well, that's my opinion.		

The excerpt shows that questions can serve a range of different purposes in the ongoing discussions. *First,* the excerpt shows that the students *pose several questions that do not always receive a reply.* For example, S9 poses three questions to her collaborative partner (turns 3, 4, and 5). No reply is given to the two first questions. They address the same topic

although they are formulated slightly differently. The first time, S9 poses a question about a copyright issue (turn 3), but S8 does not reply and instead continues to work. She then repeats more or less the same question 10 seconds later (turn 4). S8 does not give any reply this time, either. In this incident, the question from S9 creates a competition about what topic the dyad should focus on. The lack of reply demonstrates that S8 is busy with something else. In addition the lack of response can be interpreted as a way of showing that she is not really interested in discussing this new issue. These turns illustrate that there is no guarantee that one will receive an answer to questions posed at this interaction level. The lack of response illustrates that questions in dyads are not necessarily followed up on if they are perceived as irrelevant, showing that in dyadic collaboration there will sometimes be parallel attempts to redirect the focus of the work.

Interestingly, there is no indication that S9 considers the lack of reply from her partner as being impolite. S8 does not feel obliged to answer the question. Even though S9 repeats the question (turn 4), it is not answered by S8. There is no indication that this behavior is experienced as rude in the dyadic collaboration. Instead, S9 changes the question and asks S8 what she is doing (turn 5). Her question is now adjusted to the ongoing work and is no longer about a new topic. The third question shows that S9 eventually aligns herself with what S8 is working with. This is done by asking S8 to update her on what she is now doing (turn 7). She now shows that she is interested in involving herself more in what S8 is doing.

Furthermore, this excerpt illustrates that there will be more questions than answers in this kind of dyadic collaboration. Because there is no demand for a reply, this opens up for students asking each other potentially "stupid" questions continuously. A significant difference from student-teacher interaction is that the teacher will usually be obliged to answer a question from a student. This is not necessary in the student-student interaction and gives the posing of questions a new function. It is made possible by the norm that the students do not become upset if they do not receive answers to their questions.

Second, the dyad is also used *to pose more academic questions, which can be potentially embarrassing.* For example, S9 asks S8 if they have the permission to use certain videos (turns 3 and 4). At one level the question shows a lack of knowledge about copyright issues, but at the same time it shows that it is much easier to ask "stupid" questions to a close collaborative partner than doing the same at a plenary level to the whole group. It shows that the students can openly ask each other "stupid" questions in the dyad without being afraid of negative reactions. The dyad also allows for a range of questions to be asked without disturbing the rest of the group. However, in this case S9 does not receive a reply. One interpretation here is that S8 did not actually know the answer. Instead of admitting this, S8 chooses to pretend that she is busy with something else. Many students found copyright issues to be difficult. The two questions also show that S9 lacks knowledge about copyright issues (turns 3 and 4).

Note also that S9 did not address the issue of copyrights at a plenary level. One reason may be that she never got any response from S8 concerning the importance of the topic she raised. There is also an element of vulnerability in posing questions that may reveal a lack of background knowledge. It is safer to ask this type of question in the dyad and not to the others in the whole group. When interacting at the plenary level, there is a risk that the

student posing a question may lose face by exposing a low level of knowledge concerning the ongoing work.

Moreover, these questions were closely connected to the screen operations. The comment on copyrights is referring directly to what is happening on the screen. This is evident in the phrase: "(…) But how do they have permission to publish that when they are showing so many people?" (turn 3). This illustrates that questions are posed by thinking aloud or verbalizing thoughts that are linked to the laptop screen as a shared visual space.

Third, questions are posed to clarify the ongoing coordination of the work. Much of this verbal interaction is directly mediated by the different artifacts the students use. One example is when S9 asks S8 about what she is doing ("What are you writing now?"—turn 5). S8 replies by reading aloud what she is writing on a piece of paper ("Just look after 8 minutes. Music. Dance"—turn 6). This is the third question S9 poses, and now she finally receives an answer. The utterance shows that she is continuing with her writing while she is at the same time answering the question. She refers to the time period of the video she is reviewing, which is eight minutes. The utterance does not constitute an explicit explanation about what she is doing but is rather a verbalization of her own ongoing work. From one perspective, this answer shows that S8 is still focused and concentrated on the work she is doing. By just reading aloud what she is writing, she manages to keep on with her work while giving S9 relevant information. She does not have to stop working. It is likely that a more thorough explanation given as a separate meta-message would have required more effort and probably would have interrupted the flow of the work.

From another perspective, this specific response is also mediated by the tools that S8 is using. Because handwritten words are small, it is difficult for S9 to see what S8 is writing. It is more difficult to read such notes compared with observing what is being written or done on a laptop screen. The interaction shows that a piece of paper is to a much greater degree an individual tool, because the handwritten text will usually be visually inaccessible to other students. If S8 instead had written her notes on the laptop screen, S9 would perhaps not have posed the question, because she could have read the text on the screen.

Furthermore, when S8 is reading aloud what she is writing, this can also be interpreted as an indirect invitation for S9 to join the work. This reply illustrates an attempt to create a mutual alignment, because it is not a direct answer to the question but rather gives some information about what is happening. However, when S8 answers, contact has been reestablished, and this opens up for more dialogue.

In the next turn, S9 therefore makes a critical comment about the "time periods" that S8 is working with. She remarks that one cannot see too many people playing drums at that point in time in the video (turn 7). The comment is referring to a video that is probably being played on S8's laptop screen. Here S9 shows S8 that she is viewing the video on S8's laptop screen. The students are synchronizing their talk around a common topic, and S8's laptop screen is used as a shared visual space.

The talk now moves from being about what they are doing to becoming a discussion about the qualities of the wiki work (turn 7 to turn 13). S8 suggests that "it´s enough" to view the

time period around eight minutes in the video (turn 8). The two students here show that they disagree on what time sequence in the video they should highlight. However, this disagreement is not followed up on directly in the next turn (turn 9). Instead, S9 changes topic and suggests that they should remove one of the videos about a drum (turn 9 and turn 11).

S8 first supports this proposal (turn 10), but then she becomes unsure whether they should make this decision on their own (turn 12). She is indirectly assuming that perhaps the rest of the group should be involved in a decision where they remove a video. S9 replies immediately and thinks it is a bad idea to review the videos together at a plenary level (turn 13). The students here assume that it will take too much time to address the issue at the plenary level. Here it is worth noting that even in a group of nine, these two students think that a video review at the plenary level will be too time-consuming. A review of a video at a plenary level would have required that all students stop working and pay attention. Because the group has not done any preparatory work before the workshop, it is also unrealistic that they would have time to do this together.

7.7 Peer editing between students in the class

7.7.1 Rewriting or removing another student's text

In the current study, it was also possible for students to peer edit each other's work during the project period. Peer editing is here categorized as an overlapping activity that involves either *rewriting* or *removing another student's text in the wiki log*. This type of editing is significantly different from editing one's own contribution or adding separate new text contributions. In general, the wiki log showed few instances of peer editing. It validates findings from the other data that emphasize students primarily did their work in separate sections in the wiki. This was done either individually (human body group) or in small groups (second wiki assignment). With the exception of the group who worked with the Wikipedia assignment, there was little substantial peer editing in the three wiki assignments. This includes both the removal and the rewriting of other students' work in class. Most of this rewriting would be related to minor issues like the wiki layout or proofreading of the text. For example, in the "musical instruments group," a student fixed an external Wikipedia link so that it was written technically correctly on the wiki page.

However, the students primarily did their editing during their workshop in different sections of the wiki page. Because students sometimes made contributions as unregistered users, it is not always possible to be certain about who made the contributions. However, the main pattern is that unregistered users from the same IP address worked on separate sections in the wiki. This indicates that the students stayed in one area of the wiki page. The workshop data also show that there was little peer editing during the workshops. There were only a few minor attempts to do simple wiki editing and proofreading of the text. For example, in the third wiki assignment one student was assigned to proofread the wiki text. In another incident, there were some minor instances of peer editing that happened by accident because of a lack of explicit coordination.[lxxiii] However, in general, there were few attempts to do any substantial modifications of other students' work in the bigger group.[lxxiv] One reason is that since wiki is an asynchronous tool, it is difficult to work with the same text area at the same time. For example, when the students tried to do this in the fifth workshop, it created an editing conflict in the wiki.[lxxv]

In both the first and third wiki assignments, the students primarily added new content to the original text through separate new contributions.[61] For example, the "human body group" did most of the work individually in different sections before they met at the workshop. The wiki log shows that they were responsible for different areas on the wiki page.[lxxvi] Even though some of the edits were done anonymously, the data from the registered users (and the screen capture data) indicate that most of the students continued to edit their own work in different sections in the wiki article when they gathered at the workshop.[lxxvii] Although these new contributions can be regarded as a part of a broader revision of the wiki page, they do not involve any changes to other students' contributions in the course. This confirms the skepticism about peer editing reported from the group interviews. Likewise, a few studies from the review show that students primarily edit their own work and do less editing

[61] See section 7.8.1, The different types of extended peer editing, page 256.

of others' work. For example, Zheng et al. (2015) found that 53% of the students read other students' wiki pages, but only 3% actually edited their texts.

7.7.2 The multitude of peer editing activities

Nevertheless, there is one major exception in the current study. The group of six students who worked on the Wikipedia article did to some degree peer edit each other's work in a second round of modification. The peer editing of the Wikipedia article is analyzed here in further detail in the following paragraphs.

First, one type of peer editing is orientated toward the *reorganization of the text other students have written*. In one instance, a paragraph was moved to another area in the article with a new header and a new section. None of the original text was changed.[lxxviii] In another example the same student user added more headings to some of the sections where other students had produced the text. The original text was not changed this time, either.[lxxix] The user who reorganized the text is the user who designed the initial structure of the article with different headings and sections. It is likely that this student felt responsible for this type of peer editing on a macro level in the wiki. One should also notice that the original seven headings in the article remained unchanged throughout the project work. The exception is the section titled "References," which was split into the two sub-headers "References" and "Sources." However, in general, the few reorganizations of the wiki text suggest that the text was developed according to the principle of the "first-mover" advantage ", which suggests that the initial organization of the text will often remain more or less unchanged in wiki articles.[62]

Another type of peer editing is *proofreading.* For example, one student made 18 minor language edits throughout the article. This also included work that other students in the class had done.[lxxx] In another incident, minor language edits were made in sentences 1, 3, 4, and 5 in one paragraph. In addition sentence 6 was completely removed in the new version.[lxxxi] In general, most of this type of proofreading was quite superficial with little emphasis on a deeper rewriting of the content.

A third type of peer editing is about *adding new content by integrating it into text that other students have written*. One example is when a student added a new sentence to a paragraph that another student had written.[63] None of the existing text was removed, but a new relevant sentence was integrated with the existing content. This edit built directly on the advice from the Wikipedians that the students should compare their article more with articles about Swedish rock carving sites.[lxxxii] In another instance, the user both rewrote existing content and added new content. In one paragraph, the three first sentences were left unchanged, while the two following sentences were to some degree rewritten. In addition, two new sentences were added at the end of the paragraph. This includes a specification of the source reference at the end of the paragraph.[lxxxiii] This type of peer editing can be regarded as a more advanced type of rewriting.

[62] See section 2.2.2, Limitations in quality, page 25.

A fourth type of peer editing is about *removing a substantial amount of another student's contribution*. There were few such instances. One exception is a specific paragraph where four of nine sentences were removed. The first three sentences and the last sentence were removed, while the five other sentences remain unchanged. In this sense, this rewriting is primarily about removing certain sentences, while the rest of the sentences are kept more or less unchanged.[lxxxiv] There is no attempt to reduce the number of sentences and still try to preserve the essence of the meaning of the content. One reason may be that this type of rewriting would have required a deeper and more complex editing of the meaning of the content. Moreover, it is unclear why the sentences were removed, since there is no written explanation. As such, it is difficult to assess whether the removal of the text reduced or increased the quality of the text. Some of the content appears to be somewhat irrelevant to include in an encyclopedic article, because the content is about how to look after the rock carvings. More surprisingly, there were also another edit from the log data indicating a decrease in the quality of the text. In this example, one student removed all the text giving information about how one can find the different rock carving sites. Concerning this specific topic in the article, previous contributions had been made by both a Wikipedian and a student.[lxxxv] This removal also involves information about the Bronze Age and the ships that had been carved at some of the sites.[lxxxvi] None of these "removal edits" are explained, but one reason may be that the student thought that the information was irrelevant for the article. Another reason may be that the information in the paragraph did not have any reference to sources.

The lack of quality in the peer editing also coincides with the group interviews, where students claimed that their lack of background knowledge made the collective work difficult. This makes it more difficult to do meaning-related revisions of others' text. Likewise, Arnold et al. (2012) found that students primarily made meaning-related revisions to their own text and not to others (72% in their own, 28% in others' text). However, formal revisions were more balanced between the author's own text (51%) and another student's text (49%). This finding also suggests that students have fewer problems proofreading others' text compared with making more substantial changes. However, a major weakness of the lack of synthesizing efforts is that the final wiki text ends up being less coherent (e.g., third wiki assignment). This coincides with a study from the review showing that the wiki ended up being incoherent and incomprehensible (Karasavvidis, 2010a).

All these edits are done at times different from the workshop periods. It is therefore not clear whether the students had agreed on doing this type of peer editing. Since the group consisted of only six students, it is likely that they had an idea of who was doing what. On the other hand, the students in this group had very little communication between each other, because they mainly used emails.

7.8 Extended peer editing

7.8.1 The different types of extended peer editing

In the first and third wiki assignments, the students were assigned to build on and improve the work students had done in previous years in the course. In this way, the collective work with the wiki assignments moved beyond the course period as a new type of *extended peer editing* in the online setting. This editing is done across different course periods and happens within a much larger time span. It is also different from traditional peer editing in the sense that the previous contributors are usually not present anymore. In the current study, this type of extended peer editing has been divided into four separate types of peer editing activities. These involve (1) Removing text, (2) Adding new text (3) Rewriting, and (4) Keeping the text as it is ("No edit").

The table below gives an overview of the percentage of words of these four editing activities in three of the wiki assignments (the amount of "words edited" are in parentheses).[lxxxvii] Here, the final products are compared with the initial work to map the degree of change.

Table 7.8.a An overview of the amount of "extended peer editing" in the three different wiki assignments.

	Wiki page about the human body (first wiki assignment)	**Wiki page about musical instruments (first wiki assignment)**	**Wiki page about educational use of wikis (third wiki assignment)**
1. Content removal. Removing text produced by previous students.	17% (569 words)	10% (138 words)	10% (281 words)
2. Adding new text.	42% (1,391 words)	17% (227 words)	59% (1,624 words)
3. Rewriting text.	31%, (from 756 words to 1,032 words)	15% (from 139 words to 201 words)	14% 378 words)
4. Keeping the text as it is.	10% (346 words)	58% (765 words)	17% (475 words)
Size of original version and new version of wiki page.	100% (3,338 words)	100% (1,331 words)	100% (2,758 words)

7.8.2 Removing text made by former students

The first type of extended peer editing is *about removing text created by former students*. As the table shows, the percentage of text that has been removed is relatively low in all the three wiki assignments (17%, 10%, and 10%). However, one could claim that there is a substantial element of content removal in this type of extended peer editing compared with the very low amount of text removed between students in class.[64] This shows that it is easier

[64] See section 7.7.1, Rewriting or removing another student's text, page 253.

to remove previous students' work compared with removing other students' work in class. The group interviews also showed that the students were primarily concerned about peer editing between students in the class.[65]

Although the students found it difficult to criticize their peers' work in the offline setting, they found it far easier with previous students' work. There are examples of students explicitly being very critical toward some parts of the original work that former students had worked with. In several incidents, the students were openly critical toward work that previous students had done. In one incident in the first workshop, a student states that they need to rewrite a description of a musical instrument, because it is poorly written. This critique concerns the language that the previous students had used.[lxxxviii] This example shows that students are not afraid of being very critical toward the work that the previous students had done. It confirms that extended peer editing is much less problematic than peer editing in class and is very different from the cautious and polite peer editing one does with other students in class.

7.8.3 Adding new contributions to existing work

Adding new text was the most dominant peer editing activity in two of the wiki assignments (42% and 59%). Likewise, some of the studies in the review also show that the size of the collective text increases when the number of authors increases (Ravid et al., 2008) (Farzan & Kraut, 2013). The amount of text increased significantly in both the first wiki assignment and the third wiki assignment. In the third wiki assignment, it consisted of more than half of the total amount of edited text (59%). One important explanation is that these two student groups added a lot of new text as a part of the preparatory work before they met at the workshops.[lxxxix] In contrast, the group that made the wiki about musical instruments did wiki editing only during the workshop. Furthermore, both the groups who did preparatory work also did much more editing before the workshop than during the workshops. For example, in the collective work with the third wiki assignment in the fifth workshop, most of the edits during the workshop are categorized as minor changes (e.g., changing something within only one sentence).[xc] As such, one can claim that the wiki was used more effectively as an asynchronous tool over the longer time period of a week compared with just using it a few hours during the workshop.

It is less certain whether the quality of the text increases. For example, the percentage of rewriting (14%) was relatively low in the third wiki assignment. One explanation may be that much of the text looked quite finished and was already relatively "well-written." Students might therefore have felt it to be more difficult to rewrite this type of text. It is perhaps easier to just add new text with a new paragraph or topic to a "compilation of paragraphs." If the students do something more than proofreading, they also need to be confident that their edits will actual improve the original text.

[65] See section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.

7.8.4 Rewriting previous student contributions

The degree of *substantial rewriting* also varied between the three different wiki assignments. The percentage of text rewritten was significantly higher in the group that worked with the topic of the human body (31%) compared with the other two groups (14% and 15%). The human body group made some major changes to the original text, representing the most obvious improvement of previous students' work, with the largest percentage of text that was rewritten (31%) and the lowest percentage of text that remained the same (10%). In relation to several of the videos, the students produced far richer content descriptions and reviews of the videos that what previously existed. In many cases, there was no review of the videos on the wiki page. Improving the quality of these video resources was in this sense quite an easy task.[xci] This may also be the reason why the percentage of "adding new" text was much higher for the "human body group" compared with the "music instrument group." Moreover, the high percentage of *rewriting* (31%) also suggests that it is unproblematic for the students to edit previous students' work, as peer is now anonymous and no longer present in the course. In contrast, there was far less rewriting of other students' work in the same class.

In the third wiki assignment the rewriting was more superficial. In many instances, the sentences were kept as they were and simply moved to a new position in the paragraph. There were fewer attempts to actually modify the sentences but still keep the primary meaning of the content. Another issue here is that the original text was of quite good quality. This may have made it more difficult to rewrite or remove it compared with text of poor quality. Another reason may have been that the wiki history showed that the teacher had done most of the previous edits (the content had been pasted into a new wiki page from an old wiki page). It might have been difficult for the students to challenge the teacher's authority as an "expert" on the use of wikis.

In general, two types of rewriting were identified. *First*, rewriting was done in the form of *"building blocks."* Most of this "rewriting" consisted of moving and placing sentences in a paragraph in a new position. Here, the sentences were used as "bricks" or pieces in a puzzle that are moved around. The students seldom changed the sentences.[xcii] Similarly, Kessler and Bikowski (2010) found that students seldom attempt to synthesize the collective text in Wikibooks and do more advanced forms of rewriting of the text. Most of the work is about clarifying information about different issues. *Second*, the rewriting was about making *form-focused revisions*. There were more of these than content revisions. Kim (2015) also found that the quantity of students' peer editing is no guarantee of the quality. Students mainly corrected grammatical errors in other peers' work. Kessler (2009) also found that students do more form-focused revisions than content revisions in language learning.

7.8.5 Keeping the text as it is

It is also worth noting that there are significant differences between the wiki assignments regarding the percentage of *text that was kept as it is*. A much larger amount of the text in the wiki page (58%) about musical instruments remained the same as in the original version. One reason is that this group of students wrote shorter content descriptions compared with the "human body group." In addition, the "musical instruments group" only worked for a

couple of hours together during one workshop. In comparison, the "human body group" did a lot of work reviewing videos at home before they met at the workshop.[xciii] The screen capture data also show that the videos about different musical instruments were less complex compared with the videos about the human body.[xciv] They usually just showed someone playing an instrument, while the one single "human body video" covered a range of different topics. This made it less relevant to write a long and detailed content description. Overall, the complete wiki text is also much shorter in the musical instrument assignment compared with the human body assignment (1,331 words vs. 3,338 words). Another reason is that more of the students in the musical instruments group complained about their lack of background knowledge. This may have made it difficult to write a more detailed content description.[xcv]

The findings also show that most of the sections and headers in the first and third wiki assignments remained unchanged.[xcvi] This indicates a lack of effort in regard to making more global changes of how the text was organized. One reason may have been that this was the most time-efficient solution. Likewise, Kessler and Bikowski (2010) found that many ideas contributed during the first phase in the wiki work survived and were part of the final version. This is similar to "the first mover advantage" originally used to label how the first contributions to a Wikipedia article establish the foundation for the rest of the work.[66]

7.8.6 General tendencies

In general, the current study shows that peer editing works well if it is extended over time across courses. However, in the extended peer editing there were few substantial revisions of the original wiki pages. Students mostly added new text. On the other hand, it is difficult to assess if certain editing activities are more advanced or better than others. Adding, rewriting, and removing text are all actions that serve the purpose of improving others' work. However, it is usually more time-consuming to rewrite a text compared with just removing the text. The advantage with the removal of text as a revision strategy is that it is very time-efficient, but there is a larger risk that valuable information may be lost if this strategy is overused compared with rewriting the text. This result coincides with some of the studies in the review. Hadjerrouit (2014) found that students seldom revise each other's work substantially. They primarily made new text additions or did simple text formatting. The number of editing activities also depends on the guidelines for the assignment. In the first wiki assignment, the students received quite detailed instructions on what to do. Nevertheless, the data show that there were still significant differences between the two groups concerning the extended peer editing.

A general weakness with all the different editing activities is the lack of explanations of the specific wiki edits. For example, in the first and third wiki assignments none of the students who removed text wrote any explanation of why they did it. One reason is that it is more time-efficient not to write any explanations. When the students felt that they lacked background knowledge about the topic, it is likely that writing such comments would have required even more effort. However, from a learning perspective, such comments would have challenged the students to be more precise as to why they made their decisions. A

[66] See section 2.2.2, Limitations in quality, page 25.

second important explanation is that the students were not encouraged to do this by the teacher. As such, they may have found it unnecessary to do. In addition it is likely that many of the students were not aware that they could write short optional comments to each edit in the "edit summary." Instead the students wrote the mandatory summary of their collective work, which was on a more general level. It did not describe the more specific changes they had made. As a consequence, future contributors will not know anything about the choices behind the removal or rewriting of the wiki text.

In sharp contrast, the Wikipedians usually wrote short explanations for every edit they made in the students' Wikipedia article. According to the norms in the Wikipedia community, any type of content removal needs to be at least explained and, in some cases, discussed. Unexplained content removal can only be done when the reason for the removal is obvious.[67] These explanations make it easier for future editors to understand why the text has evolved in a specific way. In this way it can be regarded as peer feedback directed toward a future contributor. In the current study, the group of students who worked with the Wikipedia article adhered to these norms. As an exception from the rest of the groups, they wrote a detailed explanation of their work.[68] One reason may have been that they interacted more closely with outsiders and also received critical feedback related to their work.

[67] https://en.wikipedia.org/wiki/Wikipedia:Content_removal

[68] See section 5.7.4 Positioning the work within the broader knowledge community, page 158.

7.9 The peer as an outsider

Because the students participated in global wiki environments, there were also examples of students interacting with peers as outsiders. For example, the students who worked with the Wikipedia article received feedback from persons outside of the course setting. This also involved some editing of their work. The students who edited previous students' work also experienced a sense of building upon the work of an "anonymous group of outsiders" who had done work on the wiki page. These outsiders will be analyzed in more detail in the following sections.

7.9.1 Building on the work of an anonymous group of outsiders

In the current study, the students also felt that they were building on the work of an anonymous group of outsiders. The excerpt below is from the first workshop, where a group of students improved a wiki page about musical instruments. Two students are trying to find out if it is okay to have two videos about a musical instrument when most of the musical instruments only refer to one exemplary video. The interaction unfolds within a time period of two minutes. The excerpt is from three different time periods within these two minutes.

Table 7.9.a Excerpt – Students talking about the work that previous students in the course have done.

Turns	**Verbal interaction**	**Video, audio, and screen capture data**
Period 1 (38:50-38:58)	- S6: I am sure they have thought that, because they have two of them, but why have they? - S7: It could have been the same (my addition: as the other videos), because there is only one of them. - S6: Yes, it could have been like that. - S7: Upright piano and then the header. - S6: Yes, I agree, then it would have looked more orderly. - S7: Yes, and then it would have been. Yes, even though you only have one.	S6 and S7 are talking about the number of videos on the wiki page.
Period 2 (39:26-39:33)	- S7: Because they have done it here, too. - S7: Here it says upright piano. - S6: But that is a grand piano. - S7: That must be it.	Looking at image of upright piano on Wikipedia. Discovers that the image in the Wikipedia article is incorrect.
Period 3 (40:32-40:37)	- S6: But what is a bit strange with the stringed instruments is that they have done the same with the organ, guitar, violin, and harp but not with the other ones. We could have done something with that.	

This excerpt shows that the students are referring to the previous students' work through the use of the pronoun "they" several times. In the first time period, S6 says: "I am sure *they* have thought that, because *they* have two of them, but why have *they?*" (Period 1). S6 is not sure whether the two videos should be removed. She does not understand why the previous

contributors included two videos only about this specific musical instrument. S7 also uses "they" when she makes a comment about what is written on the wiki page ("Because they have done it here, too") (Period 2). Furthermore, she is unsure about why some of the music videos have links while others do not: "But what is a bit strange with these stringed instruments is that *they* have done the same with the organ, guitar, violin, and harp but not with the other ones" (Period 3). These three examples show that sometimes when S6 and S7 are talking about the text, they "personify" the text by referring to the anonymous group of previous students as "they." The students are reflecting upon their choices. Although the wiki archives previous edits, it provides no automatic feedback concerning the rationale behind the text that is published. This needs to be made by the contributors. Even though the previous students had written some explanations, they are brief and do not provide any details about the specific videos that have been selected. As a consequence, new contributors are given few explanations on how they could improve the existing work. The comments illustrate the problem of not including any written explanations of published work in the wiki.

Moreover, the use of the pronoun "they" indicates that these two students are sensing that they are building their own work upon contributions from a larger anonymous group. The students are not referring to one author but to the decisions of a group of previous students. This illustrates that they have incorporated the idea of extended peer editing into their use of language. The students have no information about the authors except the existence of some user names in the wiki history log. Most of these user names do not reveal full information about the actual name of the contributor.

7.9.2 Outsider feedback

The students also *received feedback from outsiders* while they were doing the project work. The table below gives an overview of the feedback they received from outsiders on the discussion page that was attached to the Wikipedia article.[xcvii]

Table 7.9.b An overview of the feedback the students received from outsiders on their work with the Wikipedia article.

Action	Editing time	Activity on the discussion page
1	20.03.12, Student A (anonymous)	Publishes some information about the wiki assignments from the course web page.
2	20.03.12, Wikipedian M (anonymous)	Recommends rapid deletion of the information.
3	20.03.12, Student A (anonymous)	Deletes the content on the page.
4	21.03.12 Student B (anonymous)	Explains how and why they have selected the content in the article (219 words).
5	21.03.12 Wikipedian N (full name)	Gives five suggestions for improvement (2 academic and 3 about the layout of the article). Praise is given two times (133 words).
6	21.03.12 Wikipedian O (anonymous, archaeologist)	Gives one suggestion for improvement about the layout of the article. This includes a warning about copyright violation (57 words).
7	21.03.12 Wikipedian P (anonymous)	Gives one suggestion for improvement about the layout of the article. Praise is mentioned two times (49 words).
8	02.04.2012 Student B (anonymous)	Apologizes for the weaknesses in their work. Promises that they will fix the text. Informs that the text is not yet finished (67 words).
9	16.04.2012 Wikipedian Q (anonymous)	Gives one suggestion for improvement regarding the layout of the article. The article needs images (2 words).
10	21.04.2012 Wikipedian Q (anonymous)	Updates information about the article and informs that the article now has images (3 words).
	(26.04.12)	A short comment is published with the editing history of the Wikipedia article. The teacher informs that the student project now is over.

In total, 10 written comments or actions were posted on the discussion page attached to the Wikipedia article. Actions 1 to 7 took place during a time period of just one day. During this brief period, the students received substantial comments from three different Wikipedians. All of these assessed the quality of the student work, and they consisted of both critique and praise. In total, the students received seven suggestions for improvement and four statements of praise. Note that these comments first appeared after the students had published an explanation of their work. This was done just after the original deadline on

March 20th (action 4). This suggests that the students must have originally assumed that the comment would be a final statement of their work. However, the subsequent feedback from the outsiders did not assume that the students were done with their work. Some of the critique was also quite harsh, because it addressed serious issues such as possible copyright violations. Likewise, some studies in the review also show that students experienced challenges related to plagiarism (Dohn, 2009; Karasavvidis, 2010a; Roth et al., 2013).

The outsider feedback motivated the students to ask the teacher to postpone the final deadline so they could improve their work. As a consequence, instead of ending the work after one week, the students continued to work with the article for one and a half months (the original deadline was extended from March 20th to April 26th). In this period, the students continued to edit and improve their own work. It is obvious that this work was done in an attempt to respond to the critique from the Wikipedians, which shows some of the motivational potential in publishing work for an authentic audience. It is also worth noting that none of these students complained to the teacher about having to do this extra work. The group interviews show that they were more concerned and embarrassed about the critique they received. Likewise, Roth et al. (2013) found that most of the students in the Wikipedia project rewrote their work and improved their citations after receiving critical feedback related to plagiarism. The students who received feedback also put more effort into their work.

The students published four comments about their work. Two of these comments were replies to initial comments made by Wikipedians (action 3 and action 8). Actions 5 and 7 consist of feedback from Wikipedians on the students' written work. Within a period of one day, three different comments were made by Wikipedians. This outsider feedback covers suggestions both on how to improve the academic content and the layout of the article. Then there is a 12-day-long break before Student B replies to the comments made by the Wikipedians. As a response to the critique, the student apologizes and promises that the group will improve their work. The students underscore that their work is still a draft and that all the students are going to review their part of the work one more time (action 8). From one perspective this apology is interesting, because it shows how the student acknowledges the importance of the outsider feedback. Likewise, the study in the review by Roth et al. (2013) found that some students really enjoy receiving recognition from others outside of the classroom, as it is motivating to receive feedback from others who are interested in the same topic.

However, this finding differs from that in the study by Farzan and Kraut (2013), who found that students sometimes became very upset if they received harsh critique or if their work was nominated for deletion. One difference with the current study is that the students received both critique and praise. It is likely that the more balanced feedback was easier to accept. In addition, the students also knew that some of the outsiders were experts. For example, one of the Wikipedians refers to himself as a field archaeologist. In this sense, the Wikipedian acts more as some kind of peer reviewer. It indicates that the praise the students received was more appreciated when it was given from a person with a significant amount of background knowledge. One student in the group interviews also reported that she is

fascinated by the feedback she receives from these outsiders.[69] Although the feedback is received from unknown individuals, the students are still confident about the quality of the feedback. The trust is inherent in the comments themselves. Both the students and most of the Wikipedians are anonymous. In this way, the comments resemble the work anonymous peer reviewers do in scientific journals.

This outsider feedback differs from that in the study by Farzan and Kraut (2013), where the students experienced the critique as demotivating, because the Wikipedia editors were not perceived as experts in their field. Some of these comments were also superficial and not very constructive. It was also an issue in the study that the students mainly used original research papers instead of reliable secondary sources. However, this was not a problem in the current study, because the students primarily used secondary sources. A third difference was that the students in the current study received only academic feedback from the Wikipedians and not from the teacher or their peers in the class. As a consequence, there was no conflict between different types of feedback. In contrast, the study by Farzan and Kraut (2013), shows that the students received more feedback from the teachers and less from other students and Wikipedians. The feedback from the teachers was then perceived as more valuable and important.

The comments the students in the current study received that were related to the encyclopedia as a genre were primarily about the correct use of citations and images. For example, one Wikipedian remarked that the article should include more images (action 8). This note was removed five days later by a Wikipedian when new images were posted (action 10). Some of the other studies in the review also report that students to some degree struggle to adjust their contributions to the norms of a Wikipedia article. For example, the students are not supposed to state their own opinion or discuss the topic (Farzan & Kraut, 2013).

Moreover, that the students preferred to be anonymous is clear because they did not specify which course or institution they belonged to. Perhaps this anonymity made them feel safer when they published their work. Likewise a study in the review, find that some students were anxious about publishing their work openly (Roth et al., 2013). Although the students in the current study made anonymous contributions in Wikipedia, the group interviews showed that they were still proud of their work. Roth et al. (2013) also found that students had ambivalent feelings regarding the psychological ownership over their own work. They did not like losing control over the wiki text and felt a stronger sense of possessiveness toward their own work.

In total, five Wikipedians commented on the student work during the project period (four were anonymous and one used full name). This is similar to the experience of one of the students in the study by Roth et al. (2013), who claimed that most students had their articles modified by four or five random people. The main difference is that the students in the current study received feedback primarily on the discussion page, while in the study by Roth et al. (2013) the Wikipedians did direct peer editing. The Wikipedians in the current study did not just edit the text without asking. They gave feedback on the discussion page. One

[69] See section 7.3, Anonymity has an influence on peer learning, page 208.

explanation is that the students let it be known that they were writing the article as a part of their course work. The Wikipedians respected the deadline of the students' work and some edits were therefore first made after the deadline on April 26th. In this way, the students maintained stronger control over the text and were able to decide how they wanted to improve it. In contrast, in the study by Roth et al. (2013), some Wikipedians just revised the content without asking for permission, which some students found hard to accept.

7.9.3 Outsider editing

This work builds on content logs from the text production history of the Wikipedia article about rock carvings. The data below give an overview of the different types of outsider editing that the Wikipedians did on the student text. The Wikipedians (1) *removed text*, (2) *added new text,* and (3) *rewrote text*.

First, in the current study the Wikipedians removed some small parts of the student-produced text. Several images in the article were removed, because the copyright license did not permit use on Wikipedia. On two occasions the removal was done automatically by a robot or "bot," which simultaneously did the same on the image site Wikimedia Commons. There is also one example where a Wikipedian removed some links that were considered to be irrelevant for the article.[xcviii]

Second, there were only a few incidents where Wikipedians added new text to the article. Once, a Wikipedian did a substantial revision of the text in an attempt to better adjust it to encyclopedic norms. This individual created an introductory definition for the article, which is a standard requirement in all articles. Although this definition is only two sentences long, it can be regarded as a substantial contribution, because it attempts to summarize the content in the article.[xcix] Interestingly, a student later removed a large part of this new definition. The first short sentence remains unchanged, but the long second sentence was removed. Instead, another paragraph in the article was moved so it could be used as an introductory definition.[c] It is worth noting that the students very seldom removed their peers' work in class, but this was done with the outsider contribution. It indicates that it is easier to remove work done by anonymous others. However, it is not entirely clear if the student was aware that a Wikipedian had actually made this definition and not another student in the group.

This finding indicates that it is easier to remove content from outsiders' work than from peers' work in the class. In the aforementioned episode, the student removed quite a lot of the new text that a Wikipedian had added even though it appeared to be quite relevant. This was very seldom done with peers in the same group.[70] This indicates that the students still felt ownership over the work and did not necessarily accept editing done by outsiders, which was more related to the content.

Another incident is when a Wikipedian added more information about how one can get to one of the rock carving sites. This information was extended from one sentence to three sentences. The new information makes it easier for readers of the article to actually find the site.[ci] This new contribution increases the quality of the text and is based on the outsider actually having knowledge about the topic in the article. Similarly, there was also one incident where an outsider published a new relevant image in the article.[cii]

In addition, the Wikipedians published a warning about copyright violation both on the discussion page and directly in the article at the top of the page.[ciii] At one level, this warning

[70] Read more in section 7.7.1, Rewriting or removing another student's text, page 253. There were very few instances where students removed or rewrote other students work in class. The data also show that this was done only a few times in the small group that worked with the Wikipedia article.

is a meta-message that can be regarded as outsider feedback, but when it is added directly into the article, all readers of the article will first read this warning at the top of the page. By publishing this warning at the top page of the article, this made the critique very transparent. Both readers on the Internet and all the students in the class would be aware of the critique of how the sources had been used. This would ensure that the students were notified and given a chance to fix their mistakes.

Third, there were also some incidents where the Wikipedians *rewrote* some parts of the existing text. In one incident, a Wikipedian corrected three images that referred to the wrong photographers.[civ] It is a bit surprising that the students had referred to the wrong photographers in the Wikipedia article. This information can be found on the image site at Wikimedia commons, indicating that the students have struggled in reading this information.

This outsider editing was an important contribution to the students' work. The students struggled with their understanding of copyright issues, and the Wikipedians eventually made the necessary modifications to the use of the images so that it was correct. However, the lack of knowledge about this issue indicates that the students did not discuss this issue enough. Since there were several errors, it is apparent that the students had made separate contributions and that there were few peers who checked whether the work had been done correctly regarding this issue. Instead, here the students became reliant on outsider editing by the Wikipedians to make sure that these important issues were fixed.

The Wikipedians also did other kinds of text editing in the current study that had far less impact on the text. First, the outsider editing manifested itself as proofreading. Several times only one or very few sentences were edited by the Wikipedians.[cv] At other times, the Wikipedians proofread larger parts of the text.[cvi] Second, the outsider editing happened as corrections of wiki code. For example, in one incident a Wikipedian adjusted some of the references according to a new standard.[cvii] Third, there was outsider editing that was more focused on adjusting the text to the encyclopedic norms. For example, one Wikipedian removed four links to other Wikipedia articles that he thought were irrelevant to include.[cviii] Another example is the Wikipedian who tagged the article with the title "work in progress" early in the process of the students' work. In addition, several Wikipedians added internal links to other Wikipedia articles and categorized the articles in a relevant way. The number of links added varied. In one incident, only one new internal link to another article was added.[cix] In another incident, as many as 21 internal links to other relevant Wikipedia articles were added over a somewhat longer time period.[cx] In this way, the article became much more interconnected with the huge network of other Wikipedia articles. The same Wikipedian also added a link to an interesting external source, which is an open book that can be used for further reading of the source. Although these edits can be regarded as minor contributions, they are important because they link the article within the large network of articles in the Wikipedia community. In this way, the article will be accessible in many different ways when people read or search for other information on the Internet.

Since the students finished their work on April 26th (the extended deadline), there have only been *minor revisions of the text*. The archive of the history of the article shows that four outsiders have visited the page and done minor edits. They have proofread the text and adjusted 12 sentences. The image at the top of the article has been replaced by a new one.

In addition, there have been some minor adjustments of the links to different Wikipedia categories in the article.[cxi] Concerning the quality of the work, the few “post-edits” give some indication that the article is of sufficient quality to be of benefit for others. There is no more need for further editing or a tag that informs the reader that more work should be done on the article. The article refers to a knowledge domain (rock carvings) that does not require updates as often as in other areas. Furthermore, it is possible to claim that the article serves the purpose of informing the public about an issue where there is a lack of information in the online setting. No other encyclopedic articles about this specific topic were found on the Internet. In this way, the Wikipedia work coincides with the study by Roth et al. (2013), who also used students to inform the public.

7.10 Answering the third sub-research question (peer learning)

The third sub-research question addresses how *peer learning emerges in teacher education*. The group interviews gave only limited information about the peer learning practices. The more specific qualities of small group learning were almost not mentioned at all in the group interviews. One reason may have been that the main focus was on peer learning in large groups. Another explanation is that this type of collaboration is so self-evident that students do not necessarily reflect that much upon its qualities. This is why more workshop data (video and screen capture data) have been included to answer this question. This was done in an attempt to enrich our understanding of the complexity of this practice in the teacher education context. As such, the summary of the workshop data will also be more extensive compared with the summaries related to the other two sub-research questions.

In general, the findings show that peer learning emerges through what could be characterized as "*polyphonic" project work*. In the offline setting, this happens as a type of "mind mingling," where students interact with each other in a flexible and spontaneous way at all interaction levels. In the online setting, the mind mingling is related to students learning from unknown others. As a consequence, new voices are introduced to the learning process. The findings will be summarized in further detail in the following section.

7.10.1 "Mind mingling" in the offline setting

The findings from the offline setting show that peer learning emerges as what can be labeled *"mind mingling"* in the offline setting. This term describe the flexible and spontaneous interplay between the many informal conversations that were going on at the same time. The practice illustrates a move from the qualities of a silent classroom to a project environment that permits a significant level of sound. Moreover, the triangulation of data shows that there are particularly two different types of informal peer feedback that can be related to this type of "mind mingling." First, the most important verbal device that regulated peer learning at a plenary level was *raising the sound level of one's voice above normal*. Second, in small groups (e.g., dyads), the *spontaneous verbalization of ongoing thoughts and actions* was an essential part of the screen-mediated peer learning.

7.10.1.1 Peer feedback through raising one's voice

At a plenary level, it was important to use acoustic force in the sense that the students needed to raise the sound level of their voice above normal to get others' attention. The students were usually sitting in the same spot throughout the workshop period. In this offline setting, *raising one's voice above normal* became a very important way of getting others' attention in an attempt to initiate a plenary discussion. This verbal act was done both with and without any direct support from physical artifacts that displayed relevant information (e.g., laptop screen).

Many of the episodes in the current study bear resemblance to what Schegloff (2000) defines as "hitchers" in relation to stretches of overlapping talk in conversational analysis. While "hitchers" are momentary arrests in the continuity of the conversation's production,

"perturbations" can be defined as marked departures from the conversation's articulation of that point. Both these maneuvers are deflections in the production of the conversation from the trajectory that it had been projected to follow. They manifest themselves as deviations from the "normal" course of production. The speech can get suddenly (i) louder in volume, (ii) higher in pitch, (iii) faster or slower in pace, (iv) cut off, or (v) the next sound may be markedly prolonged or stretched out or (vi) an immediately prior element may be repeated. The deflections may also be combined (Schegloff, 2000). In the current study, a hitcher such as getting louder in volume (i) has been identified as being of extra importance for interaction at the plenary level.

As a specific type of *informal peer feedback*, raising one's voice served several different purposes that will be summarized here. *First*, peer feedback is given by *raising one's voice to ask for answers of varying difficulty*. When students asked questions that required only a short answer, it would often not be supported by any direct visual display of relevant information on the laptop screen.[71] On the other hand, a question that required a long answer would more often be supported by supplementary information on the laptop screen.[72]

Second, peer feedback is given by students who *involve themselves in others' conversations in their surroundings*. Initially, they would not be a direct part of the conversation, but the sound of the conversation was still audibly available. In one incident, a student intervenes and provides relevant information to a discussion in another dyad. Her comment indicates that she is to some degree listening to the discussion between the students the across the table while she is working. At one point she then supplements the discussion with what she thinks is a useful comment.[73] The data indicate that the dyad initially raised their voices to draw attention to their discussion. Other students in the surroundings experience this as an indirect invitation to involve themselves in the discussion. It is also likely that it was easier to listen to the different dyadic conversations in the first wiki assignment, because the groups were smaller (with 8 and 9 students).

Third, peer feedback is *initiated by students who want others to see their work*. For example, there is one episode where a student interrupts the ongoing work in another dyad, because she wants to inform them about something she thinks is relevant. The data show that she has managed to accomplish something interesting and wants to share her discovery with other students in the group. She not only raises here voice, but she also stands up and turns her screen around in an attempt to get acknowledgement (praise) for what she has done. There is an element of pride in doing this, because the students seek acknowledgement from their peers. This act is done in combination with simultaneously lifting the laptop screen. The laptop screen as a physical artifact is used to draw attention to the work, and it also gives visual information about the work. It is not necessarily easy to bring attention to your work when all the students are focused on their own work. The laptop screen also mediates as a time-efficient way of receiving and giving praise for one's work compared with showing handwritten notes.[74]

[71] See section 7.5.1, Asking for a short answer, page 216.
[72] See section 7.5.2, Asking for a long answer, page 219.
[73] See section 7.5.3, Involving oneself in another conversation, page 223.
[74] See section 7.5.4, Showing one's work to the rest of the group, page 226.

This type of interaction also requires the acceptance of a certain level of "noise" in the classroom setting. The main reason is that the dyadic discussions need to reach a certain sound level to be acoustically available to other students in the surroundings. Also, there needs to be acceptance of a certain level of spontaneous outbursts and interruptions between the students. The urge to show other students something interesting can be interpreted as a spontaneous part of the buzz.

Fourth, the frequency of students raising their voice is *influenced by the specific material environment*. The specific seating positions and the table arrangement in the classroom will have a direct impact on the outreach of the sound. In other words, it constitutes how loud one's voice needs to be to reach all the students. When raising the sound of one's voice can be used in a flexible and informal way, it can support effective peer feedback in a large group. The most successful examples were evident in the workshops related to the first wiki assignment and the fifth workshop in the whole-class projects. In this workshop setting, the students appear to raise their voices more often and speak more freely at a plenary level when they encounter a problem or have a question. In comparison, the plenary communication in the third and fourth workshops in relation to the second wiki assignment was more formal. The plenary discussions were more "informal" in the fifth workshop. One reason can be that the table arrangement here reduced the physical distance between the students, which again made it possible to use a less loud voice when addressing the whole group. Although the students were cautious about editing each other's work in the fifth workshop, there were still some indications that the peer feedback was more informal and spontaneous. It shows that the specific table arrangements can open up for larger groups talking together more informally.[75]

If we synthesize all these different episodes, it is possible to claim that the key characteristic is that the students had access to other conversations in their surroundings while they were doing their own work. This type of "mind mingling" is closely connected to the specific sound level of the discussions, which is somewhat louder than in a buzzing classroom but is not yet at the level of being a very noisy or loud classroom. This condition of "mind mingling" has perhaps been most precisely described within psychology as the "cocktail party effect" (Bronkhorst, 2015; Cherry, 1953; Mesgarani & Chang, 2012). It is the phenomenon that describes the remarkable human ability to focus on a single speaker in environments where there are many ongoing conversations. This is possible even if that person's voice is drowned out by the noise of other voices in a room such as at a coffee bar or a cocktail party. It is still possible to have a private conversation with relative ease as if the other voices in the room were "tuned out" or muted. A similar phenomenon occurs when one can immediately detect words of importance originating from surrounding conversations. For example, it can be noticing one's own name in another conversation. This sound level will usually not be permitted in a formal educational setting. Normally, the "buzzing classroom" will be accepted as the maximum level of sound during students' work. Any higher sound levels would risk disturbing the other students. However, the disadvantage is that the potential of utilizing "mind mingling" will also dissipate.

[75] See section 7.5.5, The voice in a specific table arrangement, page 231.

An important precondition is that when the students raise their voice, they do not demand that all students stop working and pay attention to what is being said. In this polyphonic project work requests will be made, but there is no guarantee that they will be followed up on by other students. The norm is that every student can choose whether or not they want to be a part of the specific interaction. Although a student may wish that everyone listens to a question she poses, the students do not necessarily feel obliged to answer. If no answer is given, this might be an indication that no one has an answer to give. This interaction is very different from dominant interaction patterns in school, which require that all students be silent and pay attention to what is being said.

It is clear that the workshop data (video and screen capture data) *do not confirm* the finding from the group interviews that the large groups were completely ineffective because of their size. Instead, the data suggest that it is not the group size in itself that is important but instead the degree to which it is possible to *raise the sound level of one's voice* and address other students in the group in a flexible way. This pedagogical practice is perhaps similar to certain work contexts. For example, Jordan and Henderson (1995) refer to an airline's operations room where participation structures are found to be less exclusionary and more overlapping than in those of the labor room. Multiple participation structures are generated, maintained, and disassembled in response to the requirements of the ongoing work. As contingencies arise, they are taken up for notice or action by co-workers. New alignments are constantly created and recreated. There is in principle no exclusion of individuals in the group work. Likewise, in the first wiki assignment the students were working with different activities and could join in with others in a more flexible way. The acoustic force of the voice was used to support peer feedback in several different ways.

7.10.1.2 Peer learning as the verbalization of ongoing thoughts and actions

In the current study, the verbalization of ongoing thoughts and actions was mediated by *the laptop screen as a physical artifact*. In the dyadic collaboration, the discussions centered on the laptop screen as a common display space. The workshop data show that peer learning emerges as both "overlapping peer editing" and co-constructed peer feedback. The conversation was screen-mediated in the sense that both screen operations and the reflections around these operations were verbalized. Verbal language was also used to direct attention to specific content on the screen in several different ways. These will be summarized here.

First, peer learning emerges *through the verbalization of specific screen operations.* Students would often consult informational resources on the screen while they were speaking. This speech can be regarded as attempts to externalize both what the students were doing and the inner language of what they are thinking while they were at the same time operating the laptop screen. In one episode a student verbalizes the screen operations in the sense that she describes what she is doing on the screen. She reads aloud what she is typing on the laptop in an attempt to pinpoint the discussion as a part of rapid "interchanging speech." [76] These verbalizations of the ongoing work make it easier for the other person in the dyad to connect with what is going on and further elaborate on the previous comment. It can be

[76] See section 7.6.1, Verbalizing specific screen operations, 238.

interpreted as an invitation to the other student to make comments. In another episode a student is directing another student's screen operations through verbal feedback. This is done by observing the other student's screen operations and telling the student what to do. Although only one of the students is navigating the screen, the two persons coordinate the screen operations or actions through the use of verbal language. Here, peer editing emerges as a verbally co-constructed screen operation. Some of the examples also indicate that the changing of the "screen-scenery" has an influence on the turns in the conversation. As the students look at new pages on the web, the shared visual space also changes and guides the conversation in new directions. New comments are made with reference to the new content on the screen. For example, it is easier to interrupt if it is relevant to the change of the "screen scenery" while the student is navigating on the laptop screen.

Second, peer learning emerges through *the co-construction of single utterances*. The co-construction of utterances shows how students support each other by giving one another informal peer feedback at a micro level. It can be regarded as the simplest collaborative unit of "thinking together" that involves the use of verbal language. The feedback is constituted in the student's attempt to complete a "sentence" for another student. This overlapping speech adds quality to the conversation and is not perceived as impolite by the students. This interaction is different from the polite norm of letting "one person speak at a time" that follows the conventional turn-taking principle. For example, the IRE-communication structure between the teacher and the students builds on the principle of letting one person speak at a time (Cazden, 2001).

Third, peer learning emerges through the frequent posing of a *multitude of question*s in the ongoing collaboration. In the dyadic collaboration, the students regularly asked each other questions for clarification. Some of these questions were about academic issues, while others concerned the project management. Sometimes the students even posed questions without getting any reply. The students do not feel that they are required to answer all the questions posed. This makes it possible to move the conversations in many different directions as a constant opportunity. Since not all questions are followed up on, there is a surplus of questions in the ongoing flow of interactions. This is made possible by a norm where students do not get insulted if they do not receive a reply to a question. For example, when students raise their voice above normal, the informal peer feedback is characterized by a low level of "mandatory reply." The students cannot follow up on all the questions they pose to each other. On the other hand, this freedom to constantly ask questions open up for a significant level of new perspectives and disagreement in the dyads compared with the interaction at a plenary level. These questions are often spontaneous thoughts and should rather be regarded as informal invitations to one's peer to follow a new line of thought.

If we compare all these episodes, we find that the effectiveness of the groups is closely related to the students' ability to verbalize thoughts and actions as a part of the ongoing interaction. Both the peer editing and peer feedback will be influenced by shared screen-operations. Language is used to support and direct the screen operations. It is here co-constructed as an integral part of the screen-mediated verbal discourse. It does not refer to separate individual work but rather to the specific operations on the laptop screen that the students perceive that they are doing together.

It is possible to claim that this screen-mediated verbal discourse illustrates a *specific type of informal peer feedback* that is different from the usual conceptions of feedback as separate comments on individual work. Instead, the feedback is here "co-constructed" by the students in relation to the collective editing of the work in the wiki. For example, the students give each other direct instructions on how to operate the screen, and they "read aloud" important text on the screen. On one hand, this peer feedback can also be regarded as "overlapping peer editing," since the two students are working closely together and helping each other in relation to the work on one screen. Suggestions are made and modified during the ongoing discourse. This shows how students interact and give each other explicit feedback as part of the screen operation. Although only one person may be registered as the editor of the text, it is performed through the interaction of two persons. On the other hand, the pace or the rhythm of the peer feedback is sometimes slower and extends in time (e.g., for example answering a question by providing a link to a video[77] or seeking praise several times after not receiving any response the first time[78]).

7.10.2 "Mind mingling" in the online setting

Peer learning is different in the online setting, because students interact with persons who are not a part of the course. In this way, the peer as an outsider represents an extension in space in relation to the formal educational setting. This is made possible by "mind mingling" with unknown others in an online setting (spatial orientation). In the current study, this involved both Wikipedians and the collective work of the previous students in the course. Although several of the Wikipedians were anonymous, some had also published their full name on their user page. However, they were all strangers to the students.

On the basis of the findings, it is *first* possible to claim that peer learning emerges *through direct engagement with outsiders*. The findings show that Wikipedians contributed with both feedback and the direct editing of students' work. Most of the editing was related to the correction of obvious errors that were of minor importance. However, the students also received very important feedback related to copyright issues, which involved both the use of images and how the students referred to their sources. In general, the Wikipedians were cautious about making too many changes in the text. In this sense, they avoided some of the problems that were reported from a study in the review (Roth et al., 2013).

The students received both positive and negative feedback. Some comments were also of such a quality that they were without doubt helpful for the students' work. One positive effect was that the students continued to work with the article long after the original deadline had passed. This differs from the study by Roth et al. (2013), where some students experienced harsh critique as demotivating. The main difference is that in the current study, the students received both praise and critique together.

However, there were also some incidents where outsiders edited the students' work while the students were participating in the course. For example, the Wikipedians eventually removed some serious errors on copyright issues related to the use of images. This incorrect

[77] See section 7.5.2, Asking for a long answer, page 219.
[78] See section 7.5.4, Showing one's work to the rest of the group, page 226.

use of licenses would have had a negative influence on the grading of the collective work, but this did not become a problem, because the outsiders fixed these errors. This outsider editing issue poses a fundamental question concerning the fairness of the assessment of the students' work. What if some students receive help from outsiders and others do not? Outsider editing is an intervention that cannot be predicted, and it interferes with the goal of standardizing the assessment conditions. One alternative could be to let students publish a version for the teacher before they go public. However, the disadvantage will then be that the students will not get any feedback from competent outsiders in the online setting.

Second, peer learning emerges through *the further improvement of previous students' collective work*. The screen and workshop data (video and screen capture data) show that the students found it difficult to edit other students' work in class. They managed to make some minor revisions, such as reorganizing others' text by moving it to another section in the article or proofreading others' text. However, there were few substantial revisions of the content. There were few incidents where students removed others' contributions or rewrote them completely. On the other hand, the findings show that the students did more substantial revisions of work done by students from previous years. This extended peer editing was far easier to do, because it was less emotionally difficult to revise anonymous work. The students felt it was much more difficult to revise others' text if they did not know them well and still encountered them face to face regularly. In the offline setting, it became more important to be polite than to give critical peer feedback. In comparison, a distant relationship in the offline setting makes it more difficult to change others' work and criticize others' work, while this is unproblematic when it is done anonymously across an extended period of time. In principle, anonymous interaction can also take place between students in the offline setting. Students often did not know who had done the different tasks in the whole-class project, but the difference here was that it was possible to find this out in the offline setting.

8 Inhibitory conditions of CKA as a pedagogical practice in the teacher education context

8.1 Introduction

The three different sub-research questions were presented as separate accounts in chapters 5, 6, and 7. The data show that the instructional design challenged the students to collaborate in new ways that were different from existing assumptions of what good classroom teaching should be. The data reveal several difficulties, troubles, controversies, inconveniences, or problems that have been categorized *as inhibitory conditions of CKA as a pedagogical practice* in the previous chapters (see summaries of chapters 5,6 and 7). In this chapter, many of these findings are synthesized in an attempt to better understand the mechanisms that inhibited the collective wiki work. The inhibitory conditions of CKA as a pedagogical practice will be described as *four major tensions* that emerged in the teacher education context:

- Individual learning or collective performance
- Doing work the same way or doing it differently
- Group grades or individual grades
- Community ownership or individual ownership over the work

It is assumed that these tensions that were created can inform our understanding of what hurdles must be overcome to succeed with implementing a new pedagogical practice in this teacher education context. One could claim that the students' response to the wiki assignments created a *tertiary contradiction* that challenged the mainstream pedagogical practice in this specific course. By analyzing the course as an activity system, the findings show that the wiki-mediated student interaction interfered with the existing system. In this chapter, several different types of contradictions (primary, secondary and tertiary) will also be utilized as theoretical concepts in the analysis (see more information about contradictions as a concept in Chapter 3).

8.2 Individual learning or collective performance

In the current study, a *major tension* emerged between *the single student's individual learning and the collective performance of the student group*. This happened because the teacher introduced a new way of working that put more emphasis on the collective work. As a consequence, there was less focus on students' individual learning. This tension created problems of conflicts in three different areas.

First, the collective wiki work was introduced by the teacher as a *new and superior way of collaborating*. Initially, the teacher suggested that the quality of the work could potentially improve when the group size increased, but the students perceived that there were few such indications in any of the three wiki assignments. The students were challenged to maximize the collective performance by utilizing the existing individual skills or expertise in the group. The main objective was to give the students the opportunity to work together in an effective way and create something of value for others. However, the data show that the final products in the first and second assignments consisted primarily of a compilation of contributions from small groups. For example, in the second assignment the students did most of the work in smaller groups in isolation from each other. There were few discussions across these groups, and the group did not spend much time talking about each other's work at a plenary level in the whole class. Since the peer learning at a plenary level was quite weak, there were few indications of any visible advanced collective work in any of the three wiki assignments. On the contrary, in the third assignment the students only made minor improvements to the existing work, and it is likely that the collective performance decreased compared with letting all the students do separate individual tasks.

As a consequence, the students were skeptical toward the value of the collaborative model in the offline setting. Many students in the group interviews reported that collaboration in large groups did not improve the quality of the work. Most of the students therefore rejected the idea that they could create resources together that were equally good as those of a traditional expert. This problem escalated, because the students felt that they lacked relevant background knowledge. This was because the students did not get to choose what topics they wanted to work with.

Likewise, most of the studies in the review show that students are skeptical toward the quality of their own collective work. The students are concerned that student work of poor quality may have a negative effect on their preparations for the final exam. Instead they prefer expert-produced textbooks, because this ensures that the quality is good. For example, Lund (2008) found that the students were unanimous in their concern about inexpert editing reducing the quality of the work.

Furthermore, the collaborative process lacked the qualities of peer editing processes and peer feedback processes that were emphasized as important in the studies from the review. The students did not edit other students' work beyond the small groups where they were doing most of the work. This coincides with the findings from a study in the review by Lund (2008), where the students worried that peer editing might reduce the quality of their own individual work. If someone happens to change work that is already correct, there is a fear that this might result in a lower grade.

There were few discussions of the work at the plenary level. In the second and third wiki assignments, the students avoided plenary discussions, and some complained that the direct coordination of the project group became too time-consuming when the group was so large. Instead, the students made sure that their contributions from the small groups (or dyads) were clearly visible in the collective work. This resistance against peer editing coincides with findings in many other wiki studies in the review. This problem appears to be particularly evident in offline settings where the students in class meet with each other face to face. Also, the wikis used in the current study did not have any specified features that promoted peer feedback.

Other research has also shown that teachers are conservative in regard to transforming pedagogical practice because they find it time-consuming and risky. They will change their classroom teaching only if they are convinced that it adds value to what they are already doing. Further, new types of teaching will not be taken into use if they increase their workload. Teachers will tend to seek time-efficient pedagogical solutions (Cuban, 2001).

Furthermore, a pedagogy that leaves most of the work to the students threatens the role of the teacher as the knowledge expert. This assumption is usually taken for granted in the educational system. A student-produced textbook challenges the authority of the teacher educator as the knowledge provider. In the teacher education context, this pedagogy also challenges the student teachers' fundamental ideas concerning what a teacher should be doing. Some students complained that they did not learn anything new in the work because of the lack of teacher guidance or instructions. This view of learning was strongly connected to the lecture method. When the students did project work where they were supposed to utilize their own individual expertise, among some students this created the feeling that they did not learn anything new. It is evident that students will need to revise their beliefs about teaching and learning to embrace this new way of working.

According to Berry (2004, pp. 1301-1302) student teachers´ expectations of their preservice programs are strongly influenced by their prior experiences as learners together with popular stereotypes about teachers' work. One common expectation of student teachers is that their teacher education program will supply them with a comprehensive set of practical teaching strategies to ensure their success in the classroom, and they are often critical of their preparation if this does not occur (Berry, 2004). These beliefs and expectations about teaching create extreme resistance to change, and they may remain relatively unchanged throughout the student's experiences of teacher education (Berry, 2004). The wiki work created significant tensions, because it is so different from how teachers are used to working.

Second, because of the wiki assignments, *the maximization of individual learning* was not considered to be the main goal of the collective work. As a consequence, students felt that the level of individual learning was too low. Some reported that only a few students did most of the work, so the degree of individual learning varied. It ended up with some of the more technically competent students doing a lot of the work with the wiki. This finding is

also common in other wiki studies.[79] The time constraints made it convenient to leave most of the work to the skilled students—the assumption being that the skilled students would do the work faster. In general the work was organized to prioritize the collective performance rather than the degree of individual learning. However, one could claim that the project work created larger differences between the students in relation to individual learning benefits than would be in a regular setting.

Moreover, many students still felt that this should be the primary outcome of the collective work. Several students also reported that they were unhappy about this lack of focus on individual learning in the project work. In the group interviews, the students reported that they would have preferred more emphasis on the individual acquirement of technical skills or digital competence. They complained that they did not get to learn how to use the wiki as a digital tool in a proper way. This shows that several students considered it to be more important to learn how to use the wiki than to develop new team skills. Although the students had different motives and conceptions of what was important in the course, many would have preferred more focus on individual skill acquisition on how to use new digital technology. This is illustrated by how some of the students complained that they did not receive the necessary technical training in how to use the wiki. Although they had already finished the first part of the course, which had focused solely on technical skills (15 credit points), they were still not confident about learning to use the new digital tools on their own.

The students felt that the attempt to utilize the diverse student expertise in the group to maximize the collective text improvement interfered with the maximization of the individual learning. Students expected that they would learn new skills during the project work. They were primarily interested in learning more technical skills on how to use the wiki, and they were less interested in developing new team skills. However, they received no training on how to use the new wiki technology before they began the course work.

Third, the students were unsure about *the relevance of using wikis in classroom teaching*. In line with the objectives in the course, the students expected to learn how to use new digital tools in classroom teaching. However, several students felt that the wiki technology was too time-consuming and complicated to use. The students were instructed to use the wiki technology, but they received little advice on how to use it. Although they received some help from a teaching assistant, they were to a large degree expected to find out how to use the technology on their own. This may have decreased some students' motivation and their ability to understand the relevance of using the wiki in classroom teaching.

The present study indicates that the collective wiki work was only to a small degree conceptualized as a legitimate object in relation to classroom teaching. This kind of collaboration was not considered by the students to be very important when it was perceived as irrelevant for their future work as teachers. For example, although the students who produced a Wikipedia article showed a strong sense of pride, they did not consider this work to be especially relevant for their later professional work as teachers. The new object, which was the wiki work in large groups, interfered with the existing object, which was the

[79] See section 2.3.2, The sharing of the workload, page 29.

acquirement of individual skills in the course as an activity system. Students were more concerned about the lack of individual learning because they had to prioritize the quality of the collective work and maximize the collective performance.

Another reason may be that both contributions in global online environments and whole-class projects are uncommon in school. When CKA (the concept of collective intelligence was used) was introduced as a relevant new concept to the students in the present study, the teacher gave few references to existing policy documents from school or teacher education. This lack of "political legitimation" might also have made the students more skeptical toward the relevance of their work. Since the students did not receive any preliminary training, they might have viewed CKA as being different from digital competence, which was the main concept in the course in regard to the overall course objective. Most of these local Norwegian definitions focus on individual technology-based skill acquisition (Baltzersen, 2009; Erstad, 2005). Although digital competence is a broad term that can be defined in various ways, it includes much more than just computer-supported collaborative learning. If we look at the history of courses in educational technology, which date back to the 90s, the emphasis has been on the development of individual software skills (Oliver & Towers, 2000). It is only in recent years that the interest in collaborative learning has increased with the emergence of Web 2.0.

8.3 Doing work the same way or doing it differently

In the current study, several minor tensions were created in the ongoing knowledge construction process. In the teacher education context, this involves the following five issues: (1) free vs. constrained task selection, (2) similar vs. different tasks, (3) different vs. similar distribution of workload, (4) tasks divided on a similar premise vs. dissimilar premise, and (5) equal sharing of project management vs. unequal sharing of project management. During the project work, these minor tensions emerged as *a major tension between doing work the same way vs. doing it differently*. In this specific course setting, the tensions were all related to a perceived increase in the differences between the students in the course setting. These new dissimilarities resulted in an experience of the project work as being less fair than a regular assignment. This major tension will be further described as consisting of *five smaller tensions*.

8.3.1 Free vs. constrained task selection

Concerning project management, a large part of the specific tasks in the three wiki assignments was formulated in advance by the teacher. As a consequence, the students had limited opportunities of choice, and teacher control was still quite high through the detailed specifications of the wiki assignments. For example, in the first wiki assignment, the students had to choose between four specific wiki tasks in two school subject areas. These predefined tasks also had an influence on how large the student groups became. In the group interviews, several students reported that they disliked that they were given few opportunities of free choice. The students were less personally motivated, because they could not choose the topics they wanted to work with. This was common in most of the assignments in the course. Some students complained that their lack of interest in the content weakened their motivation. This is also an example of how diversification can have a negative influence on the collective work if it reduces freedom of choice.

Since the predefined tasks were different, and all of them had to be done, this increased the dissimilarities in what the students were working with. Some of these tasks were also perceived as more attractive, and this increased the feelings of unfairness. One can question whether the diverse tasks were open enough for student choice; because many of the tasks were mandatory and predefined, it is possible to claim that a smaller tension emerged between free vs. constrained task selection (open assignments vs. prescribed assignments).

On the other hand, standardized education will usually be viewed as fairer, because everybody gets the opportunity to do the same assignment or to choose freely between several alternatives. This is why an instructional design with different tasks needs to be carefully designed to ensure that students feel that the tasks are divided in a fair way.

8.3.2 Similar vs. different tasks

In the second assignment, groups of students chose to do quite different tasks. In the group interviews, several students complained that they did not get to do the more interesting tasks. For example, only a few students made the design and layout in Wikispaces, which

was considered a more attractive task. Some students complained that they had to do more difficult tasks than the other students. This challenge with dividing the tasks was not as big problem in the first assignment, because most of the students did the same subtasks. They reviewed a few of the existing video resources in separate sections on the wiki page.

However, building on others' work, like in the first wiki assignment, required that students improved texts that differed in original quality. This kind of work will give students less individual freedom of choice, because one needs to focus on improving the existing work as it is. If the quality is low, one argument could be that students might acquire misconceptions that can have a negative influence on their final exam. In addition, as with the third wiki assignment in the current study, students may find it very difficult to improve a text that looks quite finished in the first place. Although many students enjoyed contributing to a public resource with information that they cared about, online communities are living entities, and it is a challenge to create a fair assessment situation when students participate in these surroundings.

Standardized tasks where all students do the same activities were perceived to be fairer. Students usually take for granted that the assessment system is fair if they have equal opportunities to choose what kind of tasks they want to do. In a regular course, there are usually few restrictions on how many students can choose to do the same tasks. Because students are used to doing work the same way, they felt it to be less fair being able to choose between only a limited number of different tasks. When students have to do different tasks in larger groups, they will automatically view some tasks as more or less attractive. When they do not get to choose what they want to work with, this may also weaken their perception of the relevance of what they are learning. As reported in other studies in the review, there is also a concern that this might have a negative influence on their final grade.

8.3.3 Different vs. similar distribution of workload

Several students perceived the differences in the workload between the students to be too great. Some students did more work than others, while also some students were free riders. These differences in workload between the students became too uneven. One reason was that the large groups made it difficult to get an overview of the whole work. Several students were unsure about what kind of tasks they were supposed to do. Some of these students ended up being free riders involuntarily. For example, some students who were not present at the workshop session did not have to do any extra tasks. Moreover, nobody was responsible for following up on the issue of free riding when the teacher did nothing about it. The role of the teacher in relation to free riders was unclear. Some students suggested that the teacher should have helped them to cope better with the free riders. For example, students with low ambitions could do very little, because there were no clear sanctions. As a consequence, the sharing of the workload became uneven and created unfairness.

8.3.4 Tasks divided on a similar premise vs. dissimilar premise

In the second wiki assignment, the students chose to divide the tasks after the principle of "first come, first served" at the plenary level. In theory, this can be done on equal terms. However, some students were faster to sign up than others, because they know how to use the application from before. As a consequence, the students did not feel that the tasks had been divided in a similar way and gave the students unequal opportunities to choose between the different specific tasks in this assignment. Several students also claimed that the online coordination of the work was difficult. They lacked the qualities of verbal discourse, which allow for negotiations. There were also few explicit discussions of the issue in the offline setting. In the second wiki assignment, the division of tasks happened primarily through online communication. This created dissatisfaction with the group work. However, one can question whether the students really had enough time to discuss project management strategies in the large group. Usually the teacher decides this in advance, but here the students had to spend extra time on management issues when they had limited time to do each assignment.

This situation is different from small groups, where the students felt that they were able to reach some kind of informal agreement concerning the division of tasks. The experience of tasks being divided on a similar premise is here based on being able to get an overview of the group work and being able to discuss the issue and solve disagreements.

Some of the students also expected that the teacher should ensure that the tasks were divided in a fair way, but this was not done. Although the production of a few group products may reduce the assessment workload, the teacher still needs to have an overview of the ongoing work.

8.3.5 Balanced vs. unbalanced project management

There was also a tension related to how much the teacher should direct the work or organize the learning process. While direct coordination is very efficient when the teacher is in charge, this becomes a problem when it is unclear which of the students are in charge. The lack of explicit role descriptions and a clear student coordinator role made it difficult for the students to get a good overview of the different tasks the students were expected to do. The students had no experience with being given this responsibility in a formal educational setting, because the teacher usually does this job. As a result, a few students did most of the work, but the role of leadership in the group was still unclear. Their lack of ability to get an overview of the project may also be because it is usually the teacher who is responsible for this part of the job (Student coordination vs. teacher coordination).

The challenge with using a student coordinator is that there is a risk that this person gets more work than others. In addition, the coordinator will have more "power" than the others and this may also lead to negative attention. In comparison, the lecture method with a dominant teacher role will create more equality, because all students have the same passive roles. For example, some students in the group interviews stated they would have preferred more support and direction from the teacher during the project work. When the teacher makes all the decisions, this will usually be perceived as fair, because the students have

equally little influence. When some students then had more influence on the project work, there is some indication that this created feelings of unfair treatment in the student group.

8.4 Group grades or individual grades

In the current study, group grades were used instead of individual grades in an attempt to encourage the students to do more synthesizing work beyond their individual contributions. This created several tensions. First, there is no indication that the group grades increased the student motivation in the current study. In the whole-class project, several students reported that it was demotivating that the influence on the individual grade was very low. Although the group grading was intended to strengthen the focus on collective performance and team skills, it did not show any extra positive effects.

On the contrary, the large variation in the student efforts devaluated the legitimacy of the group grading. First, there was a problem with free riders. The interview data revealed that many of the students were annoyed about the fact that some students did not attend the workshop sessions. When the students observed that these individuals could get away with it, this decreased their motivation. The students found it unfair that some did more work than others yet received the same group grade for the collective effort. The problem of free riders increased with increasing group size. Also, because the students had to cope with the free riders without teacher support, this only made the problem worse. Since free riding was considered to be a sensitive issue, students found it difficult to address this topic at a plenary level. It was only in the group interviews later that students really addressed this as a problem during the group work.

In the fifth workshop, it was also obvious that only a few students worked on the third wiki assignment, while the rest were doing something else. In general, there were more differences in the workload between the students in the whole-class projects compared with the first assignment. Because of these differences, the students felt that it was unfair to use group grading.

From one perspective, the group grading increases evenness in the sense that all students in a group were given the same grade. However, this view was rejected by the students, because they felt that it removed the variations that would necessarily be present in the group. In smaller groups, students can choose partners with the same level of motivation, but in larger groups there is no escape from these differences in motivation. The ambitious students will to a large degree need to take greater control to ensure some quality in the project. When they do most of the work, it is because they want to make sure that the collective performance will be of sufficient quality in order to get a good grade.

Likewise, Kagan (1995) claims that the problem with group grading is that the individual grade will no longer be a function of the student's individual ability, motivation, and performance. The individual grades will to a greater degree become a function of chance factors. The lack of student control can create a situation of “learned helplessness.” When students know that their outcomes are to some extent independent of their efforts, their motivation may lower. Kagan (1995) builds on the logic of the individual assessment and claims that group grades may be illegitimate or ethically problematic, because students with identical ability, work, motivation, and learning can end up with quite different grades depending on which group they have been working in.

In the current study, the students were discontent with the unequal distribution of the workload, which was connected to giving the same group grades to all students. Also, the high-performing students viewed the group grades as being unfair, because an average group grade would still have a negative impact on the individual grade they would have been given had the assessment been based on individual performance. Likewise, Kagan (1995) claims that particularly high achieving students will view group grades as unfair. These students will often do most of the work since they want a good grade, while others who just want to pass the course are more likely to become free riders.

Any attempt to experiment with new assessment practices risks creating unfairness according to this baseline. The review of the wiki studies also shows that it is a major challenge to connect students' collective wiki work with a summative assessment system in a legitimate way. It is very difficult to develop instructional designs that are perceived as equally fair to a standardized exam that distributes individual grades. Moreover, the text writing in the global wiki environment is not only collaborative, but the authors are often anonymous. Such contributions are of no value in assessment systems that rate students according to an individual standard. From a historical perspective, individual writing in formal education has been strongly linked to individual assessment and grading. This mismatch, or tertiary contradiction, may be one of the reasons why students did not like this type of assignments in the teacher education context. The collective work did not produce valid and reliable information relevant for their individual grades.

However, in the current study, the students knew that the most important exam was the final oral exam, which was individual and standardized. Toward the end of the project work, the students wanted the teacher to regain control and focus more on this exam. As suggested by Berry (2004), the hidden curriculum of teacher education suggests that change is not only about to what degree the student teachers maintain their beliefs about teaching but also that the tacit messages conveyed through the structures and practices of teacher education programs will reinforce traditional notions of teaching, learning, school, and teachers (Berry, 2004, p. 1303). When the students did not want to collaborate in the preparation for this exam, these attitudes were perhaps not surprising, because a standardized, individualized exam usually reinforces competitive norms. The hidden curriculum of the course was still dominated by the deeply institutionalized pedagogical practices in the teacher education program. This can also be explained as one of the main reasons why the students wanted a return to a transmission-orientated pedagogy. For them, the most effective way of preparing for the final exam was by encouraging the teacher to tell them what was most important. The students still felt that the fundamental system of individual grading was in place. When the project work was about to be finalized, the students wanted information about what literature was important to read before the final individual oral exam, which counted for 70% of their total grade. Although the group grades were part of the assessment system, they counted for only a small part of the overall grade in the course. Moreover, these discussions in the final workshop showed that the students felt that they were now finished with the collaboration and wanted to move on to a situation where they were solely responsible for the grade they received.

The students preferred to return individual grading when they were going to prepare themselves for the standardized assessment situation. Indirectly, the project work revealed

that the students experienced this type of assessment as fairer, because it provides a more reliable assessment of their performance. When students enter an exam on their own under similar conditions, this is perceived as giving everyone equal opportunities, because students cannot get any help from others. From this perspective, a move toward more collaborative writing will interfere with the goal of maximizing the teachers' ability to give the students fair grades according to their individual performance.

Moreover, it is evident that in the current study the norms of collaboration emerged through a conflict with the norms of competition, which were closely related to the final exam. It is here worth noting that the standardized assessment builds on the concept of a fair competition. For the assessment of individual performance to be fair, students cannot help each other much. If students are encouraged to collaborate, it will be difficult to sort them according to their individual performance. This is one reason why the students did not want to share notes with each other before the exam nor continue with the collaborative approach. A fair competition around grades is reliant on independent preparation. In this way, one can create the necessary conditions that allow for variation in the grading of a group of students.

When students felt that they were competing against each other for getting good individual grades, they did not want to share their exam notes, because this would give other competitors advantages without getting anything in return. The assumption is that if you want to get a good grade, you have to do your share of the work and keep it for yourself. However, the norms of competition were strongest at the level of the whole class. Some students even suggested that it was okay to share in smaller groups, because the norm of reciprocity was stronger in those situations, and free riding was primarily found to be a problem in the whole group and not in the dyads.

8.5 Community ownership or individual ownership over the work

8.5.1 Community ownership over the work in the class

The data in the current study show that students felt the community ownership over the work in the class to be weak. Several inhibitory conditions made it difficult to develop this kind of ownership. First, when the students felt that they had done only a small part of the task in an assignment, this reduced their community ownership over the collective work. When the group size increased, the size of one's individual contribution decreased proportionally. As a consequence, some of the students became detached and less committed to the collective work. This was especially apparent in the whole-class projects in the second and third wiki assignments. Second, there was little synthesizing work across these separate contributions, which could have strengthened the feeling of collective ownership over the work. The wiki texts ended up consisting primarily of a range of separate contributions from individuals or smaller groups.

Although the assignments intended to facilitate collective authorship, the students still had proprietary feelings over their work that was done either individually or in small groups. The students attempted to separate their work from each other's to ensure that their individual contribution to the project work was visible. One reason may have been that too much overlapping work would have made it more difficult to isolate the individual contributions. When students were concerned about making equal contributions, it was viewed as important to make sure that one's contribution be traceable and not removed by others. This would be one way of avoiding any accusations of being a free rider, because this way it is easier to get an overview of the individual contributions. The current study shows very little "overlapping peer editing" or synthesizing efforts.

Another reason is that the rules of the educational system still focus on individual ownership over one's work. In a study from the review, each student chose to do their own individual independent task, because assessment procedures require that students declare that they have done their work on their own (Dohn, 2009). Dohn (2009) also found that because individual documentation is required, this inhibits the students' interest in co-constructing the collective text. To follow the underlying rules of the system, it becomes important to protect and showcase your part of the work. Although "overlapping editing" may be important for the improvement of the collective text, the students may perceive this as interfering with the possibility of protecting and showing their individual contribution to the collective work.

Moreover, community ownership in the class was also weakened, because the students perceived that only a few students were in charge. These students felt a sense of ownership over the work, but the rest of the students felt alienated because they did not experience a strong sense of shared responsibility.

8.5.2 Community ownership over the text that is produced

In the current study, both the first and third wiki assignments were built on the concept of community ownership. New students were required to improve wiki resources that previous students in the course had made. This type of assignment was different from a regular assignment, because the published student work could be transformed by others at a later point in time. There was a significant element of community ownership integrated within the qualities of being an unfinished work, and it represented a dynamic view of knowledge.

Here, the community ownership model was successful in the sense that the students had few problems sharing their work after it had been graded. However, in the current study, there is no indication that the students continued to improve these collective learning resources after the course period had ended. The students did not identify strongly with the idea that it was important to produce open learning resources. Although some students saw the potential in gathering the teacher enthusiasts in an online setting, they did not necessarily imagine themselves as being a part of this pool of volunteers.

On a more fundamental level, the teachers are paid by society to make sure that students learn the content in the national curriculum. They are not paid to produce learning resources or textbooks as part of their professional work. Usually the schools buy these resources from publishers. This is how the division of labor is organized at a macro level. Teachers will also be held accountable for their work according to these standards. A strong focus on letting all teachers produce learning resources may undermine the entire mechanism behind how knowledge is transferred in the educational system. For example, it is usually experts with a large amount of background knowledge who interpret the curriculum and create relevant textbooks that are quality-approved. Teachers are then expected to use these textbooks in their classroom teaching. The students in the current study did not feel that it was important to be part of an online community that produces learning resources together.

Moreover, producing learning resources is very time-consuming, and it is, of course, much easier to just use the resources that the publishers offer. The return value can be improved teaching, but the teachers have to decide if this kind of work can steal time from other important tasks in teachers' daily work. One can therefore question whether teachers today have enough time to produce learning resources (knowledge producers).

Benkler (2006) also claims that one major challenge with open textbooks like Wikibooks is that authors must often follow specific curricular guidelines, while the article production on Wikipedia permits more freedom of choice. Creating a textbook can be considered an advanced and time-consuming process. Furthermore, if teachers produce an open textbook, it is not possible to earn money from this kind of work in the same way as if you go through a publisher. In the existing system, the textbook authors receive payment for the books they sell, which constitutes an important part of their motivation.

This alternative knowledge production model provides few external incentives, such as earning extra income or receiving acknowledgement for your contribution. For example, in the current study the author was not listed as a source on the wiki pages. Most of the

students also preferred to make anonymous contributions. The notion of an expert author was replaced by a model of an anonymous collective of non-experts.

It seems unrealistic that most teachers would have the time to do this work in addition to all their other daily tasks. For example, in the current study, there are very few persons who have continued to contribute to Wikibooks after the course's end. However, there is one exception in the current study—there were some new contributions to the video textbook about music. This is a subject where the printed textbooks are considered to be of poor quality since they do not offer any multimodal resources. The new contributions consisted of new links to resources. One reason may be that in some school subjects, such as music, teachers spend quite a lot of time finding relevant online learning resources. A collective strategy would, in this case, be a more time-efficient and convenient way of solving the common problem. However, this lack of contributions shows that there is not a strong professional community among teachers nor teacher educators in the online setting.

One reason is that it is time-consuming to find other online resources compared with just using the quality-approved resources that the publishers offer. Although the students primarily used Internet resources in the wiki assignment, they knew that they would primarily use printed textbooks when they start working as teachers. If student teachers or future teachers had to find and assess the quality of the learning resources themselves, this would take a lot of extra time. As long as this kind of work is not defined as an obligatory part of teachers' daily work, it seems unlikely that this will be done. There have been few changes in how the publishers to a large degree control the information that students read through the textbooks that are produced.

Nevertheless, the study reveals a potential in letting student teachers publish their work and share it in open online communities. None of the students had any concern about "giving away their work to society." They also found it relevant to build on others' work, but they had problems following copyright rules. Some students did not know how to cite sources in the correct way. This was evident in the work with the Wikipedia article, which was criticized by outsiders because of the poor handling of sources and citations. The screen capture data from the workshop also show that some students copied and reused copyrighted images. This gave a clear indication that they lacked knowledge about copyright licensing. Their behavior indicates that the students assumed that they could do whatever they wanted with digital images found on the Internet. This reuse can be interpreted as a part of the original informal culture that emerged on the Internet, which was closely connected to open sharing. It became so easy to copy and reuse digital information that people just started doing it even though copyright rules still existed.

Concerning the reuse of multimodal information in the online setting, the students here acted as if this information belonged to the public domain. One could interpret the act as building on a community ownership model within a global environment. The problem is that this ownership model has limitations, and this act is illegal. On the other hand, several of the students also had difficulties understanding the Creative Commons licenses. This lack of knowledge is perhaps best illustrated in the current study by the student-produced images of rock carvings that were published with both a copyright license and a Creative Commons license. This underscores the confusion that some of the students experienced when they

needed to have knowledge about two different licensing systems. Although the students were expected to have acquired this knowledge through the first part of the course, it was lacking.

One should also be aware that although students copy text from others, this does not necessarily imply that they experience a strong sense of collective ownership in relation to the text they reuse. Utilizing a community ownership model in an online setting requires a minimum level of knowledge about licenses that the students did not have.

8.6 Unfairness as the fundamental inhibitor of CKA as a pedagogical practice

The previous sections show how the inhibitory conditions of CKA as a pedagogical practice emerge through four major tensions in the teacher education context, and the analysis shows that *unfairness* emerges as *the fundamental inhibitor* in the teacher education context. These tensions are here summarized in relation to different components in the triangular model (CHAT) that were involved in the creation of unfairness in the course setting.[80]

Table 8.6.a A summary of the main inhibitory conditions as identified in the present study and the potential connection to the different components in the triangular model.

Main inhibitory conditions of CKA as a pedagogical practice in the teacher education context	**Relevance for components in the triangular model**
1. Student-centered project management created more unfairness.	Division of labor
2. Collaboration creates more unfairness.	Informal rules
3. Information is reused in an unfair way.	Formal rules
4. The collective work has a negative influence on the degree of individual learning. - Unfair with less individual learning. - Unfair that teachers should become knowledge producers.	Object
5. Grading becomes unfair. - Unfair that all students receive the same grade.	Outcome
6. The quality of the collective work is low. - Unfair that "non-experts" should produce learning resources.	Outcome

8.6.1 Student-centered project management creates unfairness

First, *student-centered project management as a new type of "division of labor"* was viewed as creating unfairness. One of the most surprising findings in the group interviews was how unfair several of the students experienced the division of tasks to be. This happened not only because the tasks were different and unstandardized but also because the "informal rules" of how to divide the tasks were not viewed as being followed on similar terms. All these differences created an experience of the project management processes as being less fair than the teacher-centered project management in the rest of the course. The students wanted to return to traditional lectures and a transmission-orientated pedagogy where the teacher gives all the students the same relevant information. Although the students would

[80] See section 3.2.2, Contradictions will emerge at four different levels, page 55.

have less influence on the managerial decisions, this would be viewed as fairer because they would then be treated more similarly.

8.6.2 Collaboration creates more unfairness

Second, *the "informal rules" of collaboration* was viewed as creating unfairness. The project work challenged the students to move away from norms related to individual competition and instead put more emphasis on collaboration. However, the students rejected this idea and wanted to return to stronger competitive norms toward the end of the project work. They did not want to share their exam notes with each other, because this could have a potentially negative influence on their own final grade. Competition was perceived as a fairer way of preparing for the final exam. Likewise, Johnson and Johnson (1984) found that cooperation among students is rare in formal educational settings. They claim student interaction follows three different "informal rules." First, students can compete to see who is "best." Second, they can work individualistically toward a goal without paying attention to other students. Third, they can work cooperatively, showing interest in each other's learning as well as their own. Of the three interaction patterns, they claim that competition is the most dominant way of learning for the vast majority of students. Students try to do "it" better than other students, and this competitive expectation grows stronger as they progress through school. Cooperation among students, whether they are bright or struggling, is still rare (Johnson et al., 1984). This coincides with the findings in the present study.

8.6.3 Information is reused in an unfair way

Third, sources of information were reused by students in an unfair way, because it was not done correctly. Concerning the component "formal rules," the students lacked knowledge on how to reuse different types of digital information. Although the collective work was done within a culture of free sharing and flexible copying of information, the students were still required to follow the rules related to the proper use of different kinds of sources. This created problems during the project work, because the students did not know how to reuse information from an online setting in the correct way. For example, some students acted under the assumption that all images can be reused freely, and other students did not cite or paraphrase text resources correctly. This resulted in critique from outsiders and accusations of plagiarism. Although the students valued the possibility of copying digital information in an easy way, few of them knew about new types of licenses. (e.g., Creative Commons licenses). The unfairness is here connected to a failure to protect others' work. One explanation may be that the students are used to doing memory-based exams, which do not require any knowledge on how to use sources in the correct way.

However, in the review, Dohn (2009) describes a particular dilemma. If a student copies text with a Creative Commons license, it is considered legal and illustrates a new way of reusing existing information. This might be tempting because it is easy and time-efficient, but it does not necessarily improve the overall quality of the work. Moreover, according to the legal regulations in the assessment system, this type of copying behavior can also be regarded as an act of cheating. In this sense, there is a contradiction between the new and old "formal

rules" on how to reuse information. Some students assume that the idea of free usage of information covers all areas of digital information. Others were unsure about the rules and chose a defensive strategy where they were very careful about reusing any type of information. Both actions can be considered dysfunctional, because they are based on a lack of knowledge about the formal rules and the distinction between copyright and Creative Commons licenses. While copyright rules are still a fundamental part of student work and textbook production, students also need to acquire more knowledge about the new Internet culture that permits open modification and the reuse of information and that is challenging these rules. Collective work of authentic value needs to follow the new formal rules in the online setting.

8.6.4 The collective work has a negative influence on the amount of the individual learning

Fourth, the collective work was viewed as being unfair because it decreased *the amount of individual learning*. Several students complained that they did not acquire the necessary technical and practical skills. They were also unsure about the relevance of wikis for classroom teaching. It was not enough for the students to feel that they made a contribution to society. As such, the project work created many new object-related tensions. The object became complex and contradictory in several different ways. First, the collective wiki work was introduced as a new object in the course. The emphasis was not primarily on the technology itself but on how it could provide new ways of working that could improve the quality of the collective work.

The empirical analysis also shows that the students did not feel that the quality of the work improved when they collaborated in large groups. The group identity was underdeveloped, and the community ownership ended up being weak. The collective work was to a large degree reduced to tasks in small groups or individual work with little time spent on plenary discussions. The work never moved beyond being a compilation of separate contributions in the offline setting. The "division of labor" had no strong impact on the quality of the collective work. In this sense the object perceived as a new type of superior collaboration did not occur. There was a contradiction between the "object" that the teacher had introduced and the actual "outcome," which was the quality of the wiki products.

8.6.5 Grading becomes unfair

Fifth, the *new grading system* was seen to create unfairness. Concerning the "outcome" as a component in the triangular model, the use of group grades interfered with the students' perception of receiving a fair grade. They viewed it as unfair that they all got the same grade when some students had done a lot of work and others had done only some work. In the large groups, these differences between the students only increased. Some students wanted to get the best grades possible, while others just wanted to pass the course. It was difficult to cope with these differences in student motivation. Even though the group grades did not count much in relation to the overall grade, several students still felt this kind of formal assessment to be unfair and questioned the legitimacy of the group grades in the whole-class project. The students were used to individual standardized assessment and the grading

of one's individual performance from other courses in the teacher education institution. It was assumed that the group grades would stimulate students to collaborate more closely with each other, but this did not happen.

Even though the course was not considered very important in the teacher training program, the grades were still viewed as important "value papers." One reason may be that the students considered their grades to be influential in regard to their future career opportunities. Grades can be regarded as outcomes produced by the educational system, which are important for the capitalistic system that needs to identify the students who are best qualified for a given job. In this sense, good grades can potentially increase the likelihood of getting work and securing one's own economic prosperity. As a consequence, it becomes important to ensure that the assessment system is as fair as possible.

8.6.6 That teachers have to become knowledge producers is viewed as unfair

Sixth, it was considered unfair that teachers were expected to become *knowledge producers*. Concerning the "object" in the project work, the work challenged the students as "non-experts" to become authentic knowledge producers. In this way, the student work served the double purpose of being used for grading and making a contribution in an open online environment. On one level, the wiki assignment challenged them as preservice teachers and "non-experts" to become producers of valuable knowledge in the educational system and outside of this context. From this perspective, the textbook project also challenged their views on future professional work. The students were not only a community of learners, but they were also challenged to participate in what could potentially become a professional learning community with teachers in an online setting. The long-term goal was that the students would continue with this type of contribution in their future work as professional teachers. However, this idea was not fully endorsed. One reason was that the students were unsure about the value of doing this when they had limited background knowledge. Although some of the final wiki resources were of quite good quality, the students were skeptical toward the overall quality of their work. Also, the project work did not produce convincing evidence of the value of teachers working together in a large online community. As a result, most of the students did not develop a stronger belief in doing this type of work.

Moreover, the students were not used to producing learning resources. Most of the syllabus in the course and the rest of the teacher training program consist of resources produced by experts. A few selected experts were authors of the textbooks they used, and these were sold through an ordinary publisher. In the existing system, these textbook authors make a qualified interpretation of the national curriculum and provide the guidelines for teachers' professional work in school. Most teachers are then content with being "knowledge consumers" in the sense that they primarily use these expert-produced textbooks and learning resources in their classroom teaching. Most of the resources in the course were also based on printed books and usually written by few authors. The students in the course who had already worked as teachers in primary school also relied heavily on printed textbooks.

In sharp contrast, the wiki assignments proposed the possibility that any teacher could become a collective producer of learning resources. The idea of creating a community of teacher knowledge producers was very different from the existing system where a few

persons have the role of being the sole "knowledge-transmitters" as textbook authors. On a more fundamental level, this knowledge production model questioned who should be the producers of the content teachers use in school. Should it be a few experts or a large community of teachers? From an economic perspective, teachers are paid to teach, not to produce learning resources. They look upon themselves primarily as "knowledge consumers" in the sense that they use textbooks or learning resources that experts have made for them to use in the classroom. However, instead of asking ,"What knowledge is of most worth?" this project challenged the students to ask, "Whose knowledge is of most worth?" (Apple & Christian-Smith, 1991, p. 1). In this way, the wiki assignments disturbed the chain of value-production in the educational system. It challenged the students to enter the role of being "experts" and produce something valuable. However, the students were skeptical toward spending extra time on entering this role of being producers of learning resources and instead viewed it as something for volunteers or enthusiasts. The students experienced little return value in doing this work. Anonymous contributions result neither in personal acknowledgement or payment. In this sense the students did not perceive it as fair to expect teachers to become knowledge producers. Further, there is no indication that the students have continued volunteering in the production of textbooks after the course's end. Moreover, the wiki learning resources were free of cost. They can be regarded as part of Open Educational Resources (OER), which is a global movement that supports the production of open learning resources (Butcher, Kanwar, & Uvalic-Trumbic, 2015). In this way, the student work challenged the fundamental mechanisms of how a commodity such as a textbook is produced in the capitalist system. The student wiki products created a *primary contradiction* in the sense that the textbook is available at no cost, and thus the student-authored learning resources interfere with the normal division of labor in the educational system.

It is also possible to claim that the wiki-mediated group work introduced a *tertiary contradiction*. On one hand, the wiki assignments represented the introduction of a culturally more advanced object into the course as an activity system. It disturbed the students' perception of the goal of the course that was to acquire skills on how to use different digital tools. The student work moved beyond the course as a separate and isolated activity system. It challenged the students' preoccupation with individual learning. The students had to do work with different subtasks and produce resources that were relevant for others outside the course.

As a consequence, the wiki-mediated group work created a mismatch with the rules for what was considered to be fair work in the existing activity system. The analysis of all these tensions shows that it is the perception of *unfairness* that can be regarded as the *fundamental inhibitor of CKA as a pedagogical practice in the teacher education context*. Unfairness emerges as a problem in relation to most of the components in the triangular model when the course is analyzed as an activity system. This includes both the knowledge construction process and the assessment of the students' final work. Because unfairness stands in direct conflict with the principle of giving everyone an equal chance or opportunity, it is evident that any project will need to address and solve the issue of fairness to become institutionalized as a new pedagogical practice.

According to Foot and Groleau (2011) power relations become central when a new object is introduced existing activity system.[81] The new power relations need to be legitimate if the central activity is to change. Regarding this issue, the data show that the students still considered the teacher to be the best person to sustain fairness in the group work. When the students were left on their own, they did not know how to address or solve several issues related to unfairness. The student moderator was not considered to be a legitimate leader to the same extent.

[81] See section 3.2.2, Contradictions will emerge at four different levels, page 55.

9 The germ cell of CKA as a pedagogical practice

9.1 Identifying the germ cell

The purpose of this chapter is to identify the germ cell of collective knowledge advancement (CKA) as a pedagogical practice in teacher education. The *germ cell* is a singular entity that describes the *essential or simplest possible relation* of the phenomenon. It can be different things like a specific type of interaction or an artifact. It is difficult to grasp what characterizes the germ cell. The attempt to identify the germ cell will therefore need to be done by carefully comparing the different examples or episodes that have already been categorized under enabling conditions in the empirical analysis. This involves a triangulation of interview data, screen data, and observational data from all the main chapters in the empirical analysis. Important episodes manifest themselves both as deviating patterns, but also as more subtle interaction patterns, which are more commonplace. The deviating data are not part of the dominant interaction patterns or the most common opinions in the group. On the surface, several of the enabling conditions do not at first sight appear to be interconnected. Still, it is necessary to compare this rich variety of conditions to identify the essential characteristics of what constitutes the germ cell of CKA as a pedagogical practice in teacher education. Because of this analytical challenge, the germ cell was first identified in the late phases of the empirical analysis after many rounds of analysis.

In the present study, it is suggested that *help* as a phenomenon is the best candidate as the germ cell of CKA in teacher education. Help can be interpreted as the smallest and simplest initial interaction that represents the complex totality of CKA as a pedagogical practice in teacher education. As such, help requires both a giver of help and a receiver of help. In accordance with the research question and the preliminary descriptions of CKA in Chapter 1, the germ cell consists of elements from both an offline and an online setting. However, this does not imply that CKA can be reduced to just being one specific type of practice. On the contrary, the data that have been categorized as enabling conditions show that it is possible to distinguish between two types of help.

The first type of help is “help on request”, which represents an explicit intentional act of helping. The help will manifest itself through someone who asks for help and someone who gives help. The person who needs help will direct attention toward someone who one assumes can actually give the necessary help. A request will be made in an attempt to get this help. This is the interaction type which lay people often associate with the concept. Much of ordinary classroom teaching is also based on “help on request.” For example, the teacher will ask the students a question, and then the students will attempt to answer the question.

The second type of help is “help without request”, which unfolds itself without an explicit call for help. The help will be executed without the use of a meta-message that explicitly addresses a need for help. In this sense, the help is not planned in the same way. Because a request is not necessary, the helper or the one helped may not necessarily be conscious of help taking place. For example, the one helped can observe something that the helper is

doing without the helper being aware of this observation. In this sense, the giver of help will not be in direct connection with the receiver of help.

From one perspective, help can be regarded as a simple relationship. However the theoretical framework presumes the existence of *dialectic movements between giving and receiving help*. In principle, the two different types of help can therefore constitute four different positions. The table below gives an overview:

Table 9.1.a An overview of how two different types of help build on different movements between giving and receiving help.

	Giving help	**Receiving help**
Type 1. "Help on request"	Giving help when being asked for help	Receiving help when asking for it
Type 2. "Help without request"	Giving help without being asked	Receiving help without having asked for it

The characteristics of these two types of help will be further analyzed in this chapter. It is also worth mentioning that the analysis of the germ cell will have its limitations. One can ask whether help really is the best candidate for describing CKA. Are there other germ cells that could be equally relevant? This issue addresses the question of validity. It is primarily the synthesizing efforts, done by the researcher, which constitute the foundation for this claim. Although the data are limited because they are from only one single course, one could claim that the degree of interconnection between the many different enabling conditions strengthens the validity. However, this description of the germ cell is a tentative construction, and its value can only be assessed as to whether it can be used to develop CKA as a pedagogical practice in a constructive way.

9.2 "Help on request"

In the current study, "help on request" manifested itself as a simple interaction type in both an offline and an online setting. In the offline setting, "help on request" was present at both a dyadic and a plenary level. In the offline setting, this type of help would usually happen as spoken interaction.

9.2.1 "Help on request" at a plenary level

In the offline setting, "help on request" would usually take place as spoken and not written interaction. When students were sitting close to each other around a table, they requested help at a *plenary level* by raising their voice. Usually these questions would require short answers. The advantage with posing the questions to the whole group was that it increased the likelihood of reaching one or more persons in the group who knew the correct answer.[82]

Note that the students posed questions that required a longer answer only a few times.[83] In one incident, two students moved around the table and sat down next to another student for more than 10 minutes. They would then receive help on how to use the wiki technology.[84] By first being asked for permission to move over, the students who gave help were more obliged to shift from a "working modus" to a "helping modus." However, the students seldom moved around the table in this way. The findings suggest that the students need to reach some level of acquaintance before they move more freely around. For example, one statement from the group interviews showed that the student thinks it is easier to move over to another student and ask for help if one knows this person from before. Another reason may be that the group in the first wiki assignment was significantly smaller than in the whole-class project (second and third wiki assignments). All the students talked more with each other in this assignment, and it is likely that the interaction in itself strengthens the group relationship.

On the other hand, the group interviews indicated that the students were not able to help each other in an effective way. They were cautious both about asking others for help as well as helping others who had made no initial request. For example, one student felt that she first needs to ask for permission if she wants to change another student's text. There is a risk that one might offend others if one tries to help them without first receiving a request. Another student is also afraid of "stepping on someone´s toes" if she tries to help.[85] The workshop data also show examples of the same cautious approach. In the fifth workshop, a student raised her voice to ask for permission to remove a link. Her proposal was rejected by the student who had originally published the link.[86] This episode shows that if students feel that they have completed a contribution, they will experience a strong ownership over this specific part of the work. The basic norm is that one needs to ask for permission if one wants to help someone by changing their work. However, this constant need to ask for permission

[82] Section 7.5.1, Asking for a short answer, page 216.
[83] Section 7.5.2 Asking for a long answer, page 219.
[84] Section 6.5, A peer instructional model, page 173.
[85] See Section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.
[86] Section 7.5.5, The voice in a specific table arrangement, page 231.

makes the collective work more difficult and time-consuming. The students will first need to find out who has done what task. It is likely that this inhibited the students' interest in editing others' work.

The more positive aspect of this episode was that the student was able to effectively reach all the students in the whole class by raising her voice. To locate the person who had done the original work, it was necessary to pose a question to the whole group. Because of the table arrangement, it was unnecessary to "shout" to reach the rest of the group. In comparison with the third and fourth workshops, it was easier to make requests for help when the students were sitting closer to each other.[87] As a consequence, students could speak more freely at a plenary level and not feel that they were disturbing others too much with the sound of their voice. For example, when the two students discussed the issue about the link, the rest of the students continued with their work.

The overlapping dialogues in the small groups and at a plenary level created a learning environment where students would make requests for help while others were continuing their work. This raising of the sound level of the voice represented a much easier way of getting help than the more "classical" gesture of silently raising your hand to try to get access to the teacher's help. If the teacher is visually attentive to these hands in the classroom, it will usually not be necessary to verbalize a request for help. It follows that, of this type of interaction, the teacher will be the only person in the classroom who gives permission to speak.

However, in the students' collective work these norms were completely changed, because no one was responsible for granting "permission to speak." In traditional classroom interaction, it is usually only the teacher who does not need to follow this conversational norm. The teacher is the only person who can raise the sound level of his/her voice at any time, but in this collaboration any student could do so at any time. As a consequence, most students did not stop working or talking when a student raised his/her voice to ask for help. If students would have been required to pay close attention to all requests, this would have made the collaboration less effective. Instead, a norm was created that opened up for and permitted many ongoing conversations at the same time. The unidirectional IRE-communication structure (e.g., Cazden, 2001) was replaced by a cacophony of different voices, which moved in many different directions across the table in the offline setting.[88]

9.2.2 "Help on request" in the dyads

Compared with the plenary level, there was a much stronger presence of "help on request" in the smaller groups. In the *dyads*, the students continuously asked each other questions and helped each other when the need arose in the ongoing discourse.[89] The excerpt even shows that a student would sometimes pose questions to the other student without receiving an answer.[90] There is no indication that this was experienced as impolite. On one

[87] See section 7.5.5, The voice in a specific table arrangement, page 231.
[88] See section 7.10.1, See section "Mind mingling" in the offline setting, page 270.
[89] See section 7.6, Peer learning as the verbalization of ongoing thoughts and actions, page 237.
[90] See section 7.6.3, Posing different questions about the ongoing work, page 248.

level, it shows that students who "ask other peers for help" cannot take for granted that they will receive help. From another perspective, these questions can also be interpreted as open invitations that can move the dialogue in new directions. The dialogues are far messier at this interaction level in the sense that there is more overlapping speech (e.g., interruptions) and fewer adherences to the rule of one person speaking at a time. In some of the dyads, there is a surplus of help in the interaction in itself, because the students are thinking aloud while they are working.[91] However, it is not possible to follow up on all these requests for help, because this would disturb the work flow too much. In these dyads there are also examples of more indirect requests for help that take place in the co-construction of one single utterance. The unfinished utterance suggests that the initial speaker needs help, but since this is not done as an explicit request for help, it is easier for the other student not to follow up on the issue.[92]

9.2.3 "Help on request" as peer instruction

Although "help on request" was part of the informal discussions between the students, it was not part of how the formal instructional design was organized. For example, one student suggested that the instructional design should have been built more around *peer instruction*. While the teacher in this study emphasized an instructional design that could maximize the collective performance, this alternative model instead builds on all students developing expertise and being helpers for each other. It strengthens "help on request" as a collaborative norm, because it decreases the likelihood of being rejected when peers ask each other for help. When the expertise is also distributed between all students in the class, this makes it less likely that a few students end up being overloaded with requests for help. For example, one student (Sarah) warns against giving too much extra work to the most competent students in the group.[93] When students do not know each other well in advance, it becomes even more important to establish norms that support open helping behavior in the class. One needs to explicitly emphasize that anyone must feel free to ask anyone for help in the class whenever they like.

This instructional model is very different from a teacher-centered classroom, which relies on "help on request." Here, help as a resource will be far less available, because the teacher will inevitably have limited time to help all the students individually. In sharp contrast, a learning environment built on peer instruction will radically increase the number of available helping resources by transforming all students into helpers. As a consequence, the teacher will no longer be the primary deliverer of knowledge as a part of a unidirectional interaction pattern. Instead, the teacher must enter new roles that can support the students in their attempt to help each other in the best way possible.

[91] See section 7.6.1, Verbalizing specific screen operations, page 238.
[92] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[93] See section 6.5, A peer instructional model, page 173.

9.2.4 "Help on request" in an online environment

In *the online setting*, there was not much "help on request." This type of interaction will usually rely more on written interaction instead of spoken interaction. To some degree, Facebook was used for this purpose in the present study. Here, the students mostly posed questions to the whole group about different project management issues.[94] The students would usually receive answers from other students quickly, because most of them used Facebook regularly.[95] The advantage of this type of online environment is that anyone can ask anyone for help, and only the students who know the answers need to involve themselves. In addition, since the traces of the communication are stored in the online setting, other students can find and read the questions and answers at a later point in time. Since most of the questions were about project management issues, it is likely that this information would also be relevant for other students who had not posed the initial question. In this way, the postings on Facebook can potentially function as "help without request" for other students. However, the students did not use Facebook to discuss academic issues, and there is no indication that other online environments were used to discuss such issues.

In the online setting, there are also other examples of how "help on request" can be available for much longer time periods. In one example, a student had published an instructional video about how to use Hot Potatoes several years prior.[96] Even though the student had forgotten most of these skills, they were still available through the video that was accessible in the online setting. If there was a need to update these skills, the student could easily do this by watching the video again. The help had been offloaded from the person into an environment. In this specific incident, another student initially asked for help in the offline setting. But the help was not given by the student in real time, because she did not remember what to do. Rather, she encouraged the student to watch the previous "competent video version" of herself. In this case, the video became valuable again many years after it had been published. This illustrates how help that is shared unconditionally in an online setting can unexpectedly be of value at a later point in time.

[94] See section 6.1, Dividing the tasks, page 163 and section 6.9.1, Background, page 187.
[95] See section 4.3.3, The students, page 83.
[96] See section 7.5.2, Asking for a long answer, page 219.

9.3 "Help without request"

On one hand, "help without request" can be defined as the opposite of "help on request." However, the help will still need to be constituted by two basic positions in help as interaction. From the position of the person who is helping, it is about giving help even though one no one has requested or asked for help. From the position of the person who is receiving help, it is about receiving help even though one might not even think that one needs help.

9.3.1 Giving "help without request"

In the current study, there are several examples of students *giving help without the presence of any preceding request*. One student in the group interviews even described this type of help as being the natural way of collaboration among children. If kids know something, they enjoy teaching it to others.[97] Here, the student uses the child as proof of the existence of a natural desire in humans to teach others what they know. They enjoy showing others what they know as opposed to protecting their own knowledge. Instead, they share their knowledge with others unconditionally. This is also help given without any initial request. The workshop data also show an episode where a student really wants to share her work with others around the table. By raising her voice the student attempts to share her work with the rest of the group. The student stands up and shows her technical achievement on the wiki by turning the laptop screen around.[98] Although the other students do not continue to ask how she managed to do make the wiki image in a specific way, it is likely that this help is there as a latent opportunity. However, it is obvious that the student was also seeking acknowledgement for the work she had done. The emotional statements indicate a strong sense of pride about what she had managed to do.

The workshop data also show several examples of this type of help. In one incident, a student injects a brief comment into an ongoing discussion between two students across the table.[99] It is the sound level of the discussions that makes this possible. When the students "think aloud" with a loud voice, they communicate to the surroundings that others are allowed to join the discussion. In this incident, the helper interrupts because she thinks her help may be relevant. Although this kind of help was not very frequent, the key issue is that the relatively loud discussions mediate "help without request" as a constant opportunity in the offline setting. The discussions in the dyads become more public when they are available to others around the table.

In the same way as with "help on request" in the offline setting, the basic requirement here is also that the students cannot work silently. There needs to be acceptance for the "noise" that is created when many dialogues are taking place at the same time. The key is to find the correct sound level for speaking. On one hand, the verbalization of thoughts and screen operations needs to be loud enough so that they reach others around the table, but at the same time they should not be so loud that they disturb others' work. On the other hand, the

[97] See section 6.5, A peer instructional model, page 173.
[98] See section 7.5.4, Showing your work to the rest of the group, page 226.
[99] See section 7.5.3, Involving yourself in another conversation, page 223.

large groups in the whole-class project work made it difficult to have discussions that involved all the students at a plenary level. In the group interviews, some of the students claimed that it was not possible to give critical feedback in the large group because it would be too time-consuming to reach agreement with 26 students.[100]

Moreover, this "help without request" was perhaps most evident in the unconditional sharing of the students' final work in an online setting. The final wiki resources can be regarded as something that can be potentially helpful for others in the future. This help is not only directed toward a specific target group but is also distributed to unknown others who can either use the resources as they are or continue to develop them. Compared with the offline setting, the target group of the help becomes much broader. One example is the statement from one of the students who did a lot of work on the Wikipedia article and felt that she had volunteered and made a contribution to the Norwegian social democracy.[101] The use of the label "volunteering" shows that the students perceive that the work represents a type of help where one does something extra for others. Interestingly, here the help is directed toward the society as a whole. Many unknown others can read the article and find it helpful. The student connects her contribution with core values in a democratic society. She also expresses that this is her way of helping the encyclopedia. The statement also suggests a strong sense of pride over having made this contribution. Likewise, Sally describes how children can share their work in new ways by using the wiki as a poster. When this work is published openly, it can be of value to others. This also makes the children more proud of their work.[102]

Another example of giving "help without request" is the instructional video about rock carvings that was published on YouTube. This student work can also be of help to anyone at a later point in time. The large number of page viewers also indicates that this goal has been partly fulfilled. Internet users have continued to watch the videos in the years after its original publication. The help stretches far beyond the educational setting, because it is directed toward persons who may want to learn something about the rock carving sites in the future. The help is given without request, because it is distributed before any request to find information about rock carvings has been made. From one perspective, this help is distributed in the same way an expert would have done. However, what is new is that "student amateurs" can publish and distribute their work to help others without any economic costs.[103]

These examples also illustrate that "help without request" in the online setting may often happen without any direct communication between the giver and the receiver of the help. For example, in the current study students who had previously taken the course have given help to future students as a possibility through the work they have done. The new students who are the receivers of this help will not be aware of who the original helpers are (e.g., when students operate as anonymous others). Another example of giving "help without request" is the comment the students published on the wiki discussion page. This text explains the student work and helps guide the attention of future contributors to the parts

[100] See section 7.2, The size of the group has an influence on peer learning, page 204.
[101] See section 5.3, Producing knowledge for a "global" audience, page 138.
[102] See section 5.1, Supporting new pedagogical practice in classroom teaching, page 132.
[103] See section 1.1, New types of knowledge production in the Internet, page 1.

of the work that need to be improved. This gives more information about the purpose behind the published work and positions the local contribution as a part of a broader knowledge community.[104]

In both these cases, the help is left as a trace in the online environment detached from the helper. In this way the help becomes asynchronous and extends over time. The work is given away as a standing invitation for further improvement for an infinite amount of time.

9.3.2 Receiving "help without request"

In the offline setting, it is perhaps the dyadic collaboration that best illustrates how *students received help without any preceding request*. This help was many times closely related to both the ongoing screen operations and the spontaneous externalizations of student thoughts. First, help can be received through the verbalization of specific screen operations. In one episode a student would receive direct help from the other student on how to operate the screen.[105] In this type of interaction, the help is not separated from the ongoing discussion but is rather composed of brief comments the students make while they are interacting with each other.

This help is also based on both students observing the operations on the laptop screen. This requires that the two persons are sitting close to each other so they have access to the same visual information. They can then observe each other's work without having to move their bodies. In this way they will not disturb others by having to move closer if they need to see some information on the laptop screen. This makes it easier to give more direct and spontaneous help as a part of the ongoing work. In other cases, it will be enough to quietly observe what the other person is doing, which makes the costs of helping close to zero. This illustrates both the complexity but also the flexible shifts between being in a "working modus" and a "helping modus" in these dyads.

Another way of receiving "help without request" is through the co-construction of a single utterance.[106] Here, the initial speaker receives help from the other person to finish the utterance or sentence. The help is consensus-orientated in the way that it usually attempts to build on what the other person is saying. It strengthens both joint decision and further co-elaboration around ideas. From one perspective the co-construction of one utterance can be regarded as the smallest verbal unit where one's help is received without request. It also presents a powerful example of two persons "thinking together." Most dyadic work will be so closely intertwined that it will sometimes be almost impossible to separate out the individual contributions to the dialogue. Although there is no explicit request for help in this type of overlapping speech, the use of pauses can be interpreted as invitations to receive help from others by filling out the last part of a sentence. This phenomenon is therefore different from interruptions that build on competing ideas.

[104] See section 5.7, Individual knowledge-production skills, page 155.
[105] See section 7.6.1, Verbalizing specific screen operations, page 238.
[106] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.

In the online setting, there were also a few incidents where students *received help without having made any request*. This was perhaps most evident in the help the students received from outsiders in their work with the Wikipedia article.[107] The students received several helpful comments on the wiki discussion page that was attached to the article. This happened even though the students did not make any requests for help when they wrote a short summary of their work on the wiki discussion page. The students still received help, because the norm in the online community is that anyone is permitted to give help if they want to. One important reason is that all text produced in this environment is built upon shared ownership.

This type of help was also asynchronous and extended over time. At first, the students thought they had finished their assignment with the Wikipedia article, but when they received serious critique related to copyright issues, they continued to improve the work after the deadline. Some of the feedback from the Wikipedians was also given several weeks after the students had published their work. This shows that "help without request" in an online setting can be delayed substantially in time. Although the outsider feedback was primarily directed toward the students, it can also be regarded as help that is directed toward any person in the future who wants to improve that specific Wikipedia article.

Some of this help was also given through direct improvement of the text itself.[108] One example is when some outsiders did direct editing of the Wikipedia article without asking for permission.[109] Although "help without request" in an online setting still requires a giver and a receiver of help, these persons do not necessarily need to be aware of each other. This is because the giver of help does not have to be present when the help is received. For example, when the students had completed their final submission of the Wikipedia article, they no longer continued to edit the article. When new contributors improve this work, it is likely that the original authors will not be there anymore. In this way, the giver of help may not know if the help that is given will be valuable for anyone, but it is left as a trace in the work. When this condition is accepted, it is possible to conceptualize "help without request" over a much longer time period.

Another example is when the students in the first and third wiki assignments improved the work of previous students. Because the work was communal property, this was done without asking for permission to change the work. These revisions can be interpreted as a type of "help without request" taking place within an extended time period. New students helped previous students in the sense that they improved the work that they had done. The unfinished wiki pages stimulate new contributors to make improvements. However, the need for help will primarily be mediated by the new readers' perception of how the present wiki page can be improved. In this way, one could claim that the need to help a person is transformed into primarily being an issue about how one can help the text to become better. However, one episode shows that the students sometimes referred to the previous students' work through the use of the pronoun "they." This indicates that there is a perception that a larger group of anonymous authors are now receiving help from a new

[107] See section 7.9.2, Outsider feedback, page 263.
[108] See section 7.8, Extended peer editing, page 256.
[109] See section 7.9.3 Outsider editing, page 267.

group of anonymous authors.[110] This illustrates that some of the students have internalized the idea of extended peer editing into their use of language.

[110] See section 7.9.1, Building on the work of an anonymous group of outsiders, page 261.

9.4 The basic conflict of motive

The most demanding criterion of a germ cell is that it must carry in itself the foundational contradiction of the complex whole.[111] However, the data show that "help on request" and "help without request" were often closely intertwined in the pedagogical practice. There does not appear to be any basic conflict of motives between these two types of help. Rather, they supplement each other, and they are both a necessary part of help as an initial relationship. On the basis of the findings, it is instead suggested that a contradiction between *conditional help* and *unconditional help* represent the *basic conflict of motive* in relation to CKA as a pedagogical practice in teacher education. These two contradictory types of help will here be described on the basis of selected data from the empirical analysis.

9.4.1 Conditional help

In the present study, conditional help is defined as help that is given only when some terms or conditions are met. On the basis of the findings, it is possible to distinguish between *three different aspects of conditional help*.

9.4.1.1 The help must be reciprocal or balanced

One aspect of conditional help is that the help is *reciprocal* or *balanced*. If a student gives help, the same person will expect to receive some kind of help that is equally valuable in return. There must be some degree of balance in the helping relationship. One example is when the students did not want to share their individual exam notes openly because they were certain that the contributions would be unbalanced. Even if all the students were to publish their notes, the variations in the quality of the notes would inevitably result in some students receiving less help in return for their efforts.[112] The students wanted to protect their own work when they knew it was directly relevant for the final summative assessment. In the group interviews, Jessica explained this lack of interest in sharing exam notes and helping each other is part of a broader societal trend that emphasizes norms of reciprocity. The students do not want to give anything away if they do not get something in return.[113] Help is here perceived as something of value that one gives away. Other studies have also shown that students do not want to help the rest of the class if they think it will improve the general performance in whole class. If the grades are divided according to a normal distribution, it will decrease their own chances of getting a good grade (Crouch et al., 2007). In such cases, there will be a direct conflict of motive between being egoistic or altruistic.

Indirectly, these norms of reciprocity were also evident when the students complained about free riders in the whole-class project. All students were expected to make equal contributions, but there were still some students who did less work.[114] Likewise, Dohn (2009) finds that most students want to get "credit" for their contributions and are reluctant to share "their" knowledge if there are free riders in the class. Even when all students are

[111] See section 3.3, The germ cell of a new concept needs to be identified, page 58.
[112] See section 6.8, The problem with unequal contributions, page 182.
[113] See section 5.2.2, Sharing within the school, page 136.
[114] See section 6.2, Unequal sharing of the workload, page 167.

required to make a minimum contribution, they become annoyed about the lack of effort by their peers.

9.4.1.2 Permission-based help

Another aspect of conditional help is connected to *the issue of permission*. For example, students would sometimes ask for explicit permission to either give or receive help. In one episode, two students asked for permission to receive help from another student. After this permission was granted, the two students moved around the table and sat down next to the helper. In this specific episode, the issue of permission was even more important because the students who asked for help required the use of a substantial amount of time (more than 10 minutes).[115] Verbal consent strengthens the helper's commitment and her effort in making sure that the help is successful. Here, the element of disturbance was also stronger, since the students had to move around the table to sit down next to the helper. The main disadvantage is that the students cannot continue their work on their own, as they must also use time helping others. However, one should note that the students who wanted help emphasized that they just wanted to observe the other student while she was working. The student who gave help was therefore able to continue her work while the other students observed what she was doing. It is likely that this type of help is experienced as less intrusive compared with help built on receiving direct instructions on what to do. In the offline setting, this permission-based help was most common in interactions with students who did not know each other well from before. For example, the students did not ask each other for permission to get help in the dyadic collaborations.

On the more negative side, the data suggest that the norm of asking for permission inhibited the plenary interaction. One reason was that the students found it difficult to improve others' work, because they first had to find out who had done the task, and this was not always easy to find. For example, one student first had to ask who had done a certain task before she could ask for permission to help.[116] Moreover, if it was too difficult to get an overview of the collective work, the students would avoid giving help because the whole process would take too much time.[117] The interaction also became less flexible and more time-consuming when students felt they had to ask for permission every time they wanted to give or receive help.

Although this permission-based help follows the norm of being polite, the issue of permission also presupposes the possibility of being rejected. For example, in one episode a proposal to help was denied and created a somewhat tense situation between the two students involved.[118] When the permission to give help is denied, both the helper and the one helped can feel that they are "losing face."

This is very different from most student-teacher interactions. Even though students will often need to ask for help, the teacher can in principle never reject this request. Although it

[115] See section 6.10, Observing others work, page 195.
[116] See section 7.5.5, The voice in a specific table arrangement, page 231.
[117] See section 7.2, The size of the group has an influence on peer learning 204.
[118] See section 7.5.5, The voice in a specific table arrangement, page 231.

may take some time before the students receive help from the teacher, the students cannot be denied this opportunity. As such, the possibility of not giving help is not an issue in the same way, because the teacher is obliged to help the student. However, the norms were significantly different in the student-student interaction in the current study, because the students were not required to help each other. For example, some students in the group interviews reported that they had wanted more help, but when the teacher was not available, they felt that it was difficult to ask for similar help from their peers. The students were unsure who was in charge, and they wanted more teacher control.[119]

Furthermore, the findings show that students ended up doing most of their work in small groups in the whole-class project. The students worked within "separate territories" where they had a strong proprietary ownership of their work. If the students wanted to help each other by editing others' work across these groups, they would often ask for permission. It was more important to respect each other's work than to actually help them improve their work. If a group of students who had done a task had not asked for help, others would usually make few comments on their work. As a consequence, the wiki text ended up consisting of a range of separate contributions from individuals or small groups.[120] In the group interviews, some of the students also recommended that time should have been spent establishing new norms to make it easier to change others' text without asking for permission, implying that no one could be upset if somebody changed their work directly.[121]

Another challenge in the present study was that a few students received many more requests for help than others. Since help is a limited resource, it may be exhausting for these "student experts" to give all this help.[122] They may not want to be in this role but still give the help in an attempt to be polite and not offend anyone. This may be the reason why one of the students suggested that all students should be helpers for each other in the learning environment.[123] In this environment, the issue of permission would be less important, because it is given in advance as a fundamental norm. It would perhaps make both "help on request" and "help without request" more flexible and reduce the likelihood of tiring out a few "student experts."

In the online setting, the issue of permission was also related to different copyright issues that the students struggled to understand. For example, some students reused copyright protected images without asking for consent from the original photographer.[124] They were unaware that they were required to ask for permission. To some degree, the norms of giving and receiving help on the Internet were experienced as more unconditional compared with the offline setting. Although the students emphasized the principle of reciprocal help, they thought that images could be reused without any conditions.

[119] See section 6.4, Leading the project work, page 171.
[120] See section 7.7, Peer editing between students in the class, page 253.
[121] See section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.
[122] See section 6.2, Unequal sharing of workload, page 167.
[123] See section 6.10, Observing others work, page 195.
[124] See section 5.7, Individual knowledge production skills, page 155.

9.4.1.3 The help provides a final answer

A third aspect of conditional help builds on the assumption that it is possible to give a *final correct answer*. The helper knows what is correct, and the goal is therefore to transfer the "chunk" of knowledge that represents the correct help. For example, in the offline setting students would sometimes raise their voice to ask others a factual question about a specific issue. In one specific incident, the student received an answer, but she was unsure if it was correct. Another student then confirmed that the first answer was correct. Here, one could claim that the probability of receiving a correct answer increases if students receive more than one answer for the purpose of comparison.[125] The basic requirement is that both parties acknowledge that the helper is more knowledgeable than the one helped. There is an asymmetry in the helping relationship, because the help is given from a more competent expert helper. In this specific incident, the student signaled that she was unsure about the competency of the helper. The second answer, which was identical, settled this uncertainty.

The basic requirement is that the helper possesses valuable knowledge. If the answer then is assumed to be correct, it will facilitate no further discussion. When this help is received, the process of helping is over. The knowledge that is inherent in the help already exists in advance. It is stable and finite and can be used to provide the correct answer to the person being helped. The knowledge is transferred or transmitted from one person to another. The findings show that this help was usually performed as "help on request."

On the other hand, the need to provide a correct answer also created problems in the collaboration. For example, some students felt that they could not help each other in an effective way, because they had the same level of background knowledge. If they were to help others, they wanted to be sure that they were giving correct help. They felt it was pointless to edit or improve on others' work, because they lacked a superior level of knowledge in comparison with other students in the group.[126] In this sense, they perceived symmetrical help as being of little value. This is one reason why the students chose to primarily do their work in separate areas and not edit each other's work.

Moreover, the findings show that the students wanted more access to expert helpers in the learning environment. For example, at the end of the project work, the students were unanimous in their wish for the teacher to return to the role of being the superior helper. They wanted to know what literature and topics were most relevant to read before the final exam.[127] Another example is the proposed peer instruction model. The idea is to give students time to become "teachers" by first developing a sufficient level of expertise. In this way, the student experts would be able to provide better answers. This way, all students will then be available to help the other students within their specific area of expertise.[128] These findings show that the students wanted a learning environment with a short-cut to the correct answers.

[125] See section 7.5.1, Asking for a short answer, page 216.
[126] See section 5.4.4, The level of individual background knowledge and interest, page 141.
[127] See section 6.8, The problem with unequal contributions, page 182.
[128] See section 6.5, A peer instructional model, page 173.

In the online setting, the students helped each other by providing brief answers to questions about project management on Facebook.[129] The advantage was that all the other students in the course had access to the same answer at any point in time. When traces of help are stored in the online environment, they will automatically be shared with others. In this way, "help on request" is potentially transformed into "help without request" as a future opportunity.

9.4.2 Unconditional help

Here, unconditional help is defined as help that does not require that any terms or conditions be met. On the basis of the findings, three different aspects of this type of help will also be described.

9.4.2.1 Help can be unbalanced

The first aspect of unconditional help is that it can be *unbalanced*. Help is given without any expectation of receiving something of the same value in return. Although the students in the group interviews emphasize the importance of reciprocal help, some statements also indicate the presence of unconditional help. For example, one student claims that children have a natural desire to share what they know with others.[130] Another student tells about a colleague in school who has made a lot of binders with teaching materials, such as lesson plans. Others teachers in the school are allowed to copy and use whatever they like.[131] If we compare these two statements with each other, there is a significant difference in the perception of the children and the adults. While children are assumed to have a desire to help unconditionally, this is more the exception than the rule among professional teachers. The teachers who share their work openly are described as enthusiasts, different from the large majority of teachers. For example, one student thinks that it is primarily these enthusiasts that need to "join forces" in a distributed online setting to succeed with the development of collective learning resources.[132]

Furthermore, the workshop data indicate that some types of interaction build on unconditional help. This can be that a student answers a question posed by another student ("help on request"),[133] or it can be that a student shows her work to other students ("help without request").[134] On one hand, these actions can be regarded as being unbalanced help, because the student does not get anything equally valuable in return. However, if they receive some acknowledgement for giving help, this might also be a part of the motivation and create some degree of balance.

[129] See section 6.9.1, Background, page 187.
[130] See section 6.5, A peer instructional model, page 173.
[131] See section 5.2.2, Sharing within the school, page 136.
[132] See section 5.2.1, Sharing across schools in online setting, page 135.
[133] See section 7.5.2, Asking for a longer answer, page 219.
[134] See section 7.5.4, Showing one's work to the rest of the group, page 226.

In the online setting, the feedback from the Wikipedians can be regarded as one example of unbalanced help.[135] These comments were given with the intent of helping the students improving the article. This help can also be regarded as unbalanced in the sense that there was no guarantee that the students would improve their work according to the comments. However, the open publishing of the feedback made it possible for anyone else to later read the comments and improve the article.

9.4.2.2 Permissionless help

The second aspect of unconditional help is that it is *permissionless*. This type of help does not require any verbal consent or permission before one gives or receives help. For example, most of the dyadic collaboration in the present study builds on this type of help. A key issue here is that the question of being polite or impolite becomes irrelevant. One example is that the students had few problems interrupting each other if they needed help or wanted to give each other help.[136] Even when students did not receive a reply to a direct question, this was not perceived as impolite.[137] This also illustrates that the rejection of "help on request" is an acceptable norm in this type of interaction. As such, the students were able to help or not help each other in a more flexible way, because there was no risk of anyone getting insulted. Here, *permissionless help* is a necessary part of the flow of the ongoing conversation that allows students to "think aloud" while they are working. It includes elements of both "help on request"[138] and "help without request."[139]

Furthermore, these episodes show that permissionless help is reliant on a certain level of trust between the students who are collaborating in the offline setting. For example, at the plenary level this can be related to the presence of more unrestricted or unconstrained bodily movements between the students. Here, the issue of permission is about whether the student can walk over to another student and pose a question if she wants to. For example, in one episode two students first received permission before they moved over to observe another student while she was working. There is a risk of being intrusive if one moves close to another person. However, when the one of the students did this a second time, she did not ask for permission.[140] Although the second stay was brief, it indicates a change in norms toward accepting more flexible and unconstrained embodied interaction between the students. It signals that the interaction patterns are changing from permission-based help to permissionless help. And it is the collaboration in itself that changes this norm, because the level of trust increases when the students interact with each other.

In contrast, the usual student-teacher interaction would rely on the teacher as the helper moving over to the students as help-seekers. In this case, the interaction was opposite, because the student as a help-seeker moved over to the "student-helper." On the other hand, the second move can also be interpreted as just being a "follow up" to the first move.

[135] See section 7.9.2, Outsider feedback, page 263.
[136] See section 7.6.1, Verbalizing specific screen operations, page 238.
[137] See section 7.6.3, Posing different questions about the ongoing work, page 248.
[138] See section 7.6.3, Posing different questions about the ongoing work, page 248.
[139] See section 7.6.1, Verbalizing specific screen operations, page 238, and section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[140] See section 6.10, Observing others work, page 195.

Permission-based help will usually be related to a stronger fear of "disturbing" or being intrusive on others. It is much more important to ensure the politeness of the conversation, and the dominant interaction pattern is to remain seated in one's chair. The potential disadvantage is that it may result in a less flexible interaction between the students.

In the online setting, most of the published student work can be regarded as a way of giving permissionless help. For example, the publication of the Wikipedia article made it possible for others to freely receive help about the topic if they read the article. The work was also communal property, since it was published with a Creative Commons license. It allowed for anyone to use and modify the work without first needing to ask for permission. Like in the offline setting, the advantage is that the help becomes more effective, because nobody needs to use extra time on granting permission. The helper is in this sense detached from the person who receives help. The disadvantage is that there is a risk that others can change or reuse the work in such a way that the quality is reduced. One obvious example is the vandalism of the wiki resource in the second wiki assignment. Although the original wiki work could easily be restored, none did this later.[141]

9.4.2.3 The help is given as suggestions

Another aspect of unconditional help is that it can be given as *suggestions* in the ongoing work or the ongoing discussion. First, one example from the ongoing discussion, is when a student wanting help, stops in the middle of the utterance to invite the other speaker to complete the sentence by making a suggestion.[142] Another example is when a student involves herself in another conversation in an attempt to clarify the topic being discussed.[143] Second, the suggestions could be part of the ongoing work. This often happened when the students verbalized their screen operations on the laptop. For example, the other student in the dyad would tell the screen operator where to move next on the screen.[144] Here, the qualities of help are more inherent in the ongoing dialogue as the students focus their attention toward the same task. Third, the suggestions were also sometimes formulated as questions. These questions were open invitations to the other peer to move the ongoing discussion in new directions. The multitude of questions did not allow for all questions to be followed up on by the other student. There was no norm that required that the student had to answer the questions. In some cases, the questions would be of help, while in other cases they were not so helpful. Nevertheless, they gave the students more options to move the dialogue in new directions.[145]

Note that in all these examples, the helpful suggestions are primarily spontaneous verbalizations of thoughts and actions that are closely integrated in the screen-mediated ongoing discourse. This involves both "help without request" and "help on request", but the help is not a separate discourse from what the students are doing. Usually, the dyads were attempting to "find answers together" while they were positioned around the screens. In all

[141] See section 5.6, Creating valuable knowledge in the teacher education setting, page 150.
[142] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[143] See section 7.5.3, Involving yourself in another conversation, page 223.
[144] See section 7.6.1, Verbalizing specific screen operations, page 238.
[145] See section 7.6.3, Posing different questions about the ongoing work, page 248.

the examples, the helping relationship is symmetrical. Both students help each other, and the level of competency between the helper and the receiver of help is on approximately the same level. The material positioning of the bodies and the physical artifacts also indicate that the type of help was built around the co-construction of knowledge between the helper and the helped.

In the online setting, this help took place over a much longer time period. For example, the Wikipedians who made suggestions on how the students could improve their work did so independent of the deadline in the course setting.[146] As a consequence, the students continued with their work for a much longer time period. This illustrates that the knowledge production process inherent in this type of help never ends. Knowledge is assumed to be an unstable "object" that needs to be transformed and improved continuously. Compared with feedback from the teacher, which is usually given as a final authoritative answer, the students also assess the relevance of the feedback they received from outsiders.

9.4.3 Conditional vs. unconditional help

The table below gives an overview of how conditional and unconditional help contradict each other.

Table 9.4.a An overview of how conditional help and unconditional help contradict each other.

	Conditional help	**Unconditional help**
1. The sharing of help.	Help must be reciprocal or balanced (principle).	Help can be unbalanced (joy).
2. The initiation of help.	Permission-based help (norms of politeness).	Permissionless help (politeness is not relevant).
3. The finality of the help.	The help provides a final answer (asymmetrical relationship).	The help is given as suggestions (symmetrical relationship).
4. The degree of request that dominates.	Help on request.	Help without request.

First, conditional and unconditional help are contradictory in *how the help is shared*. On one hand, *balanced help* is based on a norm of reciprocity. The motivation to help is here perceived as an obligation, because it adheres to a specific rule of principle. The principle is that the help must be shared equally or built on an equal amount of contribution. On the other hand, *unbalanced help* does not necessarily demand any adherence to a principle. This help can also be motivated by the joy of sharing in itself. One example is the joy a student experiences when she shows her personal achievement to others. In addition, this type of help can take place as spontaneous comments in the ongoing work or discussions. The help will then rather manifest itself as an urge to move the discussion, as if the discussion itself requires it. In both cases, the key issue is that there is no direct return value in giving the help. This help is unbalanced, because the question of the size of the contribution becomes

[146] See section 7.9.2, Outsider feedback, page 263.

irrelevant. In some instances, the help might also be so closely integrated in the ongoing discussion that the persons involved do not even consciously perceive that their actions can be regarded as help. For example, a few of the students addressed how they openly shared their thoughts in the dyadic collaboration.

Second, conditional and unconditional help are contradictory in *how the help is initiated*. On one hand, *permission-based help* requires some kind of permission before one can begin to give or receive help. This help is closely related to the norm of being polite, and it is more present when the helper and receiver of help do not know each other very well. This help is also more unidirectional, since the issue of permission is to a larger degree about one person giving something valuable to another person. It builds on a stronger sense of ownership over the help that is given. In addition, the issue of permission will inevitably imply the possibility of being rejected or not granted permission. On the other hand, *permissionless help* will move beyond the norms of politeness. Asking for permission becomes irrelevant. There is an acceptance of overlapping talk and "impolite interaction" as a valuable part of the rapid and free exchange of thoughts during the collaboration. The help is so closely integrated into the ongoing work that it may be difficult to identify it. Help is here regarded as a collective effort where the students find answers together.

In the online setting, permission-based help is more closely connected to the copyright protection of work. The person who wants to reuse this work needs to ask for permission to receive help from the creator of the work. In contrast, permissionless help is connected to the publication of student work with a Creative Commons license. Others can then reuse this work in different ways without first asking for permission. In this way, the exchange is non-reciprocal. Because the help is distributed as digital information through an open medium, it becomes universally available.

Third, the conditional and unconditional help are contradictory through *the degree of finality in the help*. On one hand, help will be given as a *final answer*. This help assumes that there is one correct way of helping. When the correct answer is given, there will be no more need to give help. This help builds on the transfer of knowledge from one person to another. The helper is here regarded as an expert, because the helping relationship is asymmetrical.

On the other hand, help can be given as *suggestions*. This help is relevant when students face problems without any obvious correct answers. This help can be given in multiple different ways, but it will usually be about finding the answers together. Here, both the question and the answer are used to stimulate further discussion. The persons involved will therefore often switch in the role of being helpers, and they will have approximately the same level of expertise. This makes the helping relationship more symmetrical.

10 The emergence of five conceptual trails (Discussion)

Although the findings in the present study show that CKA as a pedagogical practice was difficult to implement, it was still possible to use the data to identify the germ cell of collective knowledge advancement (CKA). According to the principle of ascending from the abstract to the concrete, this identification of the germ cell (step 2) opens up for a pedagogical reconceptualization of the concept with *potentially expansive potential* (step 3).[147] In line with step 3, when the germ cell of CKA has been clearly understood, it can be enriched and transformed into a complex new system with multiple, constantly developing and expanding manifestations. New patterns of object-orientated activity may emerge, but this requires that the germ cell be materialized in such a way that the new forms of activity become stabilized. The germ cell must therefore be put into use through the construction of a range of concrete applications and tasks. It must be applied and implemented as different practical manifestations to move toward a pedagogical practice that represents a concrete new whole. It is these new conceptual trails that can potentially turn the germ cell into a new expanded object, which can become the actual driving force of expansive learning.

As such, this chapter will be organized around *five "conceptual trails"* that show how CKA can evolve into more complex forms of pedagogical practices in several different ways.

- Transparent use of artifacts.
- Nurturing critical feedback.
- Learning by teaching.
- The teacher educator as a team coach.
- Creating value beyond the learning period.

The notion of "conceptual trail" is here used to refer to future-oriented perspectives on CKA as a concept.[148] The concept formation builds on the assumption of CKA as a "perspective concept." This implies that the concept might become important in the future, but it has not yet been sufficiently acknowledged in the research literature or as a pedagogical practice in the teacher education context. In line with step 3 in the principle of ascending from the abstract to the concrete, it is important that these conceptual trails build more directly on help, which has been identified as the germ cell, instead of the initial sub-research questions. The discussion will center on the main research question and the interplay between an offline and online setting in a more detailed manner. Findings from a few other research studies will also be mentioned when they are regarded as important for a more elaborate discussion of the different trails.

[147] See section 4.5.6, Phase 5 – Expanding CKA as a theoretical concept, page 117.
[148] The notion of "conceptual trails" is inspired by step 3 in the principle of ascending from the abstract to the concrete. See section 3.3.4, Step 3, Testing the germ cell, page 61.

10.1 Transparent use of artifacts

As the first conceptual trail, it is here suggested that *CKA as a pedagogical practice emerges through the transparent use of artifacts.* The findings in the present study show that help is mediated through the transparency inherent in the artifacts the students use. This involves both physical artifacts used in the offline setting and digital artifacts used in the online setting.

"The wiki as a physical artifact" will here refer to the use of a wiki as a part of a technical device, while the "the wiki as a digital artifact" refers to how the wiki is used as a software application on the screen. The premise is that CKA emerges through the use of a range of different artifacts or tools in the complex interplay between an offline and an online setting.

On one hand, this conceptual trail requires that the wiki as a physical artifact be used in a transparent way in the offline setting. Although the wiki is usually analyzed as a tool in an online setting, the wiki can also be regarded as a technical device in a specific offline setting. From this perspective, the wiki can be analyzed as both a laptop and as a projector in the present study. In both cases, the software application is an integrated part of a specific material technology that gives visual access to the information in the wiki. The transparency will depend on the degree to which the technical device mediates the visual co-attention between the persons in the offline setting.

On the other hand, this conceptual trail requires that the wiki as a digital artifact be used in a transparent way in the online setting. While the wiki has been at the center of the analysis in the present study, the data also show that the students used a broad package of offline and online tools during the project work, involving the use of both Google docs and Facebook. The wiki should therefore not be analyzed as an isolated application but rather as a tool that is used in combination with other applications. This issue is not addressed in the review, because none of the wiki studies have collected screen capture data from the laptop screens. They have only used wiki log data from the online setting.

10.1.1 Shared display in dyadic collaboration in an offline setting

In the offline setting, the present study shows that the wiki as a physical artifact was primarily integrated with a laptop. In the *dyadic collaboration*, the laptop screens offered good support as *shared displays*. The analysis of the germ cell showed how pairs of students managed to collaborate in a flexible way. This involved both "help on request" and "help without request." The laptop screens offered sufficient visual access when both the students and the screens were positioned close to each other. The students could then share information by observing each other's laptop screens. This could even be done without having to disturb the person working. The screen offered relevant information through its visual display. The students could receive help from each other just by observing each other's work on the screen. The student working would not necessarily be aware of this observational learning taking place.

Furthermore, the findings show that it was socially accepted to observe each other's work and ask for help at any time when the students were sitting next to each other.

For example, one of the students would do the wiki editing, while the other student would try to help by commenting on what was being done on the screen.[149] In comparison, it was harder to read the notes that the other student was writing on a piece of paper.[150] As a shared display, the laptop screen made direct coordination easy, and it gave a good overview of the ongoing work in the dyads. Because the students were seated close together, it was not necessary to move the screens to provide this kind of access.

Likewise, Scott, Mandry, and Inkpen (2003) also found advantages of being seated together in front of a shared display. They investigated three collaborative settings where two children were playing a collaborative computer game: (a) a shared display with one monitor, (b) side-by-side displays with two monitors, and (c) separated displays with two monitors. In settings (b) and (c), the same output was sent to two monitors to simulate networked computers. On average, the students rated the game significantly easier to play in the shared-display setting where they were sitting together in front of one monitor compared to the side-by-side or the separated displays settings. The children reported that they could help each other and communicate more effectively when they were sitting "right beside each other" in the shared-display setting. The shared display supported concurrent, multi–user interactions around one monitor, and the children could share both a physical and virtual workspace.

In the separate display setting, the children would sometimes have trouble reaching a reciprocal understanding of the workspace. The lack of shared displays resulted in loss of eye-contact and less awareness of visual focus. The researchers concluded that when concurrent, multi-user interaction is supported by a sufficiently large shared display, children will collaborate in way similar to paper-based activities (Scott, Mandryk, & Inkpen, 2003).

In the present study, it would be most correct to label the screen-mediated dyadic collaboration as a side-by-side display with two laptop screens. However, one important difference is that Scott et al. (2003) had the children collaborate in front of large personal computers, which made it more difficult for students to have visual access to both monitors. By contrast in the present study, the students could position their small laptop screens close to each other so that both students could have visual access to each other´s screens without having to move their bodies. One can therefore claim that the laptop screens offer a combined use of both a (a) shared display and a (b) "side-by-side" display. When Scott et al. (2003) claim that traditional computer technology offers limited support for face-to-face, synchronous collaboration, one must not forget that this study had the children use large personal computers that were not portable. Today, most students use laptops, which are portable technical devices. As with the present study, students can choose whether they want to organize their work in dyads with access to a shared display. This depends on how they are seated in relation to each other. In the present study, the teacher did not explicitly encourage the students to work in pairs. Nevertheless, several students preferred to work like this instead of doing the task individually. While Scott et al. (2003) emphasize that students who want to collaborate need to adjust their interaction to the personal computers, the present study shows that the laptop as a physical artifact can to a large degree be adjusted so that it fits with how the students want to work.

[149] See section 7.6.1, Verbalizing specific screen operations, page 238.
[150] See section 7.6.3, Posing different questions about the ongoing work, page 248.

Nevertheless, the findings in the present study also reveal that the two small laptop screens limit "the shared display" to encompass only two students. There were few instances of small group collaboration with more than two students sitting together and sharing displays. It would usually be very difficult for three students sitting on a row to have visual access to all screens because of the physical distance from the different screens. Even though the laptop is portable, the small screen still limited sharing around the table. Most of the time, the students would remain seated in their chairs.

Likewise, studies of small screen devices, like personal digital assistants (PDAs), show that it is difficult for three or more members to be involved in the group work. The students who were not using the PDA are only watching the information on the screen most of the time. The sharing of information between group members becomes more difficult (Danesh, Inkpen, Lau, Shu, & Booth, 2001; Magerkurth & Tandler, 2002). When the collaborative activities are complex and involve more than two students, the students must crowd together to compete for the display of small handheld devices like PDAs. The lack of public spaces and a shared visual focus among group members inhibits group communication, and information sharing occurs only between a few members in the group (Liu & Kao, 2007). Another study, by Yang and Lin (2010), shows that if other group members want access to information on the screen, the person using the screen has to stop working. This person will usually point the screen towards the ones who want to see but will then be unable to continue the work on the device. One needs to wait until the other persons have finished looking at the screen.

Other studies indicate that it may be easier to use an iPad to share screens in small group collaboration (Falloon, 2015; Fisher, Lucas, & Galstyan, 2013). For example, Fisher et al. (2013) found that students who used iPads were more willing to share their screens and interact with each other's devices compared with when they used laptops. They claim that one reason is that the portability of the iPad is better. Some students responded that it was easier to show work on an iPad since one could move the device around and compare the work done on different iPads. In contrast, the laptop screens restricted the interactions to consist primarily of verbal discussions. It was hard for more than one person at a time to use the laptop.

Second, Fisher et al. (2013) suggest that the tactile and intuitive nature of iPad applications allowed for more collaboration. In contrast, the laptop screens made it easier for students to hide or conceal their activities from the rest of the group. Since the iPads were often left face up on the desks, the information on the screen was visible to the entire group. In this way the iPad served as a public center of communication in which multiple students could view, discuss, and interact with the device simultaneously. Also, in comparison with a laptop screen, more than one person could use the iPad at the same time (Fisher et al., 2013). However, these findings do not coincide with the findings in the present study, because some student dyads used the laptop screens together in a flexible way. One explanation can be that students were more interested in sitting next to each other in this particular study. Here, it is worth noting that many of the dyads consisted of the same students in most of the workshops. One reason may be that when students sit close to each other, this requires that the students know each other quite well in advance. There is some indication that the

quality of the group relationship improved as a result of the group interaction in itself. For example, in one episode a student first asked for permission to move over to another student, but she did not ask for the same permission the second time she went over.[151] Although this second visit was very brief, it indicates that interactional norms become more flexible as the collaboration evolves.

It also illustrates that it is not enough to just analyze the affordances of the technical device in the offline setting but that one also needs to include the positioning of the bodies in relation to the device. Nevertheless, the students in the present study seldom worked on one laptop screen at the same time, which is far easier to do with iPads. Fisher et al. (2013) describe how students can use technology in the offline setting in three different ways. First, the notion of "multi-use" describes how multiple students can interact with a single device. Second, the notion of "multi-view" describes how other students can only view the user's interactions with a device. Third, the notion of "single-use" describes how other students can only discuss the user's interactions with a device (Fisher et al., 2013). When the wiki in the present study was integrated with the laptop screen, the collaboration was primarily dominated by a combination of "multi-view" and "single view." There was little "multi-use," because the laptop is not made for this purpose. This could also have created more editing conflicts in the wiki if more than one person had edited the same page simultaneously.

10.1.2 Shared display at a plenary level in the offline setting

Concerning the use of a *shared display*, the interaction at the *plenary level* was very different from that of the student dyads. There were some incidents where students turned the laptop screen around to show others across the table what they were doing. For example, in one episode a student lifted her laptop and turned the screen around to show her work. Here the laptop was used as a portable object in the classroom environment.[152] Because it is possible to carry or move the laptop around in the classroom, the information on the screen can reach other students. However, the small size of the screen limits the outreach of this kind of help. The visual information on the screen was available only to a few students at a time.

Regarding this issue, several other studies show that a larger screen or shared display can help strengthen the collaboration between students. As noted by Liu and Kao (2007), most classrooms have projectors with displays that can support whole-class lecturing, but it is less common to have devices that support small-group activities beyond dyads. There have been attempts to solve this problem with small screens by using shared display groupware (SDG), which can support face-to-face collaboration through a shared display (Ryall, Forlines, Shen, & Morris, 2004; Scott et al., 2003; Stewart, Bederson, & Druin, 1999). For example, Liu and Kao (2007) examine face-to-face collaboration in one-to-one computing environments and explore whether group workspaces equipped with multiple shared LCDs could support collaborative learning. Students could easily display the screen of their handheld devices. The findings show that this resulted in the students interacting more closely with each other and exchanging more ideas (Liu & Kao, 2007). Although these groups were still quite small,

[151] See section 6.10, Observing others work, page 195.
[152] See section 7.5.4, Showing one's work to the rest of the group, page 226.

the findings indicate that a shared display is of value independent of group size. In a similar study, Liu et al. (2009) compare two learning scenarios with graduate students enrolled in a Statistics and Data Mining course. One group used only handheld devices (1:1 computing environment), while the other group used handheld devices integrated with LCD shared displays. The information provided by the handheld device remains in the private space until the students decide to publish the information to the rest of the group through a shared display. In the shared-display environment, the researchers found that the shared visual focus was higher. More students participated in discussion threads, and they reached more informed agreements on the basis of arguments and negotiations. On average, each shared visual focus involved 2.46 students in the shared-display setting compared with the significantly smaller average of 0.80 students in the 1:1 setting. The interaction was also more vibrant with more frequent hand-pointing behavior. Both the hand gestures and eye contact indicated a stronger degree of social presence and mutual awareness. The advantage was that all group members could access the same information. This made it easier to share information and discuss issues without being interrupted. In comparison, students in the 1:1 environment exhibited more fragmented communication patterns. They were more focused on using only their own devices. Also, most interactions occurred only between two students (C.-C. Liu et al., 2009). In the current study, the students did not have access to shared displays for small group work. It is possible that this would have stimulated a different form of group work.

Moreover, the students did not use other physical artifacts that could display information to all students in the class. Instead, the verbal discussions at a plenary level were conducted primarily without any support from a shared display. Both a projector and a blackboard were available in the classroom, but only once did the students use a projector to display information to all the students in the class. Then, one of the students summarized the collective work in front of the whole class. She gave a short presentation of the final design of the wiki page, but there were few comments or discussions of other topics.[153] Nor did any of the smaller groups present the work they had done for the whole class. One reason may have been that the students wanted to finish their work as fast as possible. Moreover, such plenary discussions of the collective work were not mandatory. Another explanation is that the teacher did not encourage them to use these tools. Perhaps the students felt that this was “teacher property” and that they were not allowed to use them.

Another explanation is that the students are used to remaining seated in their chairs. This is the “normal” behavior that is expected of them in the classroom. If they were to use the blackboard or the projector, they would have needed to move more freely around the room. The table was also positioned quite far away from the blackboard. In most of the workshops the students sat with their faces toward each other. This may have strengthened the feeling that one should not use tools or artifacts outside of the table area. The students might also have thought they were not allowed to move around because of the research project. At the same time, the video camera was positioned in such a way that it did not include the area with the blackboard and the projector. This may have reinforced the assumption that this was not an area of the classroom they should be in. Additionally, the teacher did not

[153] See section 7.5.5, The voice in a specific table arrangement, page 231.

encourage the students to use the blackboard or the projector at the beginning of the session.

One can therefore question whether the instructional design supported collaboration at a plenary level in a sufficient enough way. Although the goal of rearranging the table organization was to stimulate more discussions at a plenary level, this did not involve an emphasis on the use of shared displays. Here, one should note that the students were not particularly concerned about the lack of such displays in the group interviews. Although the interviewer did not ask any questions about this issue, no students mentioned this as a problem during the collective work. This indicates that the awareness of the importance of shared display for collaborative learning is low.

10.1.3 Sharing written work in an online setting

The student also helped each other by *sharing their written work in different transparent online settings*. This involved both academic work but also issues about project management. One example here is how the students, without the presence of the teacher, used Facebook to provide a better overview of the entire project management. Since many students checked Facebook several times a day, it is likely that all students read the different postings regularly. This increased the chances of receiving relevant feedback from someone in class who could answer a given question. According to Dalsgaard and Paulsen (2009), there are several advantages related to being open about the ongoing work in a transparent online learning environment. First, we may want to provide better quality when we know that others have access to the information and contributions we provide. Second, we may learn from others when we have access to other students' activities and contributions. Third, it is more likely that we will receive feedback from others when more students have access to our work. In a traditional learning management system, this transparency will usually be low, but with a wiki environment or with Facebook, the written comments and academic work will be visible to everyone in the learning environment.

However, some of the findings in the current study indicate that the students were not able to share their ongoing written work during the workshops in an effective way.[154] One reason is that the wiki application did not provide support for the synchronous collective work in real time in the workshop setting. For example, the students experienced an editing conflict in the final workshop when several of them began editing the same wiki simultaneously. As a consequence, the students decided to let just a few persons do the wiki work in the final workshop. Most of the other students just waited for these few persons to finish what they had to do.

One alternative could have been to use Google docs to support synchronous collaboration, but the students never raised this issue. One reason may have been that the students felt more obliged to only use the wiki since the assignments were defined as "wiki assignments." Second, the general lack of plenary discussions may have decreased the students' ability to refine their online tool strategy. Third, the students had previously experienced the tool as inefficient to use, because when all the students in the class accessed the same document it

[154] See section 7.7, Peer editing between students in the class, page 253.

became chaotic.[155] Too many traces of student activity were produced at the same time. Because of this lack of supportive digital tools, the students struggled to get an overview of the collective work. This lack of overview was also mentioned in several of the wiki studies in the review. During the workshops, the students instead used offline writing tools like Word (second assignment) or other individual applications. This made it more difficult to get an overview of what the other students in the class were doing.

In addition, the students used the wiki in a way that created a low degree of transparency. First, it became more difficult to get an overview of the individual contributions in the collective work, because not all students registered with user names. This made it easier to free ride with less risk of being discovered. Second, in the wiki assignment about rock carvings, the students did not publish much of their work before they met at the workshops. Instead of using the wiki as a collaborative tool, it was primarily used as a final publishing tool. Third, most students preferred to complete their work before they published it. They did not look upon it as draft versions that other students were supposed to change. The emphasis was rather on ensuring that their own contribution was a visible part of the total compilation of contributions (e.g., second wiki assignment). Fourth, the findings show that the students experienced a strong ownership over their work. It is therefore also possible that the students delayed the publication of their work to protect their work and ensure that no one made any changes to it. Even when students had done a lot of preparatory work before they met (first wiki assignment about the human body), they still did not use much time in the workshop sessions reviewing on each other´s contributions. One explanation may be that it would have taken too much time to look at the videos together. However, the students were not used to doing peer assessment, and it is therefore not surprising that they were cautious about letting others change their work. As a result, the sharing of written traces was low during the ongoing project work in this study.

[155] See section 6.1, Dividing the tasks, page 163.

10.2 Nurturing critical feedback

As a second conceptual trail, it is here suggested that *CKA as a pedagogical practice emerges through the nurturing of critical feedback*. The analysis of the germ cell showed how valuable critical feedback can be given both in very close as well as very distant, anonymous interactions. This type of communication builds on honesty and requires that there be no fear that the receiver of the help can be insulted. In the close relationship of the dyads, the students experienced a sense of mutual trust that permitted spontaneous and honest feedback. Critical remarks were given with few reservations. Anonymous interaction can be found at the other end of the scale of proximity. It was also effective in supporting critical feedback. The students had few problems being critical towards others' work if they knew they were anonymous. It will here be discussed how these very different interaction patterns can both facilitate critical feedback.

10.2.1 Close personal interaction in the offline setting

In the current study, the students were very comfortable giving each other help in the *close and personal interaction* of the small groups in *the offline setting*. When help was given within the framework of this close and informal relationship, there was an acceptance not only of critical feedback but also of "impolite" interruptions and overlapping speech.[156] The acceptance of this kind of "impoliteness" requires the presence of a high level of trust. The group interviews also show that the students assume that a basic requirement in effective peer learning is that students get to know each other. The students felt that this relational proximity was only present in the smaller groups.[157]

Interestingly, individual ownership over the work in these dyads was not present in the same way as in the large groups. One reason may be that when persons interact in close proximity during the whole process, they unconsciously experience the collaboration as being built on equal terms. The co-construction of an utterance is one example of dyadic interdependency in the working process.[158] When the number of group members was low, it was also easier to discuss the feedback and reach an agreement.

In sharp contrast, the lack of relational proximity in the large group in the offline setting made it difficult for the students to give each other critical feedback. Usually, the students felt the need to ask for permission to give help. In one incident, the students asked for permission to change another student's contribution, but this offer was rejected. This lack of approval appeared to reduce the quality of the collective work.[159] It is likely that the first student contributor had some sense of personal feelings attached to the work. When the student then suggested that the contribution should be removed, this signaled that the original work was not good enough. It put the original student contributor in a vulnerable position. As a consequence the student chose to be polite and not do anything.

[156] See section 7.6, Peer learning as the verbalization of ongoing thoughts and actions, page 237.
[157] See section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.
[158] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[159] See section 7.5.5, The voice in a specific table arrangement, page 231.

This episode illustrates that the students do not feel they automatically have the right to criticize other students' work. On the contrary, students are primarily used to receiving critical feedback from the teacher, who is assumed to have a much higher level of background knowledge. In peer assessment, students need to acknowledge that value of giving feedback in a more symmetrical academic relationship. One disadvantage is that the students will then not know if the feedback is of good quality. There is also a risk that the feedback can have a potentially negative influence on their work. They therefore also need to assess the quality of the feedback. Another issue is if the students are obliged to change their work after receiving this kind of feedback from their peers. Some students may resist this process, because they think it will lead to extra work and also that it is unclear if it adds value to their contribution. This may be one of the reasons why there was very little modification or removal of text produced by others.

When the relationships between the students are more distant, the students avoid giving each other feedback because they are afraid of being impolite or insulting others. The students report that they were cautious about not provoking others even when they thought they could improve others' work. It was viewed as difficult to criticize texts produced by one's peers, because the students wanted to be polite towards each other at the same time.[160] This was primarily a problem between the students in the whole class as a group, because then the students did not know each other well. Another disadvantage was that the students felt that the collaboration became more time-consuming and ineffective when the students needed to ask for permission to give help all the time.[161]

In the offline setting, effective collective work required closer relationships between the students compared with instructional designs that build on traditional lecturing or personalized learning. Regarding this issue, a major challenge with collaboration in large groups is that it takes much more time to establish a close relationship between all the students. When students, like in the current study, only meet with each other once or twice a week and the course period is short, one can question whether students really have enough time to develop the same kind of mutual trust as they do in small groups. Some students reported that several courses in the teacher education program are too short. It also requires extra time to establish trust between pre-service students who are young and have little teaching experience and the in-service students who have already had many years of teaching experience. Another potential disadvantage is that a stronger emphasis on team skills and group formation risks stealing valuable academic time. Since the course in the current study was optional and not part of the obligatory teacher training program, the students were not so interested in developing this kind of trust. Many of the students would not see each other again after the course was over.

Note that few of the studies in the review highlight the importance of close and trustful relationships in collective work. One reason may be that the relational challenge is less of a problem, because students either work individually or in small groups. The current study also shows that the relations between the students in the smaller groups were usually good but that this was more of a problem in the whole-class project. To a large degree, the whole class project also ended up as small group collaboration. The students did not spend much

[160] See section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.
[161] See section 7.2, The size of the group has an influence on peer learning, page 204.

time on verbal discussions at a plenary level, nor did the teacher facilitate any trust-building processes between students in the whole-class project. It is therefore not surprising that the students ended up with a way of collaborating that was quite similar to how they were used to working.

10.2.2 Anonymous interaction in the online setting

In the current study, there were several examples of successful anonymous interaction in *the online setting*. Here, three different types will be discussed. *First*, students can interact anonymously with students who have previously taken the course. In the present study, this happened when students continued to build on past students' work in both Wikibook assignments (first and third wiki assignments). It was usually impossible to identify who had made the previous contributions in the wiki log, because the previous students had seldom registered with their full names. As a consequence, the students felt that they were improving a collective text that was anonymous. Even though these authors were unknown to others, the students knew that they had previously been students in the course. Most students had no negative feelings about this type of extended peer editing. It was much easier to edit others' work when they did not know the authors and they were no longer present in the online environment. In the workshop setting, they were able to give honest and critical comments regarding the content in the initial wiki version.[162] In sharp contrast, they felt it was much more difficult to give critical feedback to students who were present in class and who they did not know well.[163]

Second, students can be anonymous when they interact with outsiders in an online setting. In the present study, most students chose to be anonymous when they published their work in an open environment. One possible reason is that the students might have thought that they were expected to make anonymous contributions in the global wiki environments. They did not receive any information about this issue in advance. Since the previous students who had done wiki work had not revealed any personal information, the new students just followed the same norm.

In comparison with other online environments, there is less emphasis on being registered with your full name in global wiki environments. For example, in the present study, the students were registered with their full name when they published images (Flickr and Wikimedia Commons). The students were also personally identifiable when they were part of an instructional video they published on YouTube. One possible explanation for these differences is that it is a safer to be anonymous if you are unsure about the quality of your work. For example, the students who produced the Wikipedia article informed that the article was part of a mandatory assignment in a course, but no specific information was revealed that could identify where this course was located. Since Wikipedia is a vibrant online community, the students knew that it was more likely that they would receive feedback on their work. It is also likely that the type of feedback the students received was adjusted according to the information that this was a mandatory part of an assignment. For

[162] See section 7.9.1, Building on the work of an anonymous group of outsiders, page 261 and see section 7.8.2 Removing text made by former students, page 256.
[163] See section 7.1, The peer relationship has an influence on the quality of the peer learning, page 201.

example, the students received suggestions both on how to improve their work and also a significant amount of praise for their efforts. On the other hand, the group interviews show that the students experienced the critical feedback as unpleasant even when they were anonymous.[164]

One of the disadvantages is that the student authors receive less personal acknowledgement when they are anonymous. However, note that the students who produced the Wikipedia article were still very proud of their work. The pride was connected to a feeling that the work was of societal value. When the emphasis was on societal responsibility, it mattered less that the work was done anonymously.[165] In sharp contrast, the students were preoccupied with personally identifiable contributions regarding the final exam and the individual grades they would receive.[166] As a consequence, the best solution is perhaps to let the work be personally identifiable in relation to the formal assessment and anonymous in relation to the open online setting. The same work will then serve two different purposes that are clearly separated from each other.

Third, the outsiders who interact with the students can be anonymous. For example, in the present study the students received critical feedback from Wikipedians. Some used their full names, while others used anonymous nicknames. In their relation to the students, all were "unknown others." On the positive side, this feedback challenged the students' academic work in a fundamental way. The feedback culture is in some ways similar to peer review processes in academic journals. For example, both the students and the Wikipedians were anonymous in relation to each other. Likewise, the mechanisms of quality assurance in scholarly journals build on a "double blind" peer review policy. The reviewers of the paper do not get to know the identity of the author(s), and the author(s) do not get to know the identity of the reviewer. The goal is to give unbiased and honest feedback on how to improve the work. Not so differently, the students received specific suggestions on how they could improve the Wikipedia article.[167]

Other studies also show that one can receive valuable feedback from outsiders. For example, Rebecca Black (2008) found that editorial feedback in online fan fiction writing spaces helped contributors improve their writing skills. These fan writers not only received help with grammar and narrative structure, but they also received feedback on the content. Many editors engage in powerful learning processes when they give this kind of feedback to others. One difference is that members in these fan communities are usually more socially connected with each other compared with the Wikipedia community.

However, more uncertainty will follow about the level of quality of the feedback from an anonymous outsider. In open global wiki environments, anyone can in principle give feedback. The students will therefore need to be more critical toward the feedback they get. Even though the students in the present study did not question the quality of the feedback they received from the Wikipedians, they still needed to accept it as important enough for them to change their work. This is very different from teacher feedback, which is built

[164] See section 7.3, Anonymity has an influence on peer learning, page 208.
[165] See section 5.3, Producing knowledge for a "global" audience, page 138.
[166] See section 6.8, The problem with unequal contributions, page 182.
[167] See section 7.9.2, Outsider feedback, page 263.

around this person having superior knowledge and the students being obliged to follow the advice that is given.

As such, the formal teacher in the course also lost some degree of control over the feedback process. Even though the quality of the outsider feedback in the current study was good, there will always be the risk that students can receive poor feedback in open environments. This cannot be planned for in advance. There might also be a potential conflict between the goal of the course assignment and the goal of producing a good article in a global online community. For example, one study in the review shows that the students were encouraged to use primary sources by their formal teacher but that the Wikipedians instead recommended the use of secondary sources in the encyclopedia articles.[168] Feedback from multiple persons outside of the formal educational setting can therefore also create more confusion among the students.

Still, it is obvious in the present study that some Wikipedians gave valuable academic feedback to the students. Because the critical feedback was perceived as relevant, it had a positive influence on the students' motivation to improve the work. As a consequence, the small group of students who worked with the article asked for more time to finish the project. They continued several weeks after the original deadline, doing much more work than the rest of the students in the class. Part of the problem here was that the students had a very short time period to do the work (one week). If they had been given more time in advance, it may not have been necessary to extend the deadline.

In any case, CKA challenges our conceptions of how teaching can happen in an online setting. It is not yet clear what kind of status these outsiders or "unknown others" should have, since they are not part of the formal educational system. Even though this outsider feedback can be defined as some kind of informal teaching, it is perhaps not correct to label the outsiders as teachers, since they do not provide systematic feedback to the students over a longer time period. Instead, the connection between the students and the Wikipedians was rather weak, because the interaction was anonymous and brief. Some Wikipedians did not even give feedback but instead just edited the text directly.

Even when the help from the Wikipedians was directed specifically toward the students, there was no guarantee that the critical comments would be followed up on. However, by publishing the comments openly on the wiki discussion page, others could also follow up on the outsider feedback at a later point in time. In this way, help is left as a trace in the online environment as a future opportunity of improvement for anyone who wants to continue to work with the article. In addition, others can potentially later criticize or discuss the quality of the feedback in itself.

Regarding the instructional design, one can argue that the main challenge is to ensure that the process of receiving outsider feedback is perceived as fair. For example, if small groups of students publish separate articles on Wikipedia, it will probably vary quite a lot as to how much feedback students receive from outsiders. This does not only depend on how vibrant the online community is but also on how interesting outsiders find the specific work that

[168] See section 2.5.2, Outsider feedback, page 41.

students have done. It is far from certain that all students will receive feedback even when they ask for it. There is also no guarantee that the feedback from the outsiders will be sensitive to student needs. Even though the students in the present study found the outsider feedback to be relevant, some still felt that it was quite unpleasant. Anonymous feedback can also be harsher, and there is a risk that it might influence student motivation in a negative way. It is inevitable that such instructional designs will create differences between students regarding both the quality of the feedback and how much feedback they receive. When some students receive relevant feedback while others do not, one needs to ensure that the students still end up feeling that the learning process is fair.

10.3 Learning by teaching

10.3.1 Turning the learner into a teacher

When help is identified as the key resource in a pedagogical practice that supports CKA, it becomes vital to increase *the availability of help*. In most educational settings, the notion of "giving help" is usually associated with the practice of teaching. Normally, the formal teacher is considered to be the primary giver of help, and the students are the receivers of this help. Usually, a teacher will be paid to give help, while the students need to attend class to receive this help.

This help can be given in many different ways. In transmission-orientated pedagogy, students typically ask for help from the teacher. The teacher is assumed to be the expert and is considered to be the best person to quickly provide the correct answer. Even though students often need to request help, the teacher cannot deny anyone this opportunity. However, with this division of labor only a limited amount of help will be available, because it is time-consuming to help one student at a time. As a consequence, the teacher instead attempts to deliver the same message to a larger group of students. The problem with this type of help is that it is not adjusted to students' individual needs.

As a consequence, it becomes important to design new instructional models that can strengthen the availability of help in both an offline and an online setting. One solution can therefore be to assign the learners as helpers for each other. If teaching is conceptualized as a powerful way of learning, the learner can also teach in a formal educational setting. These pedagogical perspectives are not new. For example, Maria Montessori was aware of the potential in letting learners be teachers for each other:

> People sometimes fear that if a child of five gives lessons, this will hold him back in his own progress. But, in the first place, he does not teach all the time and his freedom is respected. Secondly, teaching helps him to understand what he knows even better than before. He has to analyze and rearrange his little store of knowledge before he can pass it on. So his sacrifice does not go unrewarded. (Montessori, 1995, p. 227)

Here, "learning by teaching" is less about learning something new but is instead more about improving your understanding of what you already know from before. The perhaps most radical part of this statement is the idea that even small children can be teachers for each other. It is therefore suggested that *CKA as a pedagogical practice emerges through "learning by teaching."* Some researchers label this learning activity "peer teaching." For example, Puchner (2003) defines it as any activity where students take on a teaching role in the school setting. This involves doing activities that are associated with what formal teachers normally do to facilitate, guide, or cause learning. It also involves teaching-like behaviors even when this is not the explicit intent. This includes demonstrating, telling, or explaining material to others as well as asking questions of others to assess or bring about understanding (Puchner, 2003). Note that peer teaching does not have to take place at a plenary level but can also happen in smaller groups. The peer teaching period can also vary a lot. In principle, this time period can range from being a whole lesson, the time needed for a

special activity, or the time needed to answer a question in the ongoing group work (Hanke, 2012).

The data in the current study also show that "learning by teaching" can happen in several different ways. There were examples of peer teaching in both small groups and in the whole class. In addition, one could claim that the students were teachers for unknown others in the online setting. The table below gives an overview of the *three different types of "learning by teaching"* that will be discussed in the following sections.

Table 10.3.a Overview of different types of "learning by teaching"

Different types of "learning by teaching"	**Interplay between offline vs. online setting**
1. Peer teaching in small groups	Offline setting is most important.
2. Peer teaching that involves all students in the class	Requires the use of both an offline and an online setting, but within a restricted environment.
3. Teaching unknown others	Online setting is most important.

10.3.2 Peer teaching in small groups

First, the findings in the current study show that "learning by teaching" took place as *peer teaching in small groups or dyads*. The students were continuously helping each other as a part of the ongoing interaction in the dyads.[169] Likewise, Whitman and Fife (1988) also find that peer teaching can happen in a one-to-one relationships when two students interact as both teacher and learner. The students are then at the same level and alternate asking and answering questions. At one level, one can interpret peer teaching in small groups as being on a micro level of interaction. It is dialogical in its emphasis on mutual participation. Not so differently, Nicol (2010) suggests that peer feedback should be regarded as a dialogical process rather than as a monologue. One needs to move away from a narrow focus on the feedback comments and instead emphasize the nature of student engagement in different contexts. The different types of feedback should be an integral part of the whole learning environment. When students complain about the irrelevance of peer feedback, this may be due to the lack of dialogue in the process. The feedback is more likely to be accepted if there is a shared context for the assessment task, and the comments are provided in response to a specific student request.

In accordance with peer teaching in small groups, Nicol (2010) suggests that one way of improving the richness of feedback dialogue is to get students to work together collaboratively to produce the assignment. Student will then give feedback to each other while they are writing together. They will analyze each other's writing and detect problems in understanding, and, in the writing process, they will make suggestions for improvement. In this type of collaboration, all students will occasionally teach others when they give feedback. However, the feedback will then to a larger degree be used to co-construct a text

[169] See section 7.6, Peer learning as the verbalization of ongoing thoughts and actions, page 237.

as a part of the ongoing work rather than giving feedback on the separate work the students are doing. In this example, both the producer and the receiver of the feedback will inevitably be connected to the specific learning task. Since the feedback emerges as a need in the ongoing work, it is also more likely that it will be perceived as relevant (Nicol, 2010).

In a similar way, the informal teaching in the present study did not consist of separate written or spoken comments but was rather a part of the ongoing dialogue. At this interaction level, the peer teaching usually consisted of short instructions or explanations on what to do. The use of verbal language was to a large degree mediated by the joint operations around one or two laptop screens. As a consequence, the peer teaching would sometimes be less about making an explicit explanation but rather about verbalizing thoughts while operating on the screen.[170] The learners then help each other when there is a demand while they are solving the learning tasks (e.g., Henze, 1992). This informal peer teaching is not planned in advance but rather addresses a problem when it happens. Although the students did not move into a clearly defined teacher role, they gave explanations that illustrated teaching-like behaviors (Puchner, 2003).

The present study also shows that peer teaching can build on observational learning. Here, peer modeling is defined as the provision of desirable learning behavior by the peer teacher with the intention that others in the group will imitate it (Schunk, 1998; Topping & Ehly, 1998, p. 6). Observing how others do things heightens awareness of how you do things, through comparison and contrast (Topping & Ehly, 1998, p. 6). For example, it was sometimes enough for the student to observe what the "peer teacher" was doing on the laptop screen. This peer modeling was primarily related to imitating how students used the wiki during the ongoing wiki work. However, there were only a few examples of the students entering the role of being a teacher over a sustained period of time. In one episode, a student helps two other students over a period of 12 minutes.[171] Here, the helping roles are defined with one of the students being the helper and the two others being the receivers of this help. On one hand, the episode shows that one of the students really wanted the two other students to learn how to use the wiki. On the other hand, this type of peer modeling could delay the teaching student´s progress, but this was not so much of a problem since the guidance was given while the student was working.

In the dyads, it was much easier to continuously observe each other's work. This also involved an element of peer monitoring, which is here defined as "Peers observing and checking the process learning behaviors of others in the group with respect to appropriateness and effectiveness" (Topping & Ehly, 1998, p. 8). One example is how some students were keeping an eye on each other's work through the constant verbalization of their thoughts while they were operating their laptop screens.[172] The feedback that the students were given on their study behaviors enabled them to better self-regulate their actions toward the desired goal. This included the use of both questioning and suggestive feedback.[173]

[170] See section 7.6.1, Verbalizing specific screen operations, page 238.
[171] See section 6.10, Observing others work, page 195.
[172] See section 7.6.1, Verbalizing specific screen operations, page 238.
[173] See section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242, and section 7.6.3, Posing different questions about the ongoing work, page 248.

Even though the peer teacher may provide help of less quality than a professional teacher, there are significant benefits in the increase in the amount and the immediacy of the feedback. The value of peer teaching is not only about gaining specific target skill gains, but the aim is also to empower the students in their ability to manage their own learning (Topping & Ehly, 1998, p. 4). There are also some other studies showing that informal peer teaching can have a positive influence. One example is the peer instruction (PI) method that Eric Manzur developed in his lectures about physics. The goal is to let students more actively explore the fundamental concepts in the academic subject during the lectures. The teacher poses different conceptual questions to the students. In the first round, the students are given the opportunity to discover and correct their misunderstandings of the material individually. In the second round, which typically lasts two to four minutes, students are challenged to explain important concepts to fellow students. In this way, the students learn the key ideas of physics from one another. They usually engage in the second round of discussions when the percentage of correct responses in the whole group is roughly from 35% to 70% in the first individual response round. This response percentage leads to the most effective discussions later when students also are encouraged to find someone with a different answer (Crouch et al., 2007). The explanations in peer teaching are different, because the students try to explain something to fellow students who do not have the correct answer. In contrast, the students expect to get the correct answer when they communicate with the teacher.

According to Crouch (2007), the instructor's explanations will usually be the most direct route from question to answer and be the most efficient in terms of words and time. Although an explanation from a student will be less direct, it will often be much more effective at convincing a fellow student. In the peer discussions, the students are encouraged to try to convince each other by explaining the reasons behind the answer they have given. The feedback from peers makes it possible for all the students to assess their understanding of the concept. It helps their thinking, as they are forced to explain their answer in their own words (Crouch et al., 2007). Sometimes the student also offers a completely different perspective on the problem. In this way, the students can actually teach the teacher how to teach. Instructors can better understand the problems that students face by listening to students who reason their way to the wrong answer (Crouch et al., 2007). Furthermore, Schwenk and Whitman (1987) claim that the more competent peer can better adjust the teaching to individual learning challenges, because this person has just recently gone through the same learning process (Schwenk & Whitman, 1987).

10.3.3 Peer teaching that involves all students in the class

Second, the findings in the current study show that "learning by teaching" can be done as *peer teaching in the whole class*. Although there was not much of this type of peer teaching in the present study, one student in the group interviews explains how a new instructional design could be built around this pedagogical idea. The student suggests that the whole community of learners should be teachers for each other. All students will then need to be given time and opportunity to acquire new individual skills according to their interests. The student suggests that the division of tasks should be done according to learning needs rather than according to students' existing individual expertise or ability. Initially, one would

therefore have to map the students' individual learning needs and organize their work accordingly. In the first phase, the students acquire new skills. In the second phase, they use this expertise to help other students.

When peers consciously assist each other in learning in this way, it can be regarded as a more formal way of peer teaching. According to Hanke (2012), a student can take on the role of a teacher during the whole course. On the other hand, the roles can be switched more occasionally. The learner then takes the role of a teacher only for some specific activities and then returns to the role of being a student. However, the innovation in with the proposed instruction design in the present is that it involves all students, who all become "near peers" in relation to each other. The students perceived that one of the challenges with the instructional design was that they all had approximately the same level of background knowledge. The students felt that this made it more difficult to help each other. With "near peers", the point is instead to ensure that there are differences in background knowledge between the students who participate in the same course (Whitman & Fife, 1988).

Note also that by suggesting that all students should teach each other specific skills, the student in the group interview transforms the idea of "the student as a teacher" into "the students as being teachers for each other." From one perspective, this instructional model builds on the establishment of a community of learners (e.g., Lave & Wenger, 1991). However, in this case the emphasis is not on all students being learners but on all students being teachers for each other. Because the students are specialists within different areas, this will only increase the amount of available help. In comparison, when only the teacher is expected to be the helper, help as a resource will be much more constrained. While there have been a number of attempts to redefine the learning concept in recent years (Engeström, 1987; Lave & Wenger, 1991), fewer theories have attempted to connect learning closer to teaching as a concept.

As suggested by the student in the present study, there is a significant amount of learning in developing sufficient expertise in one area to be able to teach it to others. Likewise, some studies find that cognitive learning processes are beneficiary when learners learn for the purpose of teaching others (Bargh & Schul, 1980) (Benware & Deci, 1984). For example, in a study by Benware and Deci (1984), learners who studied the material with the intention of teaching it were more interested in the content compared with students who just studied the material to be tested. One explanation is that students become more intrinsically motivated when they are expected to teach others (Benware & Deci, 1984). Another explanation is that the verbalization of thoughts supports the learning process (Annis, 1983). It is also suggested that there are more benefits in verbalizing for the purpose of helping another person compared with just demonstrating self-mastery of the material (Durling & Schick, 1976). Gartner, Kohler, and Riessman (1971) claim there are several beneficial cognitive processes. First, the peer teacher must review the material and might then grasp the content more fully or deeply. Second, the peer teacher must organize the material so that it can be presented in an understandable way. In this process, the peer teacher might try to find new examples and illustrations that help explain the material. By teaching the subject, one might also become conscious about it from a different perspective (Gartner et al., 1971). All these studies indicate that one of main advantages of peer teaching is that the teachers will be engaged in learning themselves.

Furthermore, the peer instructional model is also an example of how the students felt that they could share responsibility in a more effective way. Likewise, some research studies also suggest that the peer helping interaction is qualitatively different from that of a teacher and a student. The peers can model enthusiasm and cooperation, and they can show that something is possible even when students have no belief in their capability (Topping & Ehly, 1998). In one study, by Stecz (2009), every student in one class participated in peer teaching in other classes. By assuming the role of "teacher," the students took on a range of teacher characteristics, such as status, authority, self-perceptions, and attitudes. This responsibility prompted action rather than passivity. Even reluctant learners were energized by the idea that others, "novices," were dependent on them for assistance. These students also taught subjects that were new to everyone. In this way, existing skills were not viewed as important. All students were first positioned as new learners and then as experienced teachers. This allowed new leadership to evolve, because the students were not prejudged in regard to how they were expected to perform in this new context (Stecz, 2009). This instructional design is strikingly similar with the peer instructional model that the student proposed in the present study. It indicates the potential of moving towards such new models that emphasize peer teaching. According to one of the students in the present study, all humans have a "natural desire" to teach others what they know. Nevertheless, even in teacher education, it is likely that learning by teaching has been underutilized as a pedagogical practice in teacher education.

Furthermore, the present study clearly showed that it becomes a problem if only a few students act as peer teachers. The students found it unfair that some had to help their peers more than others. This created a conflict between doing the assigned task and helping others. For example, in the present study, only a few of the students were considered to be experts on the wiki technology.[174] Likewise, other studies have also highlighted the importance of equal-opportunity involvement in peer teaching (Cook, Cook, & Cook, 2017; Delquadri, Greenwood, Whorton, Carta, & Hall, 1986). When the instructional model instead builds on all students being peer teachers, it is less of a problem that some students get too much extra work.

Another weakness in the instructional design in the present study was the lack of peer assessment. Here, it can be defined as "Peers formatively and qualitatively evaluating the products or outcomes of the learning of others in the group" (Topping & Ehly, 1998, p. 8-9). This feedback is usually intended to be formative in the way that it enables the learners to improve their performance. This can include writing, oral presentations, portfolios, test performance, or other skilled behaviors (Topping & Ehly, 1998; Topping, 2009).

Most of the work in the present study was done in separate smaller groups, and there were not many attempts to do any kind of peer assessment. For example, there were few presentations of what had been done in the small group at a plenary level. There is only one incident where a student summarized some of the project work in front of the rest of the class. Both the presentation and the discussion were brief.[175] As a consequence, the collective text product ended up as primarily a compilation of the work in the small groups.

[174] See section 6.2, Unequal sharing of workload, page 167.
[175] See section 7.5.5 The voice in a specific table arrangement, page 231.

There was a lack of review mechanisms, and this made the overall quality of the collective text less certain.

According to Topping (2009), one of the most significant qualities of peer feedback is that it is plentiful, because it is available in greater volume. Because there will usually be more students than teachers in classrooms, the feedback from peers can be more immediate and individualized. Peer assessment can also support students in planning their learning, identifying their strengths and weaknesses, targeting areas for remedial action, and developing metacognitive and other personal and professional skills. Students also react differently to feedback from teachers compared with that from their peers. The feedback from the teacher will usually be perceived as authoritative, while the feedback from one's fellow student will be richer and more open to negotiation (Topping, 2009).

One explanation why there was no peer assessment in the present study, is that the lack of time. It was difficult to organize any peer assessment, because the students had to follow the tight schedule the teacher had set in advance. Nor did the teacher encourage the students to do any type of peer assessment. Even though peer assessment does not require teachers' time in giving feedback, it is still necessary to use time to organize both the training and monitoring of the students. According to Topping (2009), students also need to learn how to give constructive feedback. If the peer feedback is supplementary, rather than substitutional, it is likely that there will be no time saving at all.

10.3.4 Teaching unknown others

Third, the findings in the current study show that "learning by teaching" can take place through *teaching unknown others in an online setting*. In the present study, this type of teaching is done when students share their work in different online environments. For example, the instructional video published on YouTube has had a large number of "unknown" viewers. In this online setting, the students who took part in creating the video can be regarded as teachers when they address different issues in the video. As the description of the germ cell shows, the students offer "help without request" to a large undifferentiated target group of unknown others. Another example is the students who wrote the Wikipedia article. They were very proud of their achievement, because they had made a societal contribution. Interestingly, few of these students felt uncomfortable in this role.

One reason may be that open sharing is an important part of the Internet culture (Castells, 2001; Himanen, 2001). On the more negative side, the students had mixed opinions about their own role of being knowledge producers teaching unknown others in this setting. Several students suggested that this kind of work would primarily be relevant for the enthusiasts.[176] Moreover, there is no indication that the students have continued to work with these learning resources after the course. In addition, most teachers are not used to producing and sharing digital resources. They primarily use learning resources created by publishers and expert authors. Historically, this type of work has not been considered a part of teachers' professional work. Even though it has become very easy to share resources in an

[176] See section 5.2, Supporting the development of professional teacher knowledge, page 135.

open online setting, there are also few incentives in the educational system that promoted this kind of work. For example, some of the student teachers claimed that they were not interested in sharing if they did not get anything in return.[177]

[177] See section 5.2.2, Sharing within the school, page 136.

10.4 The teacher educator as a team coach

When the germ cell has been identified as help, a fundamental question is what the role of the formal teacher or the teacher educator should be. This person will normally be perceived as the primary helper. However, it is evident that CKA requires a stronger focus on student collaboration, but it is less clear how the teacher can support the ongoing project work. Likewise, several of the researchers in the review report that the role of the teacher is usually not emphasized in the analysis in technology-orientated studies (Lund & Smørdal, 2006; O'Shea et al., 2011). It is not clear what role the teacher educator can have in technology-rich learning settings (Lund, Furberg, Bakken, & Engelien, 2014).

Moreover, the wiki studies in the review reveal different positions concerning how much help the teacher should give. While some course designs build on a teacherless learning environment, other studies show that the teacher is more in control. In the current study, the support from the teacher educator was not entirely removed, but it was reduced and changed character. At the same time, the students were unsure about how to manage the project when the teacher moved into the background and gave the students little support. On the other hand, the teacher still directed important parts of the project management in the second and the third wiki assignments. However, some of the data show that the teacher control became too strong. Nevertheless, the teacher educator needs to give some degree of support to the students in the ongoing work. It is here suggested that this support should build on a conception of the student group as a team. *CKA will then emerge through the constitution of the teacher educator as a team coach*. The role of the teacher educator will not necessarily be to maximize performance but rather how to best facilitate "learning by teaching" in both the offline and online settings during the project period.[178] Three different teacher challenges will be discussed in the following sections.

10.4.1 Ensuring equal participation

The first challenge is that *the teacher educator needs to ensure equal participation in the student group*. The findings from this research study show that students struggled with this management issue in the large self-organized student group.[179] On one hand, a large group can utilize diversity. However, as the group size increases, it becomes increasingly more difficult to directly coordinate this kind of collective work. Researchers like Johnson & Johnson (1984, pp. 30-31) suggest that groups in an offline setting should not exceed the size of six members. Groups that are bigger will be significantly more difficult to coordinate, and the members will not be able to give each other enough support. Likewise, many of the students in the current study complained that the group size in the whole-class project was too big. They did not feel that increasing the group size improved the group's performance. The students also ended up dividing the work and letting smaller groups work separately from each other. It was also difficult for the students to get an overview of all the work that was being done. This required an additional use of time.

[178] See section 10.3, Learning by teaching, page 333.
[179] See section 7.2, The size of the group has an influence on peer learning, page 204.

Another problem was that the students lacked experience on how to collaborate in these large groups. This issue of team skills was addressed by the teacher educator simply through "teaching as telling." There were no discussions on how the students could manage the work. Even though this was a new way of working, the students were required to find out how to do it on their own. Although the teacher retook some of the control during the course work, the basic assumption was that the students were supposed to design their own group without guidance from the teacher educator. Likewise, other studies from teacher education show that it is important that the teacher educator create supportive structures to facilitate a specific type of group work. For example, Berry (2004, p. 1321) refers to Grimmett (1997), who encouraged all student-teachers in his course to participate in a spontaneous free-flowing discussion, but he soon discovered that this did not happen by itself. To secure an equitable distribution of student participation, the teacher had to create structures that supported equal student access to the discussions. One strategy can be to establish more explicit collaborative norms on the different roles in the project during the initial phase. For example, in a design-based research study by Zheng et al. (2015), the researchers ended up recommending that the group members need to have specific roles and also a leader. This was important for improving the intra-group collaboration and strengthening the group's ability to work toward a shared goal. Group leaders were told to divide the task into smaller sections and make sure each that each member has a task to do. This was done by either dividing the work into manageable sub-topics or by role (e.g., "writer," "editor," and "researcher"). The group leaders also organized the offline and online communication.

The teacher educator also needs to have a strategy on how to establish a community of learners who are teachers for each other.[180] One of the students in the group interviews suggested that this can be done by ensuring that tasks are divided according to students' individual learning desires and not according to the principle of "getting the work done as fast as possible." This requires that the students agree upon how this should be done in a course. In addition, digital tools should give the students and the teacher a simple overview of all the work that is going on.

Usually the teacher will have a comprehensive overview of all the tasks. However, one can question if it is worthwhile for students to use extra time to acquire the same degree of information about the collective work. Although Web 2.0 environments permit free riding and the unconditional reuse of others' material, Dohn (2009) emphasizes that students still think it is important that every student makes a minimum contribution in the group work. It can even be a problem if some students are annoyed about the lack of effort by their peers.

10.4.2 Creating acceptance of discomfort

The second challenge is that *the teacher educator needs to create some degree of acceptance of discomfort*. In the current study, the students worried about criticizing each other's work. One reason was they did not want to offend each other. As a consequence, students often had to ask each other for permission before they could do peer editing of others' work. This made the collective work less efficient. In the teacher education context,

[180] See section 10.3.3, Peer teaching that involves all students in the class, page 336.

Berry (2004) also describes a similar tension between discomfort and challenge. An inquiry-orientated pedagogy will often confront the rules of politeness that usually guide the way the student teachers and teacher educators give each other feedback. For example, Berry (2004, p. 1323) refers to Berry and Loughran (2002), who applied this inquiry-orientated pedagogy in microteaching situations. This form of teaching is riskier because the students' self-esteem is at stake as is the teacher educators' credibility. On one hand, the teacher educator will experience tension between engaging students in a confrontational pedagogy versus the risk of being hurtful. On the other hand, the students will experience a tension between a constructive and an uncomfortable learning experience. To succeed, the teacher educator will need to support the group's ability to give critical peer feedback to each other. This can be done by discussing the topic explicitly or by modeling how it can be done. In regard to organizing critical feedback between students in the current study, the findings show that the teacher educator gave no support on this matter. It illustrates that students will avoid being confrontational if they can choose themselves. It was also more difficult to give critical feedback because the relationship was neither close enough nor completely anonymous.[181]

10.4.3 Balancing the students' responsibilities with those of the teacher

The third challenge is that *the teacher educator needs to balance the students´ responsibilities with the formal teacher's responsibilities*. In the current study, the teacher educator gave very little academic feedback to the students during their work. One can question whether this was the correct thing to do when there was a lack of formal peer feedback at a plenary level. The students would have needed more help to organize these processes.

On one hand, the current study also shows that the students wanted the teacher to take charge again during the last phase of the project work. In the final workshop in the third wiki assignment, the teacher educator had to retake control during most of the workshop. In addition the students were unanimous in their wish to return to lecturing during the remainder of the course work.[182] Likewise, other studies on teacher education have shown that a common tension arises between teachers' transmission of content and their support of students' learning processes. Berry (2004) describes this as a tension between telling vs. growth. This challenge is described as an attempt to balance the teacher educators' desire to tell the student teachers what they consider to be important versus providing opportunities for students to find this out on their own. Student teachers need to be challenged to grow, but they will also need information. Managing this growth dimension can be difficult, because many student teachers will want to be told what works, and teacher educators also want to be helpful. This is why the lecture method or direct instruction is so easily reinforced (Berry, 2004, p. 1314). This was evident in the current study when the students wanted to return to lecturing, and the teacher educator also chose to acquiesce to their wish.

A similar challenge is mentioned by Dohn (2009), who perceived that students in tertiary education prefer to obtain an answer from the teacher instead of discussing their work with

[181] See more in section 10.2, Nurturing critical feedback, page 327.
[182] See section 6.8, The problem with unequal contributions, page 182.

peers. When the teacher responds, the discussion will usually end because these comments are considered to be “expert knowledge.” As a result, teacher involvement usually inhibited openness, students’ shared responsibility, and the dynamics of the knowledge production process. There is a tension between letting students’ collective work unfold itself and the teacher’s urge to answer student requests. If students are left to co-organize their learning, they fear that they will not receive accurate feedback before the exam (Dohn, 2009). It is evident in the current study that the students also wanted a return to the teacher educator’s “expert knowledge” after they had finished their wiki assignments. This was perceived as important so that they could be able to prepare themselves in the best possible way before the exam.

Kim (2015) claims that teachers need to carefully plan the course design. Too much scaffolding might inhibit students’ voluntary participation, while too little support might create too many technical difficulties on the use of the wiki. Regarding this issue, there is also evidence in the present study that the students received too little support on technical problems. However, in relation to the project management, some episodes reveal a significant element of indirect hidden teacher control of the project work. The video data show that even though the students felt they were in control, there were significant elements of “knowledge telling” in the workshop sessions when the teacher educator decided to instruct the students directly on how to manage the project. The teacher educator struggled to transfer responsibility to the students and move out of the role of “teaching as telling.” Similarly, in a self-study in teacher education, Berry (2004, p. 1315) began to realize the discrepancy between her ideas about good teaching and her emotional tie to lecturing. Teaching as telling is difficult to resist not only because it seems right, but it is also easy to do. One can therefore question whether the students really were offered an opportunity to develop their own responsibility in a profound way.

The teacher also gave detailed instructions related to the assignments. For example, in the first assignment the students were free to include whatever new video resources they might find, but at the same time the assignment gave detailed prescriptions on what the students were supposed to do. In the second wiki assignment, the students were also assigned to work with one specific topic. In the third assignment, the students were free to make whatever revisions they preferred, but the existing text was quite extensive and directed the opportunities for further improvements. This is why it to some degree limited what the students could do, because they would have to continue to build on this text. In none of the wiki assignments could the students freely choose a topic according to their interests. As a consequence, although the teacher was not always actively present in the workshop, he still executed a large degree of control through the detailed instructions related to several of the wiki assignments. In addition, the teacher had specified what kind of technology the students were supposed to use (wikis and Google Docs).

One can question whether these detailed instructional guidelines support the students’ ability to share responsibility in an effective way. The students received a lot of instructions, both on what they were to do and how they were supposed to collaborate. In sharp contrast, they were to a large degree left to do the work on their own afterwards. However, their freedom of choice was restricted because of the all the guidelines they had to follow during the project work. In addition, they received less teacher support compared with what

they were used to. The assistant teacher gave some technical support, but the teacher gave no academic support. In one way, the restricted teacher involvement during the ongoing work was compensated through the formulation of more specific guidelines in relation to the assignments.

Likewise, other studies have also shown that it is common for teacher educators to continue to keep control over the class even though it is not part of the plan. For example, Berry (2004: 1320) claims that many teacher educators conducting self-studies have learned that their initial goals will often be undermined by their own choice of actions. In classroom teaching, one works toward a particular ideal, but at the same time it is necessary to jeopardize this ideal in real action. For example, Berry (2004, p. 1320) refers to Senese (2002), who in a self-study wanted to provide students with multiple opportunities to learn but still ended up maintaining control of the curriculum. Pieces of information were "chunked down" to the students. Similarly, the detailed planning in the current study was not intended to interfere with students' shared responsibility, but this was what happened.

Berry (2004: 1324) claims there will always be a tension between planning for learning and responding to the learning opportunities that emerge in practice. However, the most powerful learning seems to arise from the unplanned "teachable moments" between the student teachers and teacher educators. This requires that the teacher educator attempt to understand the learning situation from the point of view of the learners rather than just impose a preplanned agenda. One can ask whether the assignments in the current study opened up for these unplanned "teachable moments," with its strict schedule and preplanned agenda. There was no space left for students to choose their own topics or what tasks they had to do. The students were even required to use specific digital tools.

It is not certain whether the whole project should be planned at such a level of detail, which the teacher had done in advance in the current study. Students were not given enough time to discuss their shared responsibilities. On the other hand, open-ended assignments can easily give the students too much responsibility and create problems (e.g., Lund & Hauge, 2011). More open tasks would also have required that students use more time on the coordination of the collective work. However, this was perhaps unrealistic, because the assignment periods were very brief. The short assignment periods made it necessary for the teacher to predefine the work so that the work could be completed within the deadline. By making these decisions in advance, the collective work would be more time-efficient.

On the other hand, these planning skills can be considered as extra-important in teacher education, since instructional planning is something students are required to learn. However, the group interviews also showed that some did not like the fact that only a few students were in charge. They rather wanted the teacher educator to regain more of the control. For example, the teacher educator was not involved in the student interaction in the online setting. The Facebook environment was one such environment, which the students primarily used to communicate about project management issues, but the teacher was not present there.

The study shows a significant tension between student control and teacher control. Although more teacher actions would undermine the pedagogical idea of students' shared

collective responsibility, several students preferred this option. A more fundamental question is whether the lack of teacher control threatens the role of the teacher educator as a legitimate teacher. If more control and decisions are transferred to the students, there is a risk that the classroom may turn into chaos. This may be one of the reasons why the teacher educator regained control over the situation when the students struggled. Another disadvantage with letting students coordinate the collective work is that it can steal time from students' academic work. As the students had had no previous experience with whole-class projects, coordination issues were also more time-consuming to solve. One possible solution could be for the teacher to organize more of the work at the beginning of the course and then gradually give the students more collective responsibility.

10.5 Creating value beyond the learning period

10.5.1 "Long-term CKA"

The analysis of help as a germ cell suggests that CKA emerges along *two major timelines* in the online setting, which are distinctly different from each other. The first timeline covers students' knowledge work during the time frame of the course period, and it can be labeled as "*short-term CKA*." On the other hand, a significant part of the collective work in the present study moved beyond the walls of the institution in space and beyond the course period in time. This second major timeline can be labeled as "*long-term CKA*" and represents an extension of knowledge work over time. Because traces of student work are stored in open wiki environments, it can be of value to others within a new and over a much longer time period. This challenges our conceptions of what the outcome of student work can be in a formal educational setting.

The basic requirement is availability. Others need to be able to find the student work if they are to benefit from this work. While the individual learning primarily take place within the course period, CKA can be regarded as a slow and unplanned process that emerges over a long time period. In the current study, the wiki products were open and freely available because they had a Creative Commons license. This made it possible for new contributors to modify and use the work without spending any extra time on getting permission. Both the collective work in Wikibooks and Wikipedia built on the same open-editing policy. Based on the findings from the current study, three different types of "long-term CKA" will here be discussed.

10.5.2 New modifications made by new students

The first type of "long-term CKA" let new students continue to improve previous students' work. In both the first and the third wiki assignments, students revised the work of students from previous years. The original authors were no longer involved in the work, and in this way the new help was given without any other persons being present. When help is stretched across time, the acts of giving and receiving help become more "loosely" connected with each other. In this sense, one can claim that the help was primarily directed toward the wiki text rather than toward some specific persons. While many students found it difficult to revise each other's work in class, they had few concerns about building on others' work over time in an online setting. As already mentioned, one explanation may be the anonymity surrounding this work.[183] The original authors were no longer present. Although other studies have shown that some students experience a sense of connection with former and future students (e.g., Baltzersen, 2010), such feelings were not much emphasized by the students in the group interviews. One reason may be that some of the extended peer editing was quite impersonal. For example, the first wiki assignment consisted mainly of a review of video resources. Furthermore, there is no indication that this group of students have continued to make improvements. Likewise, a wiki study from teacher education in the review shows that teachers do not continue to use wikis as part of

[183] See section 10.2.2, Anonymous interaction in the online setting, page 329.

their professional work after their course work (Log & Michaelsen, 2014). However, one student from a study in the review states that it will be a fun experiment to see how the world continues to change the work that has been published (Roth et al., 2013).[184] Although this student will enjoy following the further development of the article, the statement does not indicate that the student will continue to work with the article.

Whether or not students continue to contribute, the key issue here is that "long-term CKA" will evolve independent from the original contributions. The collective work is reliant on new groups of students being encouraged to make improvements to the existing work. However, this new group of students will learn something from the previous work, and they can use the initial text as a guide for their further work. Likewise, Matthew, Felvegi, and Callaway (2009) claim that many wiki assignments are different from traditional individual assignments, because students need to be aware of their peers' contributions. The transparent learning environment causes students to read others' work to avoid doing the same work or to get inspiration. As a consequence, they invest more time and effort in finding relevant content that can lead to a deeper understanding. Likewise, in an interview study conducted by Zorko (2009), the students report that they compared their own work with the work in other groups so as to learn from them. They gained knowledge about how others solved tasks and what comments they had written to or received from the teacher. This gave the students information about whether they too were moving in the right direction as well as the opportunity to learn from better groups how to do things correctly, get ideas, and follow the advice the teacher had given to other groups. They could also learn from the mistakes other groups had made, which helped them not to repeat the same ones. The visibility of everyone's work in the wiki promoted the students' effort to do better, because the students did not wish to have the most boring page or they wanted their wiki page to be the best and most outstanding (Zorko, 2009).

This type of collective student work is also somewhat similar to other pedagogies, like the Knowledge building pedagogy (Scardamalia & Bereiter, 2006), that focuses on students working with project work over a sustained period of time. The difference is that it is not the same students; it is new students who continue to improve what previous students have been working with. This pedagogical practice also coincides with newer definitions of creativity (Sawyer, 2006) that highlight the notion that innovative efforts require a sustained effort over a longer period of time. The collective wiki work in the present study can be interpreted as such an iterative work that evolved over several years in a specific course setting. The work was very different from ordinary assignments in the way that students did not start from scratch but instead worked with previous versions of the collective text as a point of departure.

However, one disadvantage is that students may perceive that it is more or less easy to make the necessary improvements when they begin with text versions of varying quality. As a consequence, the work can be experienced as less fair compared with the standardized approach where everybody starts from scratch. For example, in the first wiki assignment, the groups of students were assigned to improve wiki pages that had reached somewhat different levels of maturity and quality. It is usually easier to make significant improvements

[184] See section 2.4.5, Time-extended peer editing, page 37.

to a text of low quality compared with one of high quality. This is why it is important to be specific about the assessment criteria. Students who are assigned to improve a text that looks more "finished" will then not need to worry that this disfavors their chances of getting a good grade. This will probably also reduce the likelihood of students competing to do what they perceive to be the easiest task.[185]

However, the teacher may still find it more difficult to grade the work when there are different departing points. This is because it will be necessary to compare the initial text version with the new text version to grade the quality of the improvement. It will be important to develop assessment criteria that do not disfavor the students who started with text of already high quality. In contrast, it is much easier to compare student work in a standardized assessment. It also has the advantage that one will have to read only one text version.

Another disadvantage is that this type of assignment offers less individual freedom of choice. When students build on a text that already exists, it usually directs their work in a much stronger way than if they had begun from scratch. If the existing text looks quite finished, it will probably constrain students' freedom of choice even more. For example, students might have found it more difficult to change the text in the third assignment, because it looked like a final version. Likewise, one study in the review refers to the importance of "the first-mover" advantage in wikis.[186] New contributors feel obliged to "build" on the existing text and let a substantial amount of text remain unchanged. This principle coincides with the student work in the third wiki assignment, which involved only minor text revisions. The disadvantage is that this might inhibit the creativity of the work compared with letting students start from scratch.

Another potential disadvantage with this kind of work is that students risk having to spend a lot of time removing existing text of bad quality. However, there might still be an element of constructive learning in this activity. Students will also then need to be critical readers. If the original work is of poor quality, students might also find it easier to make the revisions.

A more general weakness with the whole project was that it was limited to only one course. This limited the number of contributors and the overall quality of the wiki pages. There were few other teacher educators who were involved in the project work. Changing one isolated course will have little influence on the rest of the institution. This has also been a challenge with several other ICT projects in Norwegian teacher education (Wilhelmsen et al., 2009) (Ørnes et al., 2011). They have to a large degree been managed by single enthusiasts. Likewise, the review also shows that most of the "student-authored" textbook projects are primarily from single courses.

In a broader sense, there is little indication that the wiki assignments have had any larger impact on teachers in their professional work. Although it was not possible to review any statistical information about the number of views, there have been very few new contributions after the course work is over. There have been no changes to the wiki resource about the human body and only a few changes to the resource about musical instruments in

[185] See section 6.7, Dividing the tasks with a minimum of discussions, page 180.
[186] See section 2.2.2, Limitations in the quality, page 25.

the years after the project work. These contributors have primarily added links to the site, which is an indication that they are using these pages in their own classroom teaching. The wiki edits can perhaps be explained as new contributions from teachers in the region who had been working with the same wiki textbook both before and after the student project period. The general lack of contributions after the course period indicates that the students do not find these collective activities worthwhile in their professional work. One example is the lack of maintenance in the second wiki assignment, which indicates low interest in the wikis. However, one should be careful to draw a decisive conclusion, because the students did not work with their favorite subject areas. They may have continued their work elsewhere.

Nevertheless, an important part of "long-term CKA" is related to its ability to maintain the text quality. Most of the wiki pages require some degree of maintenance to keep the quality at a certain level. For example, there is a need for micro-contributions like updating links or removing vandalism attacks. For example, the students published links to video resources that will need to be updated regularly. The value of the book will only prevail as long as somebody checks that the links still work. If nothing is done, the resources will gradually be outdated, because some links will stop working and no new and better video resources will be added to the collection.

Regarding this issue, the original historical success of the wiki artifact needs to be understood in relation to the online encyclopedia Wikipedia, which is dependent on a huge number of contributors. The quality is created through how the online environment connects people with each other on a massive scale both temporally and spatially. Because of the scale of this environment, it is more likely that updates will happen here. However, there is less indication that teachers are ready to spend time in such environments and make contributions on a fairly regular basis.

One important reason is that most teachers do not produce learning resources. The data in the current study indicate that most professional teachers do not feel this kind of work to be part of their job. Although they acknowledge the potential of producing textbooks collectively, this work is not common in the teacher profession. Another reason is that most teachers do not have enough time to do this and that many learning resources already exist that they can use. In addition, open educational resources offer few economic incentives. On the other hand, student teachers and teacher educators have much more available time and could be more regularly involved in this type of work across teacher education institutions. However, as the current study shows, many of the student teachers have little faith in the value of the contributions they can make. As a consequence, most of the students in the present study wanted to return to the traditional expert model in the course setting when the wiki work was over.

10.5.3 New modifications made by outsiders

A second type of "long-term CKA" let persons from outside the educational setting improve the students' initial work. In the current study, there were only a few examples of this type of "long-term CKA." The students who wrote the Wikipedia article received relevant outsider

editing and critical feedback that helped them improve the text.[187] The main reason was that the student work with the Wikipedia article was part of a much more vibrant knowledge production environment compared with Wikibooks. When more people read the work, it increases the likelihood of new modifications. For example, the students who wrote the Wikipedia article did not request any improvements of their work. Still, outsiders joined the work because they were allowed to. This was done as "help without request."

Nevertheless, there have been only minor edits of this specific Wikipedia article in the years after the course finished. One reason can be that the students managed to write an article of a sufficiently high-level quality. This is supported by the positive comments the students received from the Wikipedians on their work.[188] Most new readers, who are non-experts, will then see no point in improving the text. Another explanation is that rock carvings as a topic does not need to be updated very often.

Note that most of the outsider editing was done while the students were doing their project work.[189] Most of these edits were about making the article more similar to the encyclopedic norms in Wikipedia. After this work was done, the article was left more or less untouched. Here, the Wikipedia work was different from the other wiki assignments, because the students had to adjust their work to the written guidelines in the encyclopedia. These encyclopedic norms were quite different from the norms on how to write a scientific paper. As proposed by Bereiter and Scardamalia (2010), a potential disadvantage here is that it limits the students' opportunities to work more freely with their own ideas. The quality of a Wikipedia article will therefore need to be assessed according to other quality criteria. This work is very different from the student work in Wikibooks that was been defined by the teacher.

Furthermore, there is no guarantee that every new modification will improve the existing work. For example, some of the peer editing between the students indicates that the quality of the work was reduced.[190] There will always be a risk that new edits reduce the quality of the work. Vandalism is another serious threat, because the online environments are open to everyone. In the second assignment, the resources on Wikispaces were vandalized in the years after the work was published.[191] Because the original work was not restored, this indicates that that few or none of the students continued to use or monitor the page after they had finished the course work. In comparison, the collective work on Wikipedia is much better protected, because there are persons in the online environment who regularly check articles in relation to vandalism attacks. This task does not require expert competence, but it does require someone willing to monitor the work that is being done. A disadvantage with both Wikispaces and Wikibooks is that neither site has any persons doing this kind of review work.

New contributors are needed to ensure that the content is updated. One challenge here is that while most people know that text on Wikipedia can be modified, far fewer people will

[187] See section 7.9.2, Outsider feedback, page 263.
[188] See section 7.9.2, Outsider feedback, page 263.
[189] See section 7.9.3, Outsider editing, page 267.
[190] See section 7.7, Peer editing between students in the class, page 253.
[191] See section 5.6 Creating valuable knowledge in the teacher education setting, page 150.

think that they can change someone's work on Wikispace pages. Visitors to these pages may assume that the students' work is copyright protected, because they have little or no knowledge of the Creative Commons licenses. Continuous improvement is not only reliant on the license itself but also on people knowing that it is okay to do this work.

These examples show that "long-term CKA" will not necessarily evolve as a linear process. It is likely that some edits may worsen the quality of the work. However, if there is a surplus in the number of quality improvements compared with the number of quality reductions, the knowledge product will gradually improve.

10.5.4 Reusing the published student work as it is

A third type of "long-term CKA" reuses the published student work as it is. This is reuse as "read only" actions. One example is the instructional video published on YouTube aimed to also inform tourists as a target group outside of the educational system.[192] Although others can comment on the video, they cannot modify the work. The value of the work is primarily in its accessibility, because it can reach many different beneficiaries in an online setting. Unlike the wiki texts, it is often not possible to easily change or modify the video. There are also differences in the possibility of removing the original work. While text on Wikipedia cannot be completely removed, videos on YouTube can be removed by the original student producer.

The student work on both Wikipedia and YouTube has attracted a significant number of viewers since its original publication.[193] This shows that the value of the work extends over several years after the original publishing date and illustrates the added value of not only producing work to get grades. It is likely that this student work has reached people outside of the educational setting, because it was published on popular websites. The videos on YouTube and Wikipedia receive top hits on search engines, which may have increased the views. Student work published in online communities like Wikipedia will reach a larger audience than if the work is published on Wikispaces or Wikibooks. As a topic, rock carvings also have interest for a wider audience. However, there are no guarantees the student work will be reused. For example, the number of views of the photos of rock carvings on the Flickr site has been very low. One explanation may be that the photos are more difficult to find and not so relevant to look at without any further information.

It is also possible to claim that the publication of student work in multiple different online environments strengthened the value of the work, because the outreach increased. This included not only global wiki environments like Wikibooks and Wikipedia but also YouTube and Flickr. In the second assignment, several contributions were first published in other (Web 2.0) online environments, and they were then linked to the Wikispaces site. One example is that the images of rock carvings from Flickr were embedded into the wiki site. This made it possible to present several slideshows with photos from different rock carving sites in the region and shows how this specific type of wiki can also utilize interesting features from other applications. In this sense, the work was published in several different

[192] See section 5.6, Creating valuable knowledge in the teacher education setting, page 150.
[193] See section 5.6.1, Creating value for the public, page 150.

online communities at the same time. Second, the video about rock carvings was published on YouTube and then embedded into the wiki. Some of the students visited relevant field sites where they could find rock carvings. In this way the video connected a local offline setting outside of the educational institution with a global online setting.

11 Conclusion—Final remarks

11.1 Answering the main research question

Information and Communication Technology (ICT) has been implemented in Norwegian teacher education over the course of the last 10 to 20 years. However, the projects have largely failed to transform pedagogical practice in any fundamental way (Gudmundsdottir et al., 2014; Hetland & Solum, 2008; Wilhelmsen et al., 2009). Even though enthusiasts have promoted the use of collaborative technologies in teacher training programs, the impact of such technologies on broader institutionalized pedagogical practices has been of minor importance. In this sense, there are several similarities between this study and the failure of previous ICT projects in teacher education.

Moreover, the literature review showed that concepts affiliated with collective knowledge advancement (CKA) are often poorly described in the studies. The relevant pedagogical concepts are only briefly defined. Instead, great emphasis is placed on the wiki technology itself. In sharp contrast, this dissertation proposes that the key to moving the field forward lies in describing the complexity of the new wiki-mediated pedagogical practice that is emerging. This dissertation suggests that one reason why ICT projects fail is that they lack a foundation in the relevant pedagogical concepts, which can support the new instructional designs. In keeping with the theoretical framework, the identification of the germ cell is a necessary precondition to the development of a coherent and meaningful concept. The lack of this type of in-depth analysis is one reason why new concepts often fail to have an impact; however, such analysis has been conducted in the present study. Without any attempt to identify a germ cell, there is a risk that the analysis will only describe more superficial aspects of a practice.

Because of the main research question, help was identified in both an offline and an online setting *(How does collective knowledge advancement (CKA) as a pedagogical practice in teacher education emerge in the complex interplay between an offline setting and a global online setting?).* In chapters 5, 6, and 7, this interplay between an offline and an online setting was analyzed by addressing three different sub-research questions. In chapters 8 and 9, the findings from the three preceding chapters were synthesized in order to identify the conditions that either inhibit CKA or enable CKA as a pedagogical practice in teacher education. Although one can question the degree to which CKA emerged as a pedagogical practice in the current study, the analysis shows that the core elements in the germ cell were still identified.

11.1.1 The germ cell provides the key to the conclusion

In accordance with the steps in the methodology (the principle of ascending from the abstract to the concrete), the analysis of CKA as a pedagogical practice has moved through three major phases in this dissertation. As suggested in step 1 of the methodology,[194] the data were analyzed in *the first phase of the analysis* by distinguishing between enabling and

[194] See section 3.3.2 Step 1. Practical experimentation in a problematic situation, page 59.

inhibitory conditions. This analysis represented an important preliminary step in the methodology, which attempted to answer the three sub-research questions (value of student work, peer learning, and students' shared responsibility). The sub-research questions were answered in the final section of three separate chapters in the empirical analysis (sections 5.8, 6.11, and 7.10). In keeping with step 1, these sub-questions provide only a limited understanding of CKA as a pedagogical practice. Before the germ is identified, the answers to these questions provide only a description of the most prominent characteristics of the process.

In *the second phase of the analysis*, the findings from chapters 5, 6, and 7 were compared with each other in two new chapters. In Chapter 8, the inhibitory conditions were analyzed to identify primary, secondary, and tertiary contradictions. *Unfairness* was identified as the fundamental inhibitor to CKA as a pedagogical practice in teacher education. In Chapter 9, the enabling conditions were compared with each other to identify the germ cell. It is the germ cell that is the key to a fundamental understanding of CKA as pedagogical practice. In the present study, there were also interesting episodes that deviated from the main patterns or the most representative examples of broader categories in the data.[195] There were also more subtle patterns of interaction, which were more commonplace but less obvious.[196] On the surface, the enabling conditions do not appear to be related. Still, these conditions must be compared to identify the genetic origin or the simple characteristics of the germ cell of CKA.

Because of this analytical challenge, the germ cell was first identified in the late phases of the empirical analysis, following many rounds of analysis. In accordance with step 2 of the methodology, the description of the germ cell represents an intermediate analytical step. However, the germ cell provides the key to understanding the overall complex process under investigation. It not only exhibits the simplest possible characteristics of the overall process, it also contains seeds that can stimulate the development of a new pedagogical practice. While the sub-research questions were essential in the quest to identify the germ cell, it is the germ cell that provides the key to answering the main research question and reaching a final conclusion.

However, it is *the third phase of the analysis* that provides the most direct answer to the main research question. In accordance with step 3 of the methodology,[197] the discussion of conceptual trails (Chapter 10) elaborates on the directions the pedagogical practice can take. The identification of the germ cell is an important intermediate analytical step; however, in and of itself, it is not sufficient to transform any pedagogical practice. This is why the conceptual trails are important; they represent an attempt to describe CKA as a more complex and coherent pedagogical practice in a more coherent way. These conceptual trails need to detach themselves from the sub-questions and instead build on the germ cell. Nevertheless, they still address the main research question and provide a more coherent picture of the emergence of CKA as a pedagogical practice in the interplay between an offline and a global online setting. The five conceptual trails all build on the description of the germ cell (Chapter 9). Given the analysis of the inhibitory conditions to CKA (Chapter 8),

[195] For example, see section 6.10, Observing others work, page 195.
[196] For example, see section 7.6.2, Peer feedback as the co-construction of one single utterance, page 242.
[197] See section 3.3.4, Step 3. Testing the germ cell, page 61.

the germ cell (Chapter 9), and the discussion of the conceptual trails (Chapter 10), it is here concluded that CKA as a pedagogical practice emerges through a complex combination of three types of help. These are:

- Help as informal peer feedback
- Help as open publication of student work
- Students being assigned as helpers

11.1.2 Help as informal peer feedback

The first answer to the main research question is that *CKA as a pedagogical practice emerges as a type of help that is given as informal peer feedback*. When students spoke freely at the plenary level, they were able to help each other by giving different types of informal peer feedback. *First*, students would help each other by raising their voices to ask for answers of varying difficulty. It was then important to use acoustic force in the sense that the students needed to raise their own volume above normal to get others' attention. *Second*, students would involve themselves in others' conversations in their surroundings. This also required that dyadic discussions reach a certain level of volume to be acoustically available, which made it possible for other students to join. *Third*, students would help by spontaneously showing each other something they found interesting on the laptop screen. This mingling of thoughts, questions, and comments required an acceptance of a certain level of noise to allow for spontaneous outbursts and interruptions among the students.

In the dyadic collaboration, the informal peer feedback was also closely related to the screen operations. For example, students would receive direct help from the other students on how to operate the screen. This help could be given in the form of suggestions in an attempt to find the answers together. Here, the feedback was co-constructed as an integral part of the screen-mediated verbal discourse. It was also based on both students observing the operations on the laptop screen. This required the two persons to sit close to each other so they had access to the same visual information without having to move their bodies. In this way, they did not disturb others by moving closer to their partner if they needed to see the laptop screen. It was sometimes enough to quietly observe what the other person was doing, which made the cost of helping close to zero. In this way, the dyads could shift flexibly between a *working mode* and a *helping mode*.

The students created a certain type of informal learning environment in which many conversations took place simultaneously. It was a move away from the qualities of a silent classroom. The volume of the discussions was also somewhat higher than in a "buzzing classroom" but not yet at the level of being a very noisy or loud classroom. The degree of attention was flexible in the sense that when the students raised their voices, they did not demand that all students stop working and pay attention to what was being said. This pedagogical practice is fundamentally different from more common practices in school, which require all students to be silent and pay attention to what is being said.

11.1.3 Help as an open publication of student work

The second answer to the main research question is that *CKA as a pedagogical practice emerges as a type of help that is given through open publication of student work*. In the present study, the students had to perform different tasks and produce resources that were of authentic value for others outside the course. In the global online setting, the help is left as a trace, detached from the helper. Because the student work is published openly, it is available for a wide range of target groups. It can have potential value for outsiders both inside and outside the educational context (e.g., teachers, student teachers, children, extended family, or the general public). This help is not only directed toward a specific target group, but is also distributed to unknown others who can either use the resources as they are or continue to develop them. The student work moved beyond the course as a separate, isolated activity system. The present study also showed that most students were comfortable with open publication when their work was published anonymously. This was important since some students were not convinced that they could create something of high quality because of their lack of background knowledge. The anonymity enabled them to avoid vulnerability when they were unsure of the quality of their work. Moreover, the students' work was either published as part of a *fluid knowledge production* process, in which it was expected to change over time, or as a *frozen knowledge production* process, in which the students' work was reused as it was.

In the *fluid knowledge production* process*,* the quality of the student work relies on successive improvements over a longer period of time. As mentioned in the first chapter, the success of Wikipedia has raised questions as to whether a crowd of amateurs, such as students, can outperform experts under the right conditions. The findings in the current study suggest that the quality of the student work is dependent on how it is published. For example, when students published their work in global wiki environments, it was possible to modify the existing work beyond one single course period. Outsiders or unknown others could change and reuse the work without asking for permission. (This was possible because the student work was published with a Creative Commons license.) In the present study, modifications were made by both new students (improving existing student work) and by Wikipedians (unknown others). In principle, there is no end to knowledge production because the text can be changed at any time in the future. An important characteristic of the fluid knowledge production process is that the student work does not have to reach a specified minimum level of quality before it is published. Instead, the potential value is inherent in the work if others continue to improve it in the future. The first wiki assignment with the video resources is one such example. As the data from the present study also shows, some parts of the wiki work will gradually become outdated (such as external links) or be threatened by vandalism (as in the second wiki assignment). Some maintenance work is therefore needed over a longer period of time. Another example is the Wikipedia article. Although the article was of very good quality, the students received feedback that they did not cite sources correctly. As a consequence, the students continued to improve their work after the original deadline. In the years following publication, the article has had many readers and has undergone almost no changes. This indicates that the article reached a certain minimum level of quality. In other instances, even more help from others might be required to improve the published work before it reaches a sustainable level of quality.

The advantage of the fluid knowledge production process is its *flexibility*. Contributions can not only be made anywhere at any time, but contributors can also freely choose the size of their contribution. However, this inevitably creates more uncertainty related to the quality of this type of collective work. The reader must always be source critical and check other sources. However, the findings also showed that critical peer feedback is easier to offer when it is *anonymous*. For example, new students found it a simple matter to modify students' collective work from previous years. As outsiders, Wikipedians also provided relevant feedback and direct editing of students' work. Because the work was published in a global wiki environment, it became communal property. Therefore, the Wikipedians made modifications without asking for permission. However, the quality of outsider editing cannot be predicted; it therefore interferes with the goal of standardizing assessment conditions.

In the *frozen knowledge production* process*,* it is important that the students reach a certain minimum level of quality within the course period. This work is usually done from scratch and the final work is published after the deadline. The knowledge product is then expected to be of direct value to others as it is. There is no advantage in future contributions from outsiders because the work cannot be modified. While the quality of the work depends on future improvements in fluid knowledge production, frozen knowledge production relies on students producing something of sufficient quality within a limited time period. In comparison with professional contributions, students cannot be expected to produce work of similar quality. However, the present study shows that students can instead produce something different and make other contributions compared with what a professional author would do.

First, students created multimodal learning resources about a topic that did not exist on the Internet. This included a compilation of video resources (first wiki assignment) and a comprehensive resource with images, videos, quizzes, and text (second wiki assignment). One video, which was published on YouTube, garnered several thousand views; this indicates some success in the production of material that held value for others. The degree of outreach also depended on degree of popularity of the online environment where the student work was published. While the video on YouTube has had many views, the images published on Flickr have had almost none. *Second*, students were able to introduce local perspectives on topics from the region. One example is the learning resources and the articles about rock carvings. Few such resources had previously existed. It shows that students can produce resources within areas that professional authors or publishers do not cover. *Third*, the student work was also used as a "frozen" competent digital person, which could be regarded as a helper for both the self at a later point in time and for others. In one example, a student had published an instructional video about how to use a software program (Hot Potatoes) several years earlier. Even though the student had forgotten most of these skills, they were still available through the video, which was accessible in the online setting. In this specific incident, another student initially asked for help in the offline setting. However, the help was not given by the student in real time, because she did not remember what to do. Rather, she encouraged the other student to watch the previously made "competent video version" of herself. In this case, the video became valuable again many years after it had been published.

11.1.4 Students being assigned as helpers

The third answer to the main research question is that *CKA as a pedagogical practice emerges through letting all students be assigned as helpers*. This is necessary to ensure that the project work remains fairly distributed. In the present study, the shared responsibility was weak because only a few students coordinated the work and some students did significantly more work than others. Neither did some students get to work with the subtasks they wanted. Some teacher actions, such as the appointment of a student moderator, were also counterproductive. The attempt to reduce teacher involvement only created more problems for the students. In addition, the students questioned whether free riders should get the same grade as those who had worked extensively on the project.

To strengthen the fairness of the instructional design, one student suggested that learning communities be designed in which it was mandatory that all students be teachers for each other. In the present study, some students felt they could not help effectively because they had the same level of background knowledge as other students. However, if students specialized in different areas, this design would make it easier to help each other effectively because they would have a superior level of knowledge. This instructional design would also reduce the risk of being rejected when asking for help. Students felt that they worked within "separate territories" in which they had strong ownership of their work. If the students wanted to help each other by editing others' work across these groups, they would often need to ask for permission and it was not certain that they would receive any help. It is evident that the teacher educator must guide the students in their role as knowledge producers in this learning environment (ensuring equal participation, creating acceptance of discomfort, and balancing students' own responsibilities). This requires that the teacher remain in charge, but in a very different role than that of lecturer.

As a pedagogical principle, "learning by teaching" challenges the way most teacher educators organize their classroom teaching, as well as the roles of the learner and the teacher, which are often taken for granted. In the present study, learning was largely associated with the learner and teaching was largely associated with the teacher. However, the aforementioned instructional design challenges us to describe fundamental positions in the classroom in new ways.

The wiki work also positioned the students as helpers in a global online setting. Some of the work strengthened the students' pride and perception of having made an important contribution to society. One example is the statement from one of the students who produced the Wikipedia article. She felt she had volunteered and made a contribution to Norwegian social democracy.[198] The use of the label "volunteering" shows that the students perceive that they had a new role and that the work represents a type of help wherein one does something extra for others. Interestingly, the assigned helper here can be regarded as a student giving help to society as a whole.

[198] See section 5.3, Producing knowledge for a "global" audience, page 138.

11.1.5 The inner contradictions of CKA as a pedagogical practice in teacher education

The three answers to the main research question also reveal the inner contradictions of CKA as a pedagogical practice. The pedagogical practice builds on both unconditional and conditional help. The table below provides an overview of how the answers address different types of help in the interplay between an offline setting and a global online setting.

Table 11.1.a The three answers to the main research question.

Answers to the main research question	**Type of help in the interplay between an offline setting and a global online setting**
1. Help as informal feedback	Unconditional help in the classroom as an offline setting
2. Help as an open publication of student work	Unconditional help left as traces in a global online setting
3. Students being assigned as helpers	Conditional help in the classroom as an offline setting

First, the answers to the main research question show that *unconditional help is important in both the offline setting of the classroom and in the global online setting that extends beyond the classroom*. In the classroom as an offline setting, the informal peer feedback can be regarded as a specific type of unconditional help. Here, the help manifests itself as an urge to move the discussion forward, as if the discussion itself requires it. It is very different from ordinary turn-taking conversations, which do not permit interruptions or sudden outbursts. There is an acceptance of overlapping talk and "impolite interaction" as a valuable part of the rapid and free exchange of thoughts during the collaboration. The help is so closely integrated into the ongoing work that it may be difficult to identify it. Help is regarded here as a collective effort, in which the students find answers together. The students have approximately the same level of expertise and take turns in the role of helper. This makes the helping relationship more symmetrical. At the level of dyadic collaboration, it is mediated by sharing laptop displays. This help can be regarded as unconditional in the sense that there is no direct return value in giving the help. It can be interpreted as permissionless help that moves beyond the norms of politeness. This help is unconditional in the sense that it supersedes the issue of fairness.

In the global online setting, the student work can also be regarded as a type of unconditional help that is given through the open distribution of the work. This involves both student work that builds on individual authorship and anonymous collective authorship. The help here comprises traces that are available to others. Some of the student work has many thousands of viewers, which indicates the work was of value.

Second, the answers to the main research question show that *conditional help becomes important in the offline setting of the classroom.* The proposed instructional design requires that all students must be helpers for each other. This ensures that the help is balanced in such a way that students make equal contributions. By developing expertise in different areas, the students have access to a range of different types of help. Help is perceived here as valuable units that must be mutually exchanged in the system. Although one student

claims that children want to teach others what they know unconditionally, most students claim that there is a stronger need to establish a “fair” interaction system that builds on conditional help in the teacher education context.

According to the description of the germ cell, conditional and unconditional help contradict one another. According to the theory, these contradictions need to be resolved. However, the findings show that both types of help have a function in relation to the emergence of CKA as a pedagogical practice. While unconditional help in the offline setting is more or less spontaneously created by the students, conditional help must largely be planned as a part of the instructional design. Unconditional help is also more strongly connected to language itself. In the offline setting, verbal language mediates help as spontaneous outbursts of ongoing thoughts. In the global online setting, written language mediates help through the materialization and distribution of a knowledge product. Here, the issue of fairness is not present in the same way because help is mediated through the production of language and is not something a helper gives away. Nevertheless, if some students did not participate in the verbal or written discourse at all, this also created a feeling of unfairness (that is, they got a free ride).

On the other hand, conditional help is mediated by social roles and expectations in the educational system. This type of conditional help also challenges the core position of what a learner should be doing. In the offline setting, learners are expected to partially take the role of teacher. This is balanced help based on a norm of reciprocity. The disadvantage of organized conditional help is that it loses some of the flexibility that is necessary for knowledge production to move forward. Students might end up protecting their own contributions and only offer help if they are sure they get something equivalent in return. The joy of sharing and helping may suffer.

In the online setting, the students were also challenged to enter a new social role of knowledge producer. This involved making societal contributions and creating something of authentic value. In both the offline and the online setting, the novice learner is given a more important role. However, if this role were mandatory, it is not a given that all students would feel comfortable in this position. The combination of the different types of help unavoidably creates tension, and it is not entirely clear whether or how these contradictions can be resolved. The findings suggest that the qualities of both unconditional and conditional help must be utilized if CKA is to emerge as a pedagogical practice in teacher education.

11.2 Contributions and limitations

The present study offers several empirical, theoretical, and methodological contributions. They are summarized here in six key points. Since the empirical findings are from student work in tertiary education, it is necessary to be cautious about generalizing the findings to the primary or secondary school sectors. The degree to which each contribution is relevant for contexts other than teacher education is also discussed.

11.2.1 Describing different types of informal teaching

The findings in the present study indicate that *informal teaching* is a concept that must be further developed. The word "teaching" does not necessarily refer only to formal teaching but also to informal teaching, in the same way as one distinguishes between formal and informal learning. The discussion of learning by teaching indicates the presence of several different types of informal teaching that are important components of collaborative learning. Here, teaching and learning are inherently part of the same process. According to Cole (2009), Vygotsky also used the Russian term *obuchenie* to refer to teaching and learning as being part of a dialectical two-way process made up of mutually interpenetrating opposites. However, the concept of teaching does not only describe deliberately organized instruction, but also instruction where learners are informal instructors for each other. As such, CKA as a pedagogical practice emerges as a model of teaching as much as a way of learning.

Note that as a concept, *informal learning* is used quite a lot (e.g., Rogoff, Callanan, Gutiérrez, & Erickson, 2016; Watkins & Marsick, 1992); the term *informal teaching* is used much less. However, some researchers claim that important learning principles in out-of-school learning can instead be interpreted as teaching principles (Holmes, 2016). According to Holmes (2016, p. i), "the emergence of digital and social media has fueled interest in informal learning while often ignoring or effacing the critical role of teaching." Even though there are a few examples of use (Henze, 1992), it is more common to use other concepts such as *coaching*, *guidance*, or *mentoring*. As previously mentioned, the establishment of a community of "*learning by teaching*" [199] can also be regarded as a reorientation of the notion of the community of learners (Lave & Wenger, 1991). The key in this learning environment is not to create one ideal zone of proximal development, but rather a range of zones that students can enter into in a flexible way. In accordance with the concept of *obuchenie*, the emphasis on teaching must be regarded as a dialectical part of the learning process. Here, the pedagogical practice is built on a germ cell that describes a specific pattern of interaction in the learning environment (e.g., help). This requires a broad definition of teaching that also includes many different types of informal teaching that have not yet been fully explored.

However, even though some researchers have pointed out the advantages of "learning by teaching" among smaller children, it is not clear at what age this pedagogical approach should dominate pedagogical practice. It is also unclear whether the approach is more effective for some subjects than for others.

[199] See section 10.3, Learning by teaching, page 333.

11.2.2 Describing new types of authentic learning

CKA as a pedagogical practice can also be relevant for authentic learning in several different ways (Herrington & Herrington, 2007). First, the collective work involved participation in global wiki environments, which can be interpreted as an authentic learning environment. The online setting offers easy participation in a range of different real-problem contexts. However, the most important definitions of authentic learning have, to a large degree, been developed within the framework of an offline setting with limited physical mobility (Herrington & Herrington, 2007). Even though there are attempts to develop new authentic learning frameworks that involve the online setting (Herrington & Parker, 2013), pedagogical strategies must still undergo further innovation. For example, the introduction of outsider editing and outsider feedback can also be regarded as attempts to expand on authentic learning frameworks. The production of the Wikipedia article involved serious discussion about how to write an article of sufficient quality. Students exchanged authentic feedback with outsiders who were members of different online communities. It is possible that these type of skills should also be included as collaboration as a 21st century skill.

A major instructional challenge is that it is impossible to design profoundly authentic learning experiences in advance because the learning activities cannot be predetermined (Herrington & Herrington, 2007). As in the current study, it was very difficult to predetermine outsider feedback or editing. The disadvantage is that this may make it more difficult to assess student work fairly. Unfairness was identified as the fundamental inhibitor, and shows that this is a core component in pedagogical practice that cannot be overlooked.

Second, the final student products aimed to be of value to others in the online setting. One way of ensuring quality is to let students work with the same assignment over a period of time that extends beyond one single course. While some pedagogical approaches emphasize sustained knowledge work (Scardamalia & Bereiter, 2006), few have promoted the use of instructional designs that allow students to work with assignments over a longer period of time within the online setting. Most pedagogical practice in teacher education is restricted to what happens within one single course as an isolated unit. Assignments in different courses are seldom connected to one another. Students rarely build on what other students have done. However, the rise of the Internet and the online setting offer new ways of connecting classrooms with one another and connecting the classroom with the world. The present study has shown that it is possible to develop instructional designs that let students build on each other's work and that can still function effectively.

There is less certainty regarding the degree to which students in primary and secondary school can produce work of authentic value to others. In this case, it is more important to promote other types of authentic learning that emphasize participation in realistic problem-solving processes. The *cognitive authenticity* or realism of the task becomes more important than its physical authenticity. For example, it is not obvious that maximum exposure to real situations or simulations leads to maximum effectiveness in learning (Herrington & Herrington, 2007). Likewise, some students in the present study found there was too little emphasis on nurturing a learning discourse of high quality (e.g., Mercer & Dawes, 2008).

Nevertheless, the present study has shown several ways in which these problem-solving skills can be supported. In the online setting, for example, when the students published their work in a knowledge-production community such as Wikipedia, they also learned to position their own contribution in relation to other work in the community. This can be regarded as an important research skill. Another example is that some of the assignments were part of a sustained iterative work that the students did not start from scratch. Authentic idea development was assumed here to emerge from the collective efforts of a group that work on the same topic over a sustained period of time. This type of authentic knowledge production is quite similar to what has been labeled *design mode* or a *design thinking mindset*. It is a way of thinking in which students are always alert to the possibility of producing better ideas, explanations, or ways of doing things. One should never be quite satisfied with final answers. It takes years of experience before this mindset becomes habitual (Bereiter & Scardamalia, 2014).

In the offline setting, a specific type of authentic discourse emerged through spontaneous improvisation. This *mind mingling* was somewhat similar to what Keith Sawyer labels as collaborative emergence (Sawyer, 1999, 2000). The verbal discussions could not be understood by simply analyzing the individual contributions of the group members. Instead, the complete meaning depended on the flow of the subsequent interaction. There was neither a structured plan guiding the group nor a leader directing the group (Sawyer, 1999, 2000). One example in the present study was the co-construction of a single utterance.

However, the verbal discussions in the present study differ from Sawyer's emphasis on harmony or synchronicity. For example, Sawyer (2000) emphasizes the importance of listening skills; he gives examples from jazz music, in which it is very important that each musician listen closely to the others. Although each member of the group contributes creative material, a musician's contributions only make sense in terms of the way they are heard, absorbed, and elaborated on by the other musicians. However, several episodes in the current study did not require that students listen to each other all the time. One example was when students posed questions that were not answered by others or when they joined other discussions at will. This indicated the flexibility of the ongoing dialogue. This interaction was reminiscent of everyday situations like a dinner conversation or gossip in the company cafeteria, where it is necessary to pay attention but not all the time. This indicates that the authentic dialogue in the offline setting must rather be understood in the dialectic movements between the production of a diverse multitude of voices without any script and the production of a shared conversational script. In the creative dialogue, it is also necessary to let the cacophony of voices loose. In the present study, this interaction was observed as chaotic and unorganized. It permitted questions that were never answered, unfinished sentences, and interruptions. It was the opposite of the organized educational discourse that follows conventional principles of turn-taking with initiate–response–evaluation (IRE) cycles (Cazden, 2001), but it was still perceived as meaningful by the participants. In keeping with ideas about distributed cognition (Hutchins, 2006), the findings also showed how shared displays mediated spontaneous and informal discussion because the students had easy visual access to each other's work

Here, there is also an element of empowerment that gives the voice of the learner a stronger position in the learning environment. However, one can question whether this

authentic dialogue will lead to chaos in a classroom of small children. Because of the noise that accompanies this type of mind mingling, some students may also feel uncomfortable with this way of working. The teacher may lose more control of what is happening. It is perhaps more likely that this type of work can be relevant for pedagogical practices in other programs in tertiary education.

11.2.3 Turning campus-based teaching into a "practicum period"

The findings in the present study also show the importance of the pedagogical approach in campus-based teaching in the teacher education context. Usually, both students and teacher educators assume that students learn the fundamentals of classroom teaching in their practicum period. However, the control of what happens in the practicum periods can be weak, making it difficult to explore alternative pedagogical practices that can better support 21st-century skills. As a consequence, it becomes even more important that campus-based teaching builds on new ways of learning that are not part of ordinary classroom teaching in the practicum periods. One aspect of authentic learning is about giving students access to expert performances which can model how real practitioners behave (Herrington & Herrington, 2007). In the context of teacher education, students learn new skills in the practicum period with guidance from an experienced teacher, in an apprenticeship model of learning. Although some researchers have emphasized that the teacher educator on campus is also a role model (Loughran & Berry, 2005; Loughran, 2002), students have regarded this pedagogical practice as far less relevant than the practicum periods.

However, if students were assigned to help each other in courses on campus, this interaction would serve several different purposes. *First*, students would learn something about specific content by being actively involved in the learning process. *Second*, students would learn about "learning by teaching" as a pedagogical approach. *Third*, students would receive practical teacher training on campus and not only in the practicum periods. *Fourth*, this type of pedagogical practice would offer a safe environment for experimental teaching with a larger risk of failure. It could inspire students to evaluate and reflect more deeply around what happened. As such, students would acquire the experience necessary to use a similar approach in their practicum periods. This is perhaps similar to the design mode (Bereiter & Scardamalia, 2014) mentioned in the last section. Nevertheless, campus will always be different from the practicum periods in school because it is not a direct part of the professional life of the teacher. This setting is less complex than the real-life setting; at the same time, however, some elements of teaching or learning activities can be investigated in more detail.

11.2.4 The necessity of studying the interplay between the offline and online setting

The complete analysis in the present study also illustrated the great complexity of teaching and learning. With the Internet and the online setting, the interactional patterns become even more diverse. The increased importance of an online setting as a normal part of the pedagogical practice in formal education challenges all educational researchers to direct more analytical attention to what happens in the online setting. The present study shows

this must be achieved by combining a range of different data sources from both an offline and a (global) online setting. Few handbooks on educational research methods have as of yet covered the methodological challenges related to analyzing the interplay between an offline and an online setting. One example is the chapter about digital technology (Eynon, 2017) in the *BERA/SAGE Handbook of Educational Research* (Wyse, Selwyn, Smith, & Suter, 2016). The focus here is on the new opportunities and challenges that digital environments offer researchers. However, the emphasis in the article is only on the online setting and not on the interplay with the offline settings (Eynon, 2017). As suggested by Eynon (2017), data from online settings are valuable because they make it possible to obtain insight into talk around learning that takes place outside the classroom. These data also provide researchers with an opportunity to explore processes relevant to learning and education that are often largely hidden from view. Another example is from the *SAGE Handbook of E-learning* (Haythornthwaite, Andrews, Fransman, & Meyers, 2016), which predicts several changes in the coming years. These involve both online settings (e.g., learning in environments outside traditional, educational degree-based contexts) and offline settings (e.g., human-embodied cognition and materiality); however, there is less emphasis on the importance of investigating the interplay between the offline and online settings.

Future studies of education must, to a much larger degree, build on data triangulation to capture the complex new setting in which students interact. In the offline setting, this involved data from both group interviews and video data. Data from online settings must also be collected in order to develop a complete picture of student participation in different contexts. In the online setting, this included screen capture data and wiki log data. Most wiki studies in the review were limited because their analytical attention was seldom directed toward both an offline and an online setting. Second, the mix of data from both settings enabled a combined analysis of time frames that covered everything from the millisecond moves that took place in the co-construction of a single utterance to the sustained collective work that lasted for several years. Future studies should continue to explore the complexity of the interplay between online and offline settings. This includes not only teacher education or tertiary education, but also other parts of the school sector in which students use digital technology as a part of their daily work.

11.2.5 Organizing the dissertation according to a specific type of dialectical logic

As previously mentioned, all the main sections of this dissertation build on different steps of the principle of ascending from the abstract to the concrete. Therefore, the organization of the dissertation can also be regarded as a methodological contribution in several different ways.

First, the introductory chapter provides an imaginary view of what CKA as a pedagogical practice can be. According to Davydov (1990), one essential feature in the movement from the abstract to the concrete builds on the capacity for imagination as the ability to “see the whole before its parts.” This imagination is often necessary in order to retain images of large complexity, such as an economic system or a historical epoch. It is also important so one is not led astray during the analysis. However, because the germ cell has not yet been identified, the descriptions are more or less arbitrary. Nevertheless, the chapter provides a

preliminary idea of what a concrete whole could look like. Even when this image is unfinished, it gives a direction for further analysis.

According to Davydov (1990), the concrete appears twice in theoretical thought. It first appears as the starting point in contemplation of a concept and in the final reestablishment of a new concrete whole. As such, the complete argument in the dissertation moves from the concrete as a vague notion of CKA as a pedagogical practice (Chapter 1) toward a concrete conclusion that provides a much more precise image of what CKA as a pedagogical practice can be (Chapter 11). It can be regarded as thought's "grasping" of the whole through a theoretical reproduction of reality.

Second, it is the identification of the germ cell that provides the key to the discussion of the findings. The methodology prescribes that the ascent can only be made from the germ cell and not from the sub-research questions. If the goal is to invent a new pedagogical practice, this must be done on the basis of help as it is described as a germ cell. According to Davydov (1990), the germ cell discloses the essence of a thing as that which determines further development. It is therefore of great importance to identify the germ cell in theoretical thought because it also constitutes the basis of a fully developed system. As a consequence, the analysis in the dissertation is somewhat unorthodox compared with a typical dissertation, which usually centers on the sub-questions throughout the analysis. Without the identification of a germ cell, there is a risk of doing a more superficial analysis of the phenomena, and ending up with a conclusion with less explanatory power.

As a consequence, the answers to the sub-research questions in the present study were only the first step of the analysis. In accordance with the organization of the dissertation, the germ cell was identified in two stages (chapters 5, 6, and 7). First, potentially relevant data were labeled as enabling conditions. This multitude of episodes and data were then compared with each other (Chapter 9). In the description of the germ cell, this diversity was reduced to a simple and relatively homogeneous entity. Likewise, Davydov (1990) claims that the analysis of the germ cell cannot rely on a simple comparison of the external features or attributes in particular objects, as is typical of inductive generalization. Instead, the analysis must be determined by the presence of an internal unity in the diversity of the rich data. For example, this can be done by tracing the transitions of some of the different states of an object, or by analyzing different phenomena in an attempt to identify the homogeneous state.

However, the basic components in help as a germ cell do not provide any concrete description of CKA as a pedagogical practice. Even though the components in help as a germ cell are important, they constitute an undeveloped pedagogical practice. In the present study, this problem was solved by establishing different conceptual trails that provided a link between the germ cell and its application in the context of education. As a future-oriented concept, it was also important to describe how CKA as a pedagogical practice can move in new directions through the notion of conceptual trails. The notion of trails suggests that one should move further pedagogical practice into specific areas that need to be explored. These trails are also used as a conceptual framework in the final discussion of pedagogical implications. The trails (Chapter 10) are generalizations in that they offer a conceptual move toward a more complete pedagogical practice. According to Davydov (1990), the two forms

of theoretical thought describe a general route in cognition that builds on both analytic and synthetic moves. The analytic dimension involves content-rich abstraction through the identification of the germ cell, while the synthetic dimension involves generalization through the discussion of conceptual trails. The conceptual trails represent an attempt to build a unity of assorted aspects of a developed whole from the germ cell.

Another issue in the present study is the validity of the conceptual trails in relation to the content in the germ cell. According to Davydov (1990), one should only include those connections and relationships that can really be derived from the germ cell in the new concrete whole. It is important not to burden the concrete with collateral properties and details. However, some degree of imagination is unavoidable in the formation of new concepts. In the present study, the methodological challenge is that the discussion of conceptual trails also utilizes a significant element of theoretical imagination in this part of the dissertation. The trails have not yet been tested as a part of new instructional designs.

Third, the conclusion provides the final description of the concrete whole. In the present study, the strength of the connection between help as a germ cell and the conceptual trails can be questioned. However, in the conclusion, the connection between help as a germ cell and CKA as a pedagogical practice is addressed more explicitly. The conclusion provides the final answer to the main research question. A tentative solution is also proposed regarding the resolution of the internal contradiction in the germ cell. As a scientific abstraction, the final answer to the main research question can be regarded as a more profound reflection of the pedagogical practice than any of the single episodes or examples in the current study. However, it is possible that the three main answers in the conclusion provide an overly simplistic image of the concrete whole.[200] Moreover, even though the internal contradictions are described, they are not obviously resolved. As proposed by Davydov (1990), the second form of theoretical thought can only emerge through the disclosure of the contradictions in the germ cell and as a practical determination of their resolution. Nor have all the steps in the methodology been analyzed. The conceptual trails have been discussed and concepts in perspective have been introduced, but they have not been tested as described in step 4 of the methodology.[201] This is necessary for coherent, complete exploration of what constitutes CKA as a pedagogical practice. The final section discusses these pedagogical implications. As such, this section represents one step further in the ascent toward a new concrete pedagogical practice.

However, the conclusion is primarily relevant for the teacher education context. Because of age differences, the three answers to main research question are not necessarily relevant for the primary and secondary school sectors. It is more likely that the answers are perhaps generalizable to student learning in tertiary education; however, it is unclear whether they can be generalized to children's learning to the same degree. Further studies are needed.

[200] See section 11.1, Answering the main research question, page 354.
[201] See section 3.3.5, Step 4. Suggesting a solution to the initial problematic situation, page 62.

11.2.6 Showing how one can identify the germ cell of a specific pedagogical practice

The analysis in this dissertation has demonstrated that the notion of the germ cell provides a powerful means of studying CKA as a pedagogical practice. The description of the germ cell of a specific type of pedagogical practice can also be regarded as a theoretical contribution within activity theory. While several researchers have attempted to use Vygotsky's principle of double stimulation in new ways (Engeström, 2007b) (Lund & Rasmussen, 2008) (Ritella & Hakkarainen, 2012), less attention has been directed toward the methodological principle of ascending from the abstract to the concrete.

As a consequence, there has been less discussion about how the germ cell can be used as part of a methodological approach. According to Davydov (1990), the germ cell usually has several characteristics. It is something simple, devoid of differences, fragmentary, and undeveloped. It can be regarded as a homogeneous formation or a certain delineated part of the whole, which is at the same time independent from it. It is the undeveloped element of a developed whole. On the one hand, this definition is vague and does not necessarily clarify what the germ cell actually is. This makes it difficult to delimit what the germ cell can and cannot be. On the other hand, this vagueness enables a range of interpretations of what a germ cell could be. With regard to this issue, the current study provides examples of what the germ cell of a pedagogical practice can be. Compared with other studies related to germ cells, the germ cell identified in the present study was in some ways different.

First, compared with the *embodied* germ cell (*sit to stand*) that was identified by Engeström and Sannino (2012),[202] the germ cell in the present study is primarily mediated through the use of verbal and written language. The distinction between request and no request is closely related to different language acts. In comparison, Engeström and Sannino (2012) downplay the importance of verbal language when the germ cell is identified as *sit to stand*, a very concrete pattern of embodied interaction. While the present germ cell does also include bodily movements and the use of gestures, it is nevertheless a less dominant part of the analysis.

The validity of the germ cell also depends on the richness and diversity of the data that is used in the analysis. In the present study, the analytical challenge was to create an internal unity out of the diverse data from both the offline and online settings. In contrast to Davydov's (1990) emphasis on a particular phenomenon, the germ cell in the present study is somewhat different because it describes the complementarity of two simple patterns of interaction that are mutually dependent on one another. Since the germ cell consists of two components ("help on request" and "help without request"), it is different from the *embodied* germ cell (*sit to stand*) described by Engeström and Sanninos (2012), which describes only one component. As such, the germ cell in this study is more similar to the water molecule analogy highlighted by Vygotsky (1987). Two types of help were identified as the core components in what can be labeled the "water molecule" of CKA as a pedagogical practice in teacher education.[203] The first "atom" was identified as "help on request", which represents an explicit, intentional act of helping. The second "atom" was identified as "help

[202] See section 3.3.3, Step 2. Identification of the germ cell behind the problematic situation, page 60.
[203] See section 3.3, The germ cell of a new concept needs to be identified, page 58.

without request”*,* which unfolds itself without an explicit call for help. Help does not exist in one single particular form, rather as two complementary components (“help on request” and help without request). There were also internal contradictions between conditional help and unconditional help.

However, it is not clear whether the description of help is too general. In contrast, the germ cell, *sit to stand*, identified by Engeström and Sannino (2012), is much more specific. This germ cell is also defined as a part of a much more specific local activity system (*sit to stand*). However, it is less of a theoretical problem that help is so commonplace. For example, Davydov (1990) illustrates that the germ cell in Marx’s *Capital* is commodity exchange, which is very commonplace. It is a very simple, ordinary, basic relationship of bourgeois society encountered billions of times. In this elementary phenomenon, all of the contradictions of modern society are disclosed.

Second, in accordance with the theory, the germ cell in the present study was also identified as contradictory. According to Davydov (1990), the principle of ascent is dependent on the disclosure of contradictions in the germ cell, as well as in the concrete whole. It is necessary to find and describe these contradictions if they are to be resolved. Likewise, the conclusion attempts to explain the internal contradictions in CKA as a pedagogical practice; however, it is not clear whether or how these contradictions can be resolved.

The main reason is that unconditional help emerges as something fundamentally different from conditional help, which is more reliant on some kind of commodity exchange. For example, the findings show that verbal interaction can be interpreted as mediating unconditional help in itself. The urge to move the conversation forward through new turns automatically stimulates unconditional help. This happens by simply participating in the dialogue. Here, the exchange of turns does not require an equal amount of sharing from all students. There are also other examples of unconditional help that are not directly dependent on any type of exchange. For example, the students enjoyed showing and sharing their achievements, both through verbal interaction and written sharing of work.

On the other hand, “help on request” is more closely connected to conditional help. This is primarily because the request increases the consciousness of transferring something of value to others. It is built upon the verbal act of giving something away to others. As a language act, it can be interpreted as the necessary foundation for permission-based help and the possible introduction of commodity exchange as a primary contradiction. When help is perceived as an act of transfer, it also becomes possible to assess the degree of help. As such, help is also given within the norm of reciprocity that expects a similar return value of the help that is given away as a commodity. The findings show that both unconditional help and conditional help can coexist in the same pedagogical practice. It is therefore possible that the solution is not to remove the contradictions, but to balance the contradiction in some way so that both types of help can coexist in a functional way.

Furthermore, one can ask if help is the only valid germ cell of CKA as a pedagogical practice. When Davydov (1990) describes examples of germ cells from science (e.g., how a steam engine works), it is with the assumption that the germ cell can identify the one correct and valid law for the formation of that whole. One can question whether it is possible to identify

the same type of correct “essence” of pedagogical practice. Even though help has been identified as a very important part of CKA as a pedagogical practice, it is possible some parts of the pedagogical practice are excluded. For example, students work both independently and with each other, but do not always help one another. Does this suggest the need to address a complex set of more than one germ cell to explain the concrete whole? This issue should be addressed in further research. Nevertheless, it should be noted that the germ cell in the present study includes a very large range of different activities. For example, “help without request” is closely related to how ongoing verbal interaction can in itself be a mediator of help.

Moreover, it is not clear that this specific germ cell can be generalized to other contexts. The different descriptions of a germ cell show that the definitions vary depending on the concrete object being described. Even though the discussion of CKA as a pedagogical practice is restricted to the teacher education context, it is likely that the description of the germ cell (“help on request” and “help without request”) can be useful in the analysis of similar pedagogical practices in other educational contexts. In a more fundamental sense, it is possible that help represents a powerful conceptualization that can be interpreted as the core interactional relation in all formal education. It is likely that most pedagogical practices rely on some degree of the two complementary components, “help on request” and “help without request.” Any pedagogical practice which is part of an educational system seeks to provide and distribute help. Without the presence of some kind of help, there exists no formal education. As suggested by Davydov (1990), the germ cell can be a simple universal form, into which certain complex phenomena are constantly passing, and to which they are reduced. Although different theories about education may offer different design solutions, they all attempt to provide help to the learner in the best possible way. However, in the teacher education context, the key issue is to help prospective teachers to become the best possible helpers.

It is evident that theoretical concepts, such as germ cells and contradictions, can be used to revitalize activity theory to capture the increased complexity that emerges with the online setting. It is perhaps not necessary to invent new theoretical concepts. For example, in some recently published papers (Engeström, 2009a, 2009b; Engeström & Sannino, 2010), it is suggested that Internet-based peer production and the online setting challenge scholars to rethink the shape of activity systems. A range of new concepts, labeled as fourth-generation activity theory, are just briefly described (e.g., runaway objects, knotworking, co-configuration, boundary crossing, expansive swarming, etc.) (Engeström, 2009a). The present study shows that it is not certain this conceptual approach is necessary; however, some of the core concepts in the existing theory can be used in new ways.

11.3 Inventing an instructional design that can maximize help

When the germ cell was identified (Chapter 9), this made it possible to discuss in what new directions CKA as a pedagogical practice may evolve (Chapter 10). The notion of "conceptual trails" was used to show how new pedagogical concepts can build on the maximization of help as a simple, but fundamental, interaction pattern. As a consequence, it is not enough to only implement a new digital technology; rather, one needs to develop different instructional designs that can utilize a combination of different types of help. The findings suggest that a direct or simple transfer of CKA into teacher education is not possible to realize, because the learning environment is extended both in time and space. As a pedagogical practice, CKA emerges as something different from both the lecture method of teaching and constructivist teaching methods. The table below provides an overview of how the different conceptual trails (Chapter 10) can be linked to four instructional design principles, which provide an outline of the pedagogical implications of the findings.

Table 11.3.a An overview of how the five different conceptual trails are linked to four instructional design principles.

Conceptual trails	**Offline setting**	**Online setting**	**Instructional design principles**
1. Transparent use of artifacts	- Sharing displays by using physical artifacts that are transparent (e.g., that support visual co-attention)	- Sharing written traces by using digital artifacts that are transparent (e.g., which give easy access to and an overview of the student work)	2. Maximizing the transparency in the learning environment
2. Nurturing critical feedback	- Close and personal interaction	- Different types of anonymous interaction (e.g., the unknown other as a teacher)	1. Maximizing the number of available teaching activities in the learning environment 3. Maximizing the potential in anonymous interaction
3. Learning by teaching	- Students being guides for each other in the dyad - Designing a community of students being teachers for each other		1. Maximizing the number of available teaching activities in the learning environment
4. The teacher educator as a team coach	- Guiding the students in their role as knowledge producers (ensuring equal participation, creating acceptance of discomfort, balancing students' own responsibility)		1. Maximizing the number of available teaching activities in the learning environment

5. Creating value beyond the learning period		1. New modifications made by new students (improving existing student work) 2. New modifications made by outsiders (publishing student work in a vibrant knowledge production environment) - Reusing published student work as it is	2. Maximizing the transparency in the learning environment 3. Maximizing the potential in anonymous interaction 4. Making existing knowledge as available as possible

The table shows how the five conceptual trails are connected to *four instructional design principles,* which can potentially guide the further development of pedagogical practice within this area. The four design principles are related to step 3 in the methodology.[204] It requires the construction of an explicit, simplified model that offers a solution to the problematic situation. Instead of focusing on the development of one grand design, one should instead cultivate tentative solutions developed through experimentation. These solutions are here presented as design principles primarily relevant for the teacher education context. If they are successful, it is possible that they can be generalized and spread to new contexts.

11.3.1 Maximizing the number of available teaching activities in the learning environment

The first instructional design principle suggests that *CKA as a pedagogical practice should attempt to maximize the number of available teaching activities in the learning environment*. In the discussion of the third conceptual trail,[205] it was suggested that this could be done by letting the students enter the role of being "teachers for each other." From a historical perspective, this is different from the dominant interaction pattern in the educational system that builds on the teacher giving help and students being receivers of this help. However, to maximize the amount of help in the learning environment, it becomes important that the students are able to help each other in both an offline and an online setting. Teaching can therefore be regarded as something only the teacher does. By involving the students, one can create a multitude of informal teaching activities in the classroom that can greatly increase the availability of helping resources.

However, it is not obvious what approach to "*learning by teaching*" is the most efficient. On one hand, it is likely that there needs to be a strong presence of student discussion in the offline setting. For example, most of the learning by teaching in the present study took place when students helped each other as a part of the ongoing interaction in the small groups (dyads). The students also gave each other informal help at a plenary level, but this happened less frequently. The many ongoing conversations created a certain level of noise, but the students were still able to listen to what was going in their surroundings in a flexible way. It is less clear to what degree young children will be able to participate in this type of collaboration, or "mind mingling," in a successful way.

[204] See section 3.3.4, Step 3. Testing the germ cell, page 61.
[205] See section 10.3, Learning by teaching, page 333.

On the other hand, “learning by teaching” can also involve a “student lecturer,” which is something very different from being a “student guide” who helps other students individually. The current study shows that there was very little student lecturing, because the students did not present or discuss the work done in the smaller groups at a plenary level. One reason was that the students were not required to do this as a part of the formal instructional design. It is likely that the teacher educator, as suggested by one of the students in the interviews, would need to facilitate the more formal types of “learning by teaching” at a plenary level.

In the teacher education context, one should also note that “learning by teaching” becomes even more important, since the overall objective is to provide teacher training. Learning by teaching does not only need to happen in the practicum periods in schools; it can also be regarded as a fundamental instructional design principle for the courses on campus. Here, one of the biggest challenges is to ensure that the “student teaching” is perceived as fair. The findings show that the whole community of learners need to participate on equal terms. This is why the teacher educator will still need to organize and direct the process. Although it may be tempting to design teacherless environments, the current study shows that the passivity of the teacher had a negative influence on the group’s ability to do the project work. Even when the goal is to let students become more autonomous, the teacher needs to maintain some degree of support of and control over the project management of the ongoing work. For example, the teacher educator needs skills in guiding the students’ work.[206] Over time, it is likely that the teacher can leave increasingly more control to the students.

In addition, the teacher educator needs to make sure that the grading is done on fair terms. Because most of the students in the present study were motivated by grades, they considered their individual performance to be more important than the collective work. Several students were concerned about receiving group grades. They also worried that the low quality of the collective work might have a negative influence on their individual grades. The instructional design therefore needs to balance the collective work in relation to the need to “sort” the students according to individual grades.

Furthermore, the study shows that unknown others on Wikipedia served as “informal teachers” for the students in the online setting. These outsiders bring into question the idea of who teachers can be and where teaching can happen. However, there are several challenges. First, both students and the teacher educator will lose some control of the learning environment, because a greater level of unpredictability is introduced. The teacher educator will need to cope with the opinions of outsiders who are not a part of the formal educational setting. For example, it is important that the feedback is not in conflict with the learning objectives in the course. Second, the critique can be harsher when it is anonymous. Even though it may be relevant, it may not be adjusted enough to student needs. Third, some students might not even get any outsider feedback at all, and this can be perceived as unfair. It is not possible to control this, because the feedback in the global online community is given independently from the plans of the teacher.

[206] See section 10.4, The teacher educator as a team coach, page 341.

However, perhaps the biggest challenge is that both students and teacher must perceive teaching to be one of the most powerful ways of learning. Learning by teaching will often be iterative in the sense that the student will work with a problem or topic several times. For example, they will need to prepare a lesson, enact the teaching, and afterwards reflect upon what happened. However, several students in the current study felt that they did not learn much when they had to do most of the work with little teacher support. Instead, they wanted to return to the lecture model when they had finished the project work. This shows that they had not changed their conceptions of teaching and learning in any fundamental way. They still preferred a teacher-centered transmission-orientated model of learning. They assumed that the most important learning would happen when the teacher was talking, because they ascertain that this knowledge is valuable. Teaching was regarded as a formal activity directed by the teacher (or teacher educator), while learning was regarded as something that was happening with the students in the formal role of being learners.

However, the current study shows that it is necessary to separate these activities of teaching and learning from the roles of being a teacher and a student. Students will often both learn and teach in an educational setting. For example, in small-group collaboration, students can both learn something and at the same time be doing "informal teaching" for the rest of the group. Likewise, when the learners become teachers for each other, it is likely that the teacher educator will also learn something from this process. The teacher educator will then become more of a guide or learning partner. These roles will also need to be discussed openly. Without any metacommunication about what teaching and learning can be, it is not likely that students will accept a change in the instructional design toward more learning by teaching.

11.3.2 Maximizing the transparency in the learning environment

The second instructional design principle suggests that *CKA as a pedagogical practice should attempt to maximize the transparency in the learning environment.* Regarding the definition of the germ cell of CKA, one should here note that transparency is important because it opens up for new possibilities of help that are not planned. When student work is made available for and visible to others, help can be offered in many different ways.

First, the transparency in the present study was mediated by how the physical artifacts were used in the offline setting. The discussion of the first conceptual trail emphasized the importance of using artifacts that mediate visual co-attention between students.[207] For example, the laptop screen provided good visual access to the students who were sitting close to it. As such, student dyads were able to collaborate in an effective way in the ongoing dialogues. Because both students had visual access to the same information, they could share ideas in a time-efficient way. In many incidents, short and spontaneous comments were mediated by screen operations that both students had visual access to. In sharp contrast, work on a sheet of paper was seldom used to share information. It did not mediate visual co-attention between students to the same degree.

[207] See section 10.1, Transparent use of artifacts, page 320.

However, the small size of the laptop screen limited the outreach of the screen sharing in the offline setting. Sometimes the students moved their laptop screens to actively share or show other students their work. Nevertheless, there were few other physical artifacts that could be used as an object of shared attention and support plenary discussions in a larger group. In general, the students did not spend much time discussing issues together as a whole group. This made the collective work less transparent at a plenary level.

Second, the transparency was mediated by the verbal interaction in itself. In the dyadic collaboration, students often verbalized their thoughts as a part of the ongoing dialogue. These spontaneous processes were similar to both "thinking aloud" and "thinking together." The perhaps most striking example of overlapping speech was how the students even co-constructed single utterances. This type of interaction illustrates how some student dyads were making their thoughts as transparent as possible. Help will here be an integral part of the ongoing dialogue and will be available as a constant opportunity. As informal peer feedback, it will "move more freely around," since there is no need to ask for permission to give or receive help.

At the plenary level, the sound level of the voice was an important mediator of the transparency of the verbal interaction. For example, by "raising one's voice above normal," one could get others' attention. The degree of increase in sound level also varied depending on the specific table arrangement and how far the students were sitting from each other. The voice was important, because there were few available physical artifacts that could visually display the collective work to all students.

In addition, the transparency of the discussions was present through the more general sound level of the many ongoing conversations taking place at the same time. This was not a fight for the floor, in which the aim of talking louder was to "shout the other down" or win by acoustic force (e.g., Schegloff, 2000). Instead, the conversations in the smaller groups were adjusted to an acoustic level that made it possible for others to join the different conversations while still sitting around the table. Even though the ongoing conversations were primarily isolated from each other, the transparency provided through the sound level made flexible participation possible. Information from several other conversations was constantly accessible, and students could join a conversation whenever they found it to be relevant. For example, because some student dyads used a relatively loud voice level for longer stretches of time, they received feedback from other students on the work they were doing, which opened up for a relatively flexibly way of regulating problems that arose in the group interaction. The general sound level contributed to the vibrancy of the learning environment in the offline setting.

Although one could claim that transparent interaction also strengthens the dialogic space, one could claim that the basic quality is not to be found in the diversity of one single plenary conversation in the classroom but rather in the many ongoing parallel conversations. In polyphonic classrooms, different perspectives will also be accessible through the many ongoing conversations available in the surroundings. The basic requirement will then be the existence of a norm that permits some level of "noise." However, the difference between what students experience to be disturbing noise and merely loud collaboration may be difficult to distinguish. In the present study, the students were able to regulate the sound of

their voices to an acceptable volume that was not perceived to be so loud that it disturbed others.

Note that the transparency in this polyphonic project work is very different from the norm of letting one person speak at the time. It is not about creating a shared space to which all students are paying attention at the same time. On the contrary, students are not required to pay attention to what others are saying, but they can if they want to. When this norm is accepted, it permits many simultaneous conversations that need only to be accessible for others as a potentiality. All students are allowed to speak, but not all voices will necessarily be heard. One potential disadvantage, then, is that some students who are modest may not be able to participate in this learning environment. The teacher will then need to ensure that every voice in the classroom is heard.

Nevertheless, the quality of the interaction is, in this way, built around the simultaneous verbalization of many of the ongoing thoughts in the larger group. The quality is then present in the possibility of joining the many ongoing conversations more than letting one person speak at the same time. The help will be mediated by the transparency of the many informal verbal discussions in the smaller groups that were going on at the same time.

Third, the transparency was mediated by digital artifacts. In the current study, the wiki transparency was limited during the workshops, because the students did not have access to each other's work in real time. Nor did the students use the wiki to support their project management. Instead, Google Docs and Facebook were used as supplementary tools to support the project work and the communication between the students. It is therefore suggested that a mix of different digital tools be utilized to maximize the transparency of the collective work.[208] This involves a combination of both asynchronous and synchronous tools. Since many were unfamiliar with this kind of collaboration, it is likely that students will need training on how to use these tools efficiently

However, the main advantage with the wiki as a digital artifact was primarily related to the open distribution of the students' final work. The findings show that the students were proud of publishing their work in a transparent environment, because many had access to and could read their work (e.g., Wikipedia). When the work can be reused, it also becomes valuable to others over an extended time period. Even the comments on the wiki discussion page were stored and remained available for new readers. This open "dialogue space" made it possible for others to not only assess the quality of the article but also to provide a review of the work. When the reviewers know that others can read their review, this transparency may strengthen their efforts to give high-quality feedback.

11.3.3 Maximizing the potential in anonymous interaction

The third instructional design principle suggests that *CKA emerges through maximizing the potential in anonymous interaction.* One important finding in the present study is that students had few problems doing anonymous peer editing on previous student work. Extended peer editing was unproblematic, because it built on work done by an anonymous

[208] See section 10.1 Transparent use of artifacts, page 320.

collective of unknown students.[209] In sharp contrast, the students found it much more difficult to be critical toward each other in class. Except in the dyads, the informal relationships between the students were more distant. Because the students did not know each other well, the students were unsure about whether they should be honest and give critical feedback to others. Because most of this work was personally identifiable, the students feared this could potentially create conflicts and disagreements. There was a fear of provoking or insulting others that overrode the urge to give or receive help (conflict of motive). This was less of a problem when the peer editing was done anonymously. When the collective work built on students' work from previous years, the students knew that they would not have to interact directly with the original authors but rather only with the text they had left behind.

The wiki also downplayed the visibility of the personal contribution, because there was no reference to the names of the original authors. Although one can still trace a single contribution by username in the wiki log, the contributor's username would not necessarily be the same as his/her actual name. The emphasis is on the collective text as a communal property. Likewise, the students also chose to make anonymous contributions in both Wikibooks and Wikipedia. This is very different from interactions in a smaller offline setting, where the norm is that you know who you are working with. Here, the student contributions will usually be personally identifiable. Even though the dyadic collaborations illustrate that critical feedback was possible, it was still reliant on a certain level of trust between the students. It is usually assumed that trust is a precondition for human cooperation in a face-to-face or offline setting (Bryk & Schneider, 2002; Cranston, 2011; Dodgson, 1993; Gambetta, 2000).

However, when the groups became larger, as in the second and third wiki assignments, it became increasingly difficult and time-consuming to become acquainted with the other students. At this interaction level, the students were not close, but at the same time nor were they anonymous in relation to each other. Here, the advantage with anonymity is that it is not necessary to use extra time on establishing trust between students before giving feedback.

When the course period is short, it will usually not be possible to establish close relationships between all the students in the class. One alternative can therefore be to organize anonymous interaction between students in the offline setting. For example, it is possible to use different peer review assignment tools, which let students give each other peer feedback (e.g., Paré & Joordens, 2008). However, in the current study the anonymous interaction was primarily perceived as negative, because it opened up the possibility for free riding. In the large groups, the students struggled to get an overview of the collective work, and this made it easier for free riders to "hide."

Furthermore, one can question how one can assess the trustworthiness of anonymous comments. The findings in the current study suggest the existence of at least three types of trustworthiness. First, the trustworthiness of the online community will be of influence. In the current study, Wikipedia was one such vibrant global online community where students

[209] See section 7.8, Extended peer editing, page 256.

received comments on their work. Although in principle anyone could give feedback, the students showed a great deal of respect for the outsider feedback. For example, the students asked for an extension of the original deadline so as to improve the article according to the feedback. Because the students knew that Wikipedia was an important online encyclopedia, this may have influenced the level of seriousness with which they responded to the critique. Second, the trustworthiness of the specific outsider will be of influence. Several of the Wikipedians who gave feedback were anonymous, but a few of them still gave some information about their level of background knowledge on the wiki discussion page.[210] Third, the trustworthiness of the content itself will be of importance in that the students will also assess the quality of the comment or edit that has been made. Because the content has been produced anonymously, students will automatically be more critical of it. At the same time, they can use their background knowledge to assess the relevance of the comment. In contrast, students will usually assume that comments made by the teacher are usually of high quality.

Ideally, this type of feedback will function in the same way as anonymous peer review in scholarly journals, but this is far from certain. Moreover, the anonymity does not provide any personal acknowledgement for this type of work. This may be one reason why few students continued to edit on the wiki pages after the course work. It is therefore likely that the potential of this type of work is greatest when it is done as a part of the preservice teacher training.

Despite these challenges, it is evident that anonymous interaction is a viable option when students are to collaborate in large groups. This type of interaction becomes essential to utilize "the power in the numbers" and represents a different way of giving "honest" feedback. In contrast, personally identifiable interaction usually requires that some time is spent to establish a good relationship. In this sense, anonymous interaction challenges the fundamental pedagogical idea that a good relationship is a necessary condition for high-quality collaboration. As such, CKA emerges as a pedagogical practice within the polarities of proximity, in both very close and the very distant, almost "non-existent," relationships.

11.3.4 Making existing knowledge as available as possible

The fourth instructional design principle suggests that *CKA as a pedagogical practice should make existing knowledge as available as possible*. The present study shows that students can produce authentic knowledge of value for others in several ways. It was especially the second wiki assignment that made it clear that students in the education context can produce valuable knowledge even though they are amateurs or "non-experts." First, the student-produced Wikipedia article about rock carvings represented a significant contribution to the most important encyclopedia on the Internet. The students wrote the article with very little initial background knowledge. They used several different relevant sources, and they also traveled out to different field sites and took photos. This article has been read quite a lot and has more or less remained unchanged in the years since. This indicates that the initial work was of sufficient quality to be of value to others.

[210] See section 7.9.2, Outsider feedback, page 263.

Second, the instructional video about rock carvings illustrates that students can make existing knowledge available in new multimodal formats. The goal with this video was not only to reach schools but also target groups outside of the educational system, such as tourists. When the student work is distributed through an open online environment, the outreach will be very broad. A multitude of potentially relevant target groups can be reached. Both these examples illustrate that students can do tasks of authentic value but that do not require a very sophisticated level of expert knowledge.

On one hand, one could claim that the student-produced wiki work threatens the hegemony of what has previously been defined as "expert knowledge." Here, the key issue is to define what "knowledge advancement" can be in a teacher education setting. If it is sufficient that students make existing knowledge more available, they can produce many different types of resources that can be of value, which does not require a very high level of expertise. The two aforementioned examples suggest that "student amateurs" can produce other types of resources that can supplement what experts do. Here, much of the quality is to be found in the increased diversity of knowledge in many different formats. For example, the students produced instructional videos, Wikipedia articles, and a learning resource about rock carvings. In this way, they made the existing knowledge more available. Another example is that they took photos from different field sites.

Furthermore, the first wiki assignment also illustrates the potential value in letting students make "micro contributions," such as reviewing a single video or finding a new video that can be added to a compilation of video resources. This is not very difficult to produce, but it is very time-consuming for one person to watch many videos and assess their quality. Students with some background knowledge can do this work, and if the workload is shared, it may not require that much effort from each student.

However, some of the findings indicate that the students need to have a certain minimum level of background knowledge to be able to transform existing knowledge into new valuable formats. In both the wiki assignments about musical instruments and the third wiki assignment, the students struggled to make any significant improvement because of their lack of background knowledge. Another challenge is that when all students are involved in this kind of work, it is likely that some of the work will be of low quality. Some of the wiki revisions indicate that the quality of the work was reduced. The students also lacked review strategies that could optimize the quality of the student contributions. For example, there were no formal peer feedback processes. In this way, the students were unable to work like a research team,[211] which reviews each other's work from a critical perspective. Rather, the review was present as "long-term CKA" when students built on and improved work that previous students had done.[212] In this way, new students could remove poor-quality work that others had done. This also illustrated how the process of "advancement" is primarily related to creating something of value over a longer learning period and should therefore be restricted to only one course. Note also that this type of knowledge advancement is dependent on the use of licenses (e.g., Creative Commons licenses) that make it possible to freely copy and reuse text. In this way, it becomes easy for new contributors to make improvements.

[211] See Chapter 1.
[212] See section 10.5, Creating value beyond the learning period, page 347.

If the assignments are properly designed according to student interests, there is little doubt that there is a huge potential for scaling up the number of student contributors in this kind of work. A large number of contributors can ensure that the quality of the existing article remains at a high level. This is done by keeping the sites updated or by removing "vandalism." Even though this type of work is easy to do, it still needs to be done. This requires accessibility and manpower. For example, the problem with a quiet global wiki environment like Wikibooks is that the student work will gradually become outdated because of a lack of contributions. One alternative is to publish the student work in a vibrant knowledge production environment like Wikipedia, where it is likely that outsiders will update the original work. In this sense, CKA is reliant on some kind of maintenance work in order to be sustainable over time.

Nevertheless, the students in the current study were not ready to embrace the idea that they could create something valuable. Several students experienced a reduction in the amount of individual learning. There was a tension between the goal of maximizing individual learning versus the goal of maximizing the quality of the collective work. Although some of the work ended up being of value, some students still complained that they did not learn much. If one wants to maximize the amount of individual learning, it is not necessarily a good idea to let students do tasks they already know how to do. It may be better to let an inexperienced student do that specific task. On the negative side, this may reduce the quality and the value of the collective work in itself.

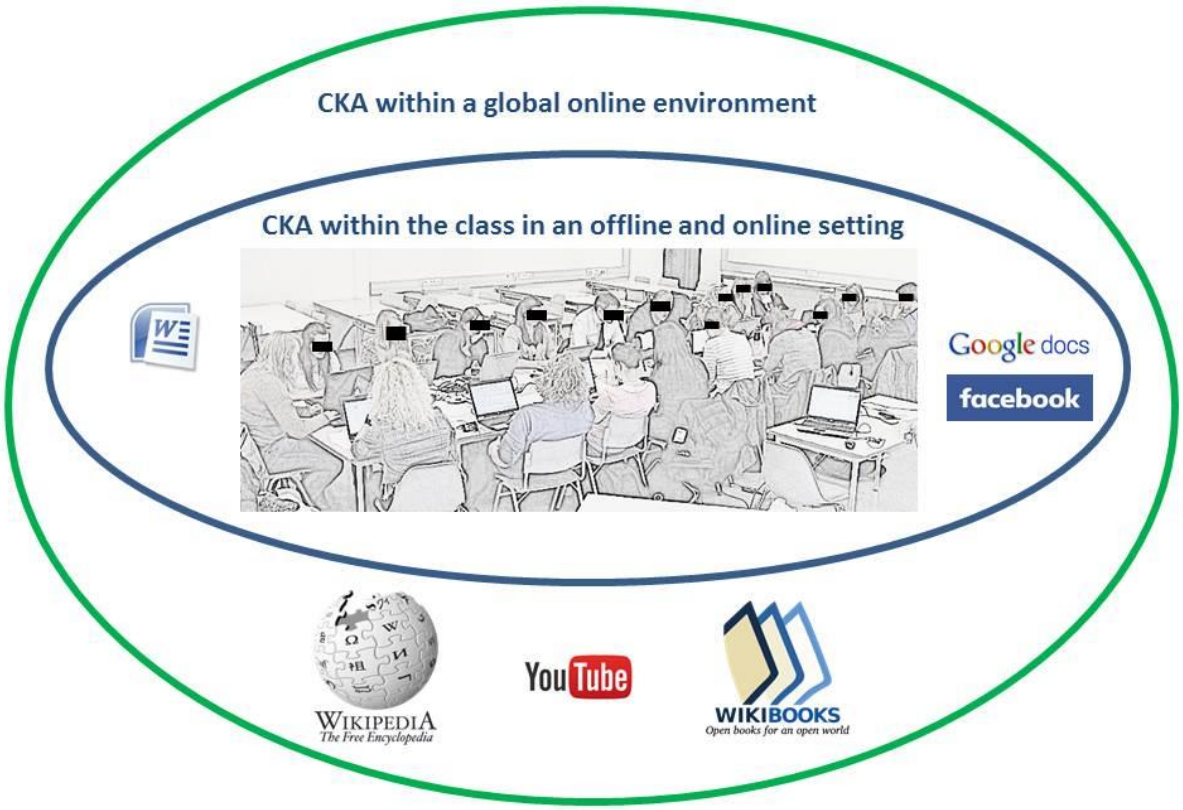
However, it is possible to regard this type of student work as a way of enculturating the students into the knowledge-creating society.[213] In the current study, some students expressed this through their feelings of pride after having made a societal contribution. Here, CKA as a pedagogical practice is to a larger degree connected to fundamental ideas about democratic citizenship. By giving students the opportunity to make contributions, one empowers the "non-experts" in realizing that they, too, can create valuable societal knowledge. The introduction of more voices and diversity in the public can also be regarded as important in a democratic society.

[213] See section 1.2, Knowledge-producing skills in the network society, page 3.

11.4 CKA emerges as a polycontextual pedagogical practice in teacher education

While many educational researchers have investigated ICT-based collaboration, very few have investigated how CKA evolves in the interplay between an offline and an online setting. The rise of the Internet and the many new online communities represents a potentially radical expansion of the learning space in both teacher education and the rest of the educational setting. Students can easily interact in online settings outside the classroom and the school. A huge range of online environments offers new opportunities for collaboration in an unrestricted global space. Many of these communities offer a new kind of transparency, where student work can become visible to a much larger degree than before. Student work in Wikipedia will be public in a very different way compared with a closed learning management system. As a consequence, CKA as a pedagogical practice will need to offer the opportunity to participate in several different online environments. The data show that students move between their verbal discussions in the offline setting, the use of different digital tools as a part of the work in the offline setting, and the publication of their work in the global wiki environment. CKA will therefore need to be studied as a *polycontextual phenomenon*, where interactions happen at several different levels. The model below shows how students in the present study participated in multiple different learning environments.

Figure 11.4-a Model showing how CKA emerges as a polycontextual pedagogical practice.



First, the *blue inner circle* shows that the student work was done *within the class in a teacher education institution*. A new pedagogical practice will need to emerge within a specific socio-historical condition in the offline setting. The new practice will need to be adjusted to local constraints related to both the institutional culture and the dominant pedagogical practice. For example, the students were still very concerned about the degree of individual learning in the course and how the collective work would influence the final grades they received. The wiki work did not fit well with the competitive norms they felt to be an essential part of the assessment system. The students showed this attitude when they rejected an invitation to collectively prepare for the final individual exam. In addition, a large part of the course was built around lectures, and the wiki work differed significantly in its lack of lecturing. The students also perceived the project work as being less fair than other types of assignments they were used to doing. They had to do different tasks and were not given equal opportunities to choose what they wanted to do.[214] It is therefore important that new instructional design manages to ensure that the norm of giving a fair assessment is sustained. The power of self-organized groups will also need to be nurtured over time. The findings suggest that the students will not be able to collaborate effectively in larger groups without extensive training. Students will also need to use digital tools that can support the collective work in the online class community in an effective way (e.g., Facebook and Google Docs).

Second, the *green outer circle* in the model shows that some of the digital tools were also used to contribute in *global online environments* (e.g., Wikibooks, Wikipedia and YouTube). It is this larger circle that radically extends the idea of a learning environment, because the students here create knowledge outside of the educational setting. The model shows that the students participated in two separate online environments. The online setting makes it even possible for students to participate in a range of different global environments that are not part of the formal teacher education context. As a consequence, CKA as a pedagogical practice necessitates a reconceptualization of participation in a "singular learning community" into participation in "plural learning communities." This new polycontextuality involves student participation in the class as a local setting and in several different global online environments.

The proposed instructional design principles intend to provide some guidelines for the further development of CKA as a pedagogical practice. However, the value of CKA as a possibility concept will still depend on whether other teacher educators take interest in moving their classroom teaching in this direction. For example, one should continue to explore how students can maximize help among themselves as a part of the formal instructional design. Moreover, it is unclear how CKA as a pedagogical practice can be effectively integrated with the formal assessment system. The findings show that group grades are problematic to use. In addition, there is a need to further clarify how CKA can be connected to educational policy and the recent focus on 21st-century skills. This involves further investigation into what types of individual skills CKA requires.

However, it is obvious that learners in the future, independent of CKA as a pedagogical practice, will participate both in a local offline setting in class and in an extended online

[214] See section 8.6, Unfairness as the fundamental inhibitor, page 293.

setting. Both teacher educators and prospective teachers need to be aware of how learner participation in multiple communities and across multiple contexts will be the new standard. Although student participation in global online communities is not currently common practice, it is likely that it will become more a more normal part of teacher training programs in the future. It has been the intention of the present study to examine what is at stake, and how we can implement, support and sustain such practices.

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13 Appendix

13.1 Appendix 1: Glossary of transcript symbols

This glossary of transcript symbols is only relevant for the detailed transcriptions of the verbal interaction in section 7.6.2 Peer feedback as the co-construction of one single utterance. It is a modified version of Jefferson (2004).

word (quoting text written on the laptop screen)

[*A left bracket* indicates the point of overlap onset.

] *A right bracket* indicates the point at which two overlapping utterances end.

= *An equal sign* indicates no break or gap.

(.) *A dot in parentheses* indicates a brief interval (approximately one-tenth of a second) within or between utterances.
(0.0) *Numbers in parentheses* indicate elapsed time by tenths of seconds.

:: *Colons* indicate prolongation of the immediately prior sound. The longer the colon row, the longer the prolongation.

- *A dash* indicates a cut-off.

( ) *Empty parentheses* indicate that the transcriber was unable to get what was said. The length of the parenthesized space reflects the length of the speech not captured.

WORD *Upper case* indicates especially loud sounds relative to the surrounding speech.

<word *A pre-positioned left carat* is a “left push,” indicating a hurried start; in effect, an utterance trying to have started a bit sooner than it actually did.

____ Underscoring indicates some form of stress via pitch and/or amplitude. A short underscore indicates lighter stress than does a long underscore.

◦word◦ Degree signs bracketing an utterance or utterance-part indicate that the sounds are softer than the surrounding talk.

(( )) *Doubled parentheses* contain the transcriber´s descriptions.

13.2 Appendix 2: Interview guide

General question that were used in all group interviews:

- How great is the potential of wikis?
- Video book: What do you think of the students doing this kind of work? Is it a good thing?
- How important is it to develop open learning resources produced by teachers?
- How do you experience what it is to write, modify and continue to develop others' work?
- How important is it to give students experience with wiki work?
- What do you think about the quality of the sources you have used?
- How should these types of projects be managed?
- How is it possible to use wikis in school?

(To ensure anonymity, the more specific questions from the student blog posts have been excluded).

13.3 Appendix 3: Information about the research project

Forespørsel om å samle inn datamateriale i et forskningsprosjekt i tilknytning til din deltakelse som student ved IKT for lærere ved Høgskolen i Østfold

Jeg heter Rolf K. Baltzersen og er kursansvarlig for studiet IKT for lærere. Jeg jobber som førstelektor ved Høgskolen i Østfold og leder nå forskningsprosjektet " Design og implementering av prinsipper for kollektiv kunnskapsutvikling i lærerutdanningen"

I dette prosjektet er vi interessert i å studere samarbeidsorienterte læringsprosesser med bruk av ulike digitale verktøy. Vi er interessert i å skaffe oss mer kunnskap om hvordan dere som studenter bruker nye wikiverktøy når dere samarbeider, skriver oppgaver og deltar i undervisningen på studiet IKT for lærere. Formålet er både å forbedre de IKT-baserte studiene i lærerutdanningen ved Høgskolen i Østfold og utvikle en bedre forståelse for nye former for IKT-baserte samarbeidsprosesser.

Jeg ønsker å samle inn datamateriale i tilknytning til det arbeidet dere skal gjøre i forbindelse med den wikibaserte arbeidsoppgaven i studiet som vil pågå i mars 2012. Hovedfokuset vil bli på hvordan dere jobber i gruppe med å løse mappeoppgaven. Jeg ønsker å ta lydopptak av hvordan dere snakker sammen og løser problemer når dere jobber sammen. I tillegg ønsker jeg å sette i sammen med konkrete skjermaktiviteter. Derfor ønsker jeg å ta opp skjermaktiviteter med bruk av screencast. Jeg ønsker også se dette i sammenheng med de tekster (nettsider) som dere faktisk utvikler. I tillegg til disse ønsker vi å filme aktivitetene i klasserommet som helhet med videokamera stående bakerst i klasserommet.

Opptak av gruppearbeid vil pågå i mars 2012 i undervisningen på tirsdager og torsdager fra kl.1715-2000. Tirsdag 6.mars, Torsdag 8.mars, Tirsdag 13.mars, Torsdag 15.mars, Tirsdag 20.mars og Torsdag 29.mars.

Vær da oppmerksom på at stemmen din blir regnet som personidentifiserende. Resultatene av denne studien vil primært bli publisert som gruppedata, uten at den enkelte kan gjenkjennes. Prosjektet forventes å være ferdig innen utgangen av 2014.

Det er imidlertid mulig at det vil bli aktuelt å gjennomføre mer utfyllende analyser av materiale ved en senere anledning. Vi ønsker derfor å oppbevare datamaterialet videre etter prosjektslutt, og gjøre dette tilgjengelig for andre forskere i 20 år fra forskningsprosjektets estimerte avslutning i 2014. Datamaterialet vil bli oppbevart i en forskningsdatabase. Eventuelle nye prosjekter meldes til personvernombudet for forskning ved NSD (eller Datatilsynet). Forskere og studenter vil kunne bruke materialet i denne perioden til pedagogisk forskning.

Senest 31.12.2024 vil navnelister, videomaterialet og screencastene bli slettet, mens eventuelle indirekte personidentifiserende opplysninger vil bli slettet eller grovkategorisert på en slik måte at enkeltpersoner ikke kan gjenkjennes.

Denne forskningen gjennomføres av Rolf K. Baltzersen som jobber ved Høgskolen i Østfold og Andreas Lund ved Universitetet i Oslo. Det er bare disse to som vil ha tilgang til personidentifiserbare opplysninger.

Det er helt frivillig å delta i prosjektet og du kan på hvilket som helst tidspunkt trekke deg fra gruppeintervjuet uten å måtte begrunne dette nærmere. Du kan også

reservere deg mot oppbevaring av transkribert materiale. Det samme gjelder for noe av innholdet som du nevner i intervjuet. Dersom du trekker deg vil alle innsamlede data om deg bli anonymisert og ingen enkeltpersoner vil kunne gjenkjennes i forskningsresultatene. Hvorvidt du velger å delta i prosjektet eller ikke, har ingen betydning for den ordinære gjennomføringen av studiet. Forskere som får tilgang til de personidentifiserbare opplysningene er underlagt taushetsplikt og personopplysninger vil bli behandlet strengt konfidensielt. Navnelister vil bli oppbevart separat fra det øvrige datamaterialet, men vil kunne kobles mot det øvrige datamaterialet ved hjelp av en referansekode som kun forskerne har tilgang til.

Hvis det er noe du lurer på kan du ringe meg på 41 23 25 22, eller sende en e-post til rolf.k.baltzersen@hiof.no.

Studien er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste A/S.

Med vennlig hilsen
Rolf K. Baltzersen
Høgskolen i Østfold
Remmen
1757 Halden

Samtykkeerklæring

Jeg har mottatt informasjon om forskningsprosjektet " Design og implementering av prinsipper for kollektiv kunnskapsutvikling i lærerutdanningen" og ønsker med dette å delta i prosjektet.

Navn ..... (bruk blokkbokstaver)
Signatur .....
Telefonnummer .....
e-postadresse .....

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Rolf K. Baltzersen
Avdeling for lærerutdanning
Høgskolen i Østfold
Remmen
1757 HALDEN

Vår dato: 14.01.2011 Vår ref: 25463 / 3 / JSL Deres dato: Deres ref:

KVITTERING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 04.11.2010. Meldingen gjelder prosjektet:

25463	*Design og videreutvikling av pedagogiske prinsipper for kollektiv kunnskapsutvikling i globale wikifellesskap*
Behandlingsansvarlig	*Høgskolen i Østfold, ved institusjonens øverste leder*
Daglig ansvarlig	*Rolf K. Baltzersen*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, eventuelle kommentarer samt personopplysningsloven/-helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/forsk_stud/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://www.nsd.uib.no/personvern/prosjektoversikt.jsp.

Personvernombudet vil ved prosjektets avslutning, 31.12.2014, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtvedt Kvalheim

Juni Skjold Lexau

Kontaktperson: Juni Skjold Lexau tlf: 55 58 36 01
Vedlegg: Prosjektvurdering

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 25463

Formålet med prosjektet er å undersøke hvordan studentarbeid i globale wikifelleskap kan støtte design og utvikling av pedagogiske prinsipper for kollektiv kunnskapsutvikling. Det vil videre være sentralt å undersøke hvordan evalueringsintensiv undervisningsvirksomhet påvirker kvalitetsutviklingen av et teknologibasert studium i lærerutdanningen.

Utvalget består av ca 54 personer fra Avdeling for lærerutdanning ved Høgskolen i Østfold - 4 lærerutdannere og to grupper med ca 25 studenter. Utvalget informeres skriftlig og/eller muntlig om prosjektet (jf. informasjonsskriv mottatt per e-post 12.01.2011) og samtykker muntlig til deltakelse.

Opplysningene samles inn gjennom spørreskjema, gruppeintervju og observasjon. Det vil bli benyttet videoopptak under observasjon av undervisningsaktiviteter, og det vil bli tatt lydopptak av samtaler. Det registreres direkte personidentifiserende opplysninger i prosjektet. Det tas høyde for at det behandles indirekte personidentifiserende opplysninger gjennom bakgrunnsinformasjon som alder, kjønn, arbeidserfaring m.m.. Direkte personidentifiserende opplysninger lagres separat fra det øvrige datamaterialet ved hjelp av en referansekode som kun daglig ansvarlig har tilgang til.

Prosjektet avsluttes 31.12.2014. Datamaterialet oppbevares videre etter prosjektslutt i en forskningsdatabase, og vil være tilgjengelig for forskere og studenter for pedagogisk forskning på IKT. Dersom andre prosjekter skal benytte datamaterialet, må det sendes egen melding til personvernombudet.

Senest 31.12.2024 vil navnelister, videomaterialet og screen-castene bli slettet, mens eventuelle indirekte personidentifiserende opplysninger vil bli slettet eller grovkategorisert på en slik måte at enkeltpersoner ikke kan gjenkjennes.

Vi ber om at utkast til fokusgruppeintervju sendes til ombudet for vurdering i god til før denne delen av prosjektet igangsettes.

14 Endnotes

Most of the endnotes refer to data in the Case study database (CSD)

[i] Although as many as 2880 book projects are mentioned, many of the books are not fully developed and the quality of the work is also unclear. (http://en.wikibooks.org/wiki/Main_Page Retrieval date 16.12.2016).
[ii] "(…) It is also important that you cite your sources in the proper way. Remember that your text should be written within the genre of an encyclopedia" (Guidelines from the course web page). File *Written guidelines - the second wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.2."
[iii] File *Written guidelines - the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" - "Wikioppgave nr.3".
[iv] File *Oppsummering av funn-kartleggingsundersøkelsen* and *Studentundersøkelse vår 2012.* In folder "4. Kartleggingundersøkelse av studenter."
[v] These statements have not been included in the interview guide in the appendix to ensure anonymity.
[vi] Students doing off-task activities. One student telling that she has nothing to do. Page 10, file *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Tredje wikioppgave."
[vii] File *Long term changes and use-the wiki assignments*. In folder 3. "Studentenes produksjon av wikitekster."
[viii] For example, when a student removes and adds some sentences in a paragraph, this was labeled as rewriting but could also have been labeled as two separate operations of adding text and removing text. See page 16 to 19. File *The student revision work – the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."
[ix] The changes to the wiki texts were also compared within different time periods (before workshop, during workshop, from project start until deadline). File *Comparison of Version 0,1 and 2 – human body - first wiki assignment*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.1 - Human body." File *Comparison of Version 0 and final version - musical instruments – first wiki assignment*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.1 – Music instruments." File *The student revision work – the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.3."
[x] This episode started with the students joking about wanting to please the teacher in an attempt to get good grades. S8 (time 12:52.085) in file *Videofil wikioppgave nr.1-musikkinstrumenter-workshop-før pausen*. In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Første wikioppgave."
[xi] In the period from July 2015 to Feb 2017 there were 4481 pageviews with a daily average of 7 views. The article has also remained more or less unchanged over this period, with only three edits made by two editors. The few revisions give an indication that student teachers can produce information for a wider audience that can be of significant value. File *Long term changes and use-the wiki assignments*. In folder 3. "Studentenes produksjon av wikitekster."
[xii] Two videos about rock carvings on YouTube. Found by the teacher and were later removed by the students. Video 1: 0:54 minute, 390 views; Video 2: 1:24 minute, 255 views. Retrieval date April 15th 2016. Page 18 in file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.2."
[xiii] Students' written summary of the project work in second wiki assignment. Page 14-15 in file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.2."
[xiv] YouTube video about rock carvings. 2,638 views over a period over approximately four years. 3 likes, and 1 dislike. Retrieval date April 15th, 2016. Page 9 in file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."
[xv] Statement that the wiki textbooks also make it easier for teachers to choose other teaching methods in their classrooms. In file *Students written explanations of the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.3."
[xvi] The final student-designed wiki ended up consisting of eight wiki pages with the following titles: "Images," "Facts," "Videos," "Places in the region," "Student work", "Tasks," "Curriculum objectives," and "Sources." In

file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."

[xvii] Page 14 in file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."

[xviii] A visit at Flickr almost four years after (on April 15th, 2016) shows that most of the student-produced images have had very few views (approximately 30 views) since they were published in March 2012. Page 9, File *Long term changes and use-the wiki assignments*. In folder 3. "Studentenes produksjon av wikitekster."

[xix] Page 5 and 6 in file *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."

[xx] For example, the students explained that they selected videos of children playing musical instruments so that it would be more motivating for other children to use. In file *Students written explanations of the first wiki assignment*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."

[xxi] "If the wiki is published openly, other teachers can also use the resources and participate in the further improvement of the wiki" File *Excerpt – the final text in the third wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."

[xxii] For example, S8 said, "I think it is a bit difficult to assess it, because I don´t know anything about it from an academic perspective" Time B1 [00:22:35.023] in file *Content logg – S8 med S9 – wikioppgave nr.1 – musikkinstrumenter*. In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Første wikioppgave."

[xxiii] During a plenary discussion in the last workshop, one student stated: "We don´t think we know terribly much about this topic" Time [00:22:57.687] in Videofile 7. Page 18, file *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Tredje wikioppgave."

[xxiv] File *Content log - screen capture Ulf (Wikioppgave 2 - Workshop 2)*. In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Andre wikioppgave."

[xxv] The photo was tagged with a Creative Commons license on the website, but the student had also put a copyright logo on the image itself (Page 6). File *Student-produced wikispaces page about rock carvings*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.2."

[xxvi] Uploading images with the wrong licenses into the Wikipedia article that were later removed by Wikipedians. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxvii] In addition, some Wikipedians raised concerns about plagiarism because of close paraphrasing. Some of the text in the body of the article was too similar to the original source. In file *Wiki log data – discussion page – Wikipedia article about rock carvings.* In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[xxviii] The students emphasized the value of introducing source criticism . In file *Excerpts – the final text in the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes produksjon av wikitekster."

[xxix] For example, students who worked with the first wiki assignment about the human body made separate individual edits before the workshop session, and this text was to a small degree changed during the workshop session. File *Wiki log data – human body – first wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.1" – "Human body."

[xxx] Time 19.mars kl.1918-20:49. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxi] Time 10. apr. 2012 kl. 19:28. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxii] Time 16. apr. 2012 kl. 10:28. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[xxxiii] Time 16. apr. 2012 kl. 19:06. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxiv] Time 16. apr. 2012 kl. 20:55. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxv] Time 20. mars 2012 kl. 20:18. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxvi] Time 9. apr. 2012 kl. 12:23. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipediaartikkel."

[xxxvii] Time 2. apr. 2012 kl. 12:04. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipedia artikkel."
[xxxviii] Time 2. apr. 2012 kl. 13:56. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipedia artikkel."
[xxxix] Time 18. mar. 2012 kl. 21:44 and then removed on 10. apr. 2012 kl. 19:28. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipedia artikkel."
[xl] Time 2. apr. 2012 kl. 13:56. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" - "Studentenes Wikipedia artikkel."
[xli] Students produced a lengthy explanation of their work with the Wikipedia article on the wiki discussion page. In file *Wiki log data – discussion page – Wikipedia article about rock carvings.* In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipedia artikkel."
[xlii] A Wikipedian also encouraged the students to compare the content in the article with the same culture on the Swedish side of the border. In file *Wiki log data – discussion page – Wikipedia article about rock carvings.* In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipedia artikkel."
[xliii] The students explain that they have written about how one can get access to the rock carving sites in the Wikipedia article so that it will be more relevant for tourists. In file *Wiki log data – discussion page – Wikipedia article about rock carvings.* In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipedia artikkel."
[xliv] Approximately seven minutes was used on dividing the tasks in Google Docs. Screen capture file *Frida 130312*, time period 10:30- 17:50. In folder: "Helleristninger 130312" – "Individuell screencast – 130312."
[xlv] Screen capture file *Frida 130312*, time period, time period 14:00- 14:10. In folder: "Helleristninger 130312" – "Individuell screencast – 130312."
[xlvi] Approximately seven minutes was used on dividing the tasks in Google Docs. Screen capture file *Frida 130312*, time period 10:30- 17:50. In folder: "Helleristninger 130312" – "Individuell screencast – 130312."
[xlvii] The students also used a Facebook group. File document *Use of Facebook*. In folder "5. Facebook."
[xlviii] The wiki log shows that all students made individual contributions in the first wiki assignment about the human body before the workshop. However, there were substantial differences in the content descriptions. File *Wiki log data – human body – first wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.1" – "Human body."
[xlix] The wiki log from the third wiki assignment shows that only half of the group had many contributions before they met at the workshop. File *The student revision work – the third wiki assignment*, page 20. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."
[l] Many students seemed to perceive these sessions as mandatory (Frida, page 5). File *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe.* In folder "1.Workshop data (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" - "Tredje wikioppgave.."
[li] Several students were doing other tasks or talking about non-academic topics in the fifth workshop sessions. Example, students playing music (page 3), A group of students talking about dance (page 24). File *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder: 1.Workshop data (video and screen capture) - 1.1 Hypertranscribe+Content log i word -Tredje wikioppgave.
[lii] File *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder: 1.Workshop data (video and screen capture) - 1.1 Hypertranscribe+Content log i word -Tredje wikioppgave.
[liii] This excerpt can be found from page 16 (subtitle "the problem with unequal contributions"). File *Students shared responsbility-excerpts*. In folder: "1.Workshop data (video and screen capture)."
[liv] File The use of Facebook. In folder: "5. Facebook."
[lv] (1.) File *Transkriberte filer-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder: 1.Workshop data (video and screen capture) - 1.1 Hypertranscribe+Content log i word -Tredje wikioppgave.
(2.) File *Transkriberte filer-Wikioppgave 2-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Andre wikioppgave."
[lvi] The student moderator (S2) is in charge. File name *Students shared responsibility – excerpts*. In folder "1.Workshopdata (video and screen capture)."
(3.) File *Transkriberte lydfiler-Wikioppgave 2-Workshop 2-Workshop II-kopi fra hypertranscribe*. In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Andre wikioppgave."
[lvii] The student moderator (S2) appointing a student to do a task. File name *Students shared responsibility – excerpts*. In folder "1.Workshopdata (video and screen capture)."

[lviii] One student guiding two other students on how to use the wiki. Time period 05:12–05:40 in *file Lydfil wikioppgave nr.1-musikkinstrument-workshop-etter pausen*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Første wikioppgave."
[lix] Videofile with students who are working with the wiki assignment about musical instruments. Image from 05.48 in file *00005*. In folder "Storgruppe 1-instrumenter-0603" – "Plenumvideo 0603."
[lx] The first excerpt covers a time period of one minute and six seconds (01:22:22.453 - 01:23:28.883). Page 14 and 15 in file *Transkriberte filer-Wikioppgave 2-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Andre wikioppgave."
[lxi] In the first wiki assignment, students sometimes raised their voices without direct screen support to inform the others about an issue. For example, at V4[00:14:16.763] in file *Videofil wikioppgave nr.1-musikkinstrumenter-workshop-før pausen*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Første wikioppgave."
[lxii] Image from 21:22 in file *00004*. In folder "Storgruppe 1-instrumenter-0603" – "Plenumvideo 0603."
[lxiii] Image from 22:00 in file *00004*. In folder "Storgruppe 1-instrumenter-0603" – "Plenumvideo 0603."
[lxiv] The students did not talk much about the table arrangements, but at the end of the fifth workshop the teacher asked the students how they felt about the table arrangement. One student said that she was able to get a better overview of the students compared with the fourth workshop and that it was easier to see all the other students. Several of the other students agreed. Time [00:29:50.915], Page 19 in file *Transkriberte videofiler-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshopdata (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" – "Tredje wikioppgave."
[lxv] Image from fifth workshop. Time 25:31 in file *File 00006_x264*. In folder "Pedagogisk bruk av wiki-290312-video og screen capture." – "Filming av plenumsaktiviteter-2903."
[lxvi] Excerpt can be located on page 17 in file *Transkriberte videofiler-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshopdata (video and screen capture)" - "1.1 Hypertranscribe+Content log i word" – "Tredje wikioppgave."
[lxvii] Page 12 in *Transkriberte lydfiler-Wikioppgave 2-Workshop 2-Workshop II-kopi fra hypertranscribe*. In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Andre wikioppgave."
[lxviii] Image from 34:29 in *File 00002_mpeg4*. In folder "Helleristninger-200312" – "Videofilming-plenum-2003."
[lxix] The student is asking the another student to repeat the comment because she cannot hear what is being said. Page 14 in file "Transkriberte lydfiler-Wikioppgave 2-Workshop 2-Workshop II-kopi fra hypertranscribe". In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Andre wikioppgave."
[lxx] For example, in the beginning of the workshop S9 asks S8 "What are we going to look at?" and then S8 replies by specifying the type of music instrument that they are going to work with B1[00:21:58.373]. File *S9 samarbeid med S8-musikkinstrumenter-wikioppgave nr.1*. In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Første wikioppgave."
[lxxi] Image from 34:33 in file 00003. In folder "Storgruppe 1-instrumenter-0603" – "Plenumvideo-0603."
[lxxii] Time period that the excerpt covers. B1[00:32:22.004] - B1[00:33:13.316]. File *S9 samarbeid med S8-musikkinstrumenter-wikioppgave nr.1*. In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Første wikioppgave."
[lxxiii] The workshop data also show that there was little peer editing during the workshops. There were only a few minor attempts to do simple wiki editing and proofreading of the text. For example, in the third wiki assignment one student was assigned to proofread the wiki text (Page 4, time 00:19:26.324). In another incident, there were some minor instances of peer editing that happened by accident because of a lack of explicit coordination (Page 16, time 00:15:36.538). File *Transkriberte videofiler-Wikioppgave 3-Workshop I-kopi fra Hypertranscribe*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Tredje wikioppgave."
[lxxiv] However, in general, there were few attempts to do any substantial modifications of other students' work in the bigger group. File *The student revision work – the third wiki assignment*, page 20. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3." File *Student-produced wikispaces page about rock carvings*. In folder "3. Studentenes produksjon av wikitekster - Wikioppgave nr.2."
[lxxv] One reason is that since wiki is an asynchronous tool, it is difficult to work with the same text area at the same time. For example, when the students tried to do this in the fifth workshop, it created an editing conflict

in the wiki. Time 00:21:56.945. File *Lydfil-wikioppgave nr.3-workshop*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Tredje wikioppgave."

[lxxvi] For example, the "human body group" did most of the work individually in different sections before they met at the workshop. The wiki log shows that they were responsible for different areas on the wiki page. File *Wiki log data – human body – first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.3" – "Human body."

[lxxvii] Even though some of the edits were done anonymously, the data from the registered users (and the screen capture data) indicate that most of the students continued to edit their own work in different sections in the wiki article when they gathered at the workshop. File *Wiki log data – human body – first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.3" – "Human body."

[lxxviii] In one instance, a paragraph was moved to another area in the article with a new header and a new section. None of the original text was changed. Time 20:49. March 19th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxix] In another example the same student user added more headings to some of the sections where other students had produced the text. The original text was not changed this time, either. Time 20:18. March 20th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxx] Another type of peer editing is *proofreading.* For example, one student made 18 minor language edits throughout the article. This also included work that other students in the class had done. Time 12:04. April 2th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxi] In another incident, minor language edits were made in sentences 1, 3, 4, and 5 in one paragraph. In addition sentence 6 was completely removed in the new version. Time 16:14. March 20th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxii] None of the existing text was removed, but a new relevant sentence was integrated with the existing content. This edit built directly on the advice from the Wikipedians that the students should compare their article more with articles about Swedish rock carving sites. Time 22:04. April 9th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxiii] In addition, two new sentences were added at the end of the paragraph. This includes a specification of the source reference at the end of the paragraph. Time 20:55. April 16th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxiv] The first three sentences and the last sentence were removed, while the five other sentences remain unchanged. In this sense, this rewriting is primarily about removing certain sentences, while the rest of the sentences are kept more or less unchanged. Time 16:14. March 20th, 2012. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxv] Concerning this specific topic in the article, previous contributions had been made by both a Wikipedian (Time 15:45, March 27th) and a student (Time 20:49 March 19th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxvi] This removal also involves information about the Bronze Age and the ships that had been carved at some of the sites. (Time 11:15 April 10th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[lxxxvii] To estimate the relative size (in percent) of these different types of extended peer editing activities, it was necessary to code the different types of editing and count the amount. Note that for the peer editing activity of "rewriting," it is the size of the final contribution that is used as an indicator of the amount of this editing activity. File *Quantitative overview of different edits – musical instruments - first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body." File *Quantitative overview of different edits - human body - first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body." File *The student revision work – the third wiki assignment*, page 8. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."

[lxxxviii] One student states that a sentence is "terribly bad. L2[00:10:08.192] File *Lydfil wikioppgave nr.1-musikkinstrument-workshop-etter pausen*. In folder "1.Workshop data (video and screen capture)" – "1.1. Hypertranscribe+Content log i word" – "Første wikioppgave."

[lxxxix] The amount of text increased significantly in both the first wiki assignment and the third wiki assignment. In the third wiki assignment, it consisted of more than half of the total amount of edited text (59%). One important explanation is that these two student groups added a lot of new text as a part of the preparatory work before they met at the workshops. File *Quantitative overview of different edits – musical instruments - first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body." File *Quantitative overview of different edits - human body - first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body."

[xc] For example, in the collective work with the third wiki assignment in the fifth workshop, most of the edits during the workshop are categorized as minor changes (e.g., changing something within only one sentence). File *Wiki log data during workshop - third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."

[xci] The human body group made some major changes to the original text. In many cases, there was no review of the videos on the wiki page. Improving the quality of these video resources was in this sense quite an easy task. File *Wiki log data – human body – first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body."

[xcii] Most of this "rewriting" consisted of moving and placing sentences in a paragraph in a new position. Here, the sentences were used as "bricks" or pieces in a puzzle that are moved around. The students seldom changed the sentences. See page 16 to 19. File *The student revision work – the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."

[xciii] In comparison, the "human body group" did a lot of work reviewing videos at home before they met at the workshop. File *Wiki log data – human body – first wiki assignment*. In folder 3. "Studentenes produksjon av wikitekster" – "Wikioppgave nr.1." – "Human body."

[xciv] The screen capture data also show that the videos about different musical instruments were less complex compared with the videos about the human body. One example is when students S8 and S9 are complaining because they are just playing drums in the video. Time B1[00:23:16.333].K1[00:25:02.977] in file *S9 samarbeid med S8-musikkinstrumenter-wikioppgave nr.1*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Første wikioppgave."

[xcv] Another reason is that more of the students in the musical instruments group complained about their lack of background knowledge. This may have made it difficult to write a more detailed content description Time B1[00:22:35.023] in file *S9 samarbeid med S8-musikkinstrumenter-wikioppgave nr.1*. In folder "1.Workshopdata (video and screen capture)" – "1.1 Hypertranscribe+Content log i word" – "Første wikioppgave."

[xcvi] The findings also show that most of the sections and headers in the first and third wiki assignments remained unchanged. First wiki assignment: Page 3 (musical instruments) and page 8-10 (human body), file *Enkel statistisk bearbeiding av wiki tekstdata*. In folder "3. Studentenes produksjon av wikitekster" Third wiki assignment: Page 5, file *The student revision work – the third wiki assignment*. In folder "3. Studentenes produksjon av wikitekster" – "Wikioppgave nr.3."

[xcvii] An overview of the feedback the students received from outsiders on their work with the Wikipedia article.

[xcviii] Several images in the article were removed, because the copyright license did not permit use on Wikipedia. On two occasions the removal was done automatically by a robot or "bot," which simultaneously did the same on the image site Wikimedia Commons (Time 13:34 April 4th and time 08:54 April 10th). There is also one example where a Wikipedian removed some links that were considered to be irrelevant for the article (Time 09:44 April 10th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[xcix] This individual created an introductory definition for the article, which is a standard requirement in all articles. Although this definition is only two sentences long, it can be regarded as a substantial contribution, because it attempts to summarize the content in the article (Time period from 01:33 to 14:29 on April 9th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[c] Interestingly, a student later removed a large part of this new definition. The first short sentence remains unchanged, but the long second sentence was removed. Instead, another paragraph in the article was moved so it could be used as an introductory definition. (Time 22:04 April 9th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[ci] Another incident is when a Wikipedian added more information about how one can get to one of the rock carving sites. This information was extended from one sentence to three sentences. The new information makes it easier for readers of the article to actually find the site. (Time 15:45 March 27th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cii] Similarly, there was also one incident where an outsider published a new relevant image in the article. (Time 13:21 April 16th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[ciii] In addition, the Wikipedians published a warning about copyright violation both on the discussion page and directly in the article at the top of the page. (Time 16:12 March 28th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[civ] In one incident, a Wikipedian corrected three images that referred to the wrong photographers (Time 21:41 April 16th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cv] The outsider editing manifested itself as *proofreading.* Several times only one or very few sentences were edited by the Wikipedians (Example: Time 12:48 April 9th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cvi] At other times, the Wikipedians proofread larger parts of the text (12 changes: Time 15:45 March 27th and 6 changes: Time 21:26 March 28th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cvii] For example, in one incident a Wikipedian adjusted some of the references according to a new standard (Time 15:06 April 17th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cviii] For example, one Wikipedian removed four links to other Wikipedia articles that he thought were irrelevant to include. (Time 12:48 April 9th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cix] In one incident, only one new internal link to another article was added (Time 16:46 April 7th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cx] In another incident, as many as 21 internal links to other relevant Wikipedia articles were added over a somewhat longer time period (Time period 01:33-14:29 April 7th). File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."

[cxi] Since the students finished their work on April 26th (the extended deadline), there have only been *minor revisions of the text*. The archive of the history of the article shows that four outsiders have visited the page and done minor edits. They have proofread the text and adjusted 12 sentences. The image at the top of the article has been replaced by a new one. In addition, there have been some minor adjustments of the links to different Wikipedia categories in the article. File *Wiki log data – Wikipedia article about rock carvings*. In folder "3. Studentenes produksjon av wikitekster" – "Studentenes Wikipediaartikkel."