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An agentic perspective on teachers' enactment of professional digital competence

Stine Brynildsen, Østfold University College, Halden, Norway
Halvdan Haugsbakken, Østfold University College, Halden, Norway

stine.m.brynildsen@hiof.no

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AN AGENTIC PERSPECTIVE ON TEACHERS' ENACTMENT OF PROFESSIONAL DIGITAL COMPETENCE

Stine Brynildsen & Halvdan Haugsbakken

Østfold University College, Halden, Norway

Abstract: *Understanding digital competence in teaching is challenging because technology and teachers' workdays are moving targets. Previous research suggests using professional digital competence (PDC) as an approach for better understanding how teachers develop a deep understanding of technology, learning processes and subjects. Accordingly, inspired by a short-term design-based research methodology, a project was conceived to have a group of teachers and teacher educators collaborate on developing digital teaching environments using Microsoft Class Teams and OneNote Class Notebook at a lower secondary school in Norway. To investigate the outcomes, this paper adopts an agentic socio-cultural perspective to examine how the teachers enacted digital teaching environments to develop PDC. The results show that the teachers employed negotiation strategies and used different material and immaterial resources in their local school contexts to enact digital teaching environments. The study suggests adding new research to two emerging and relevant research streams—teachers' digital competence and Microsoft Class Teams and the OneNote Class Notebook—by emphasising a strong human-centric agency approach and that teachers' digital competence can be made visible through acts of collaboration.*

Keywords: *professional agency; teachers' professional digital competence; digital teaching environments; Microsoft Teams; OneNote Class Notebook*

Brynildsen, S. and Haugsbakken, H.

Introduction

In educational systems, teachers work within defined structures, for example related to national policies, strategy documents and so forth, but teachers also have a relative degree of manoeuvrability to independently carry out pedagogical and didactical practices in their classrooms. Furthermore, there is an ongoing digital transformation of education in which technologies become embedded as part of local school contexts, creating the conditions for understanding various forms of teachers' digital competences. Because there is rarely a set of prefixed usages following the introduction of technology in classrooms, teachers also have a degree of manoeuvrability when applying these digital technologies and can become actively involved and negotiate how they support their pedagogical practices. In fact, professional twenty-first-century teachers are urged and challenged to become digitally competent agentic practitioners (Engeness, 2021).

These conditions create interesting opportunities to research how teachers can enact their professional digital competence (PDC) in local school contexts. This can be connected to the growing research on digital competence among teachers, which has received attention in recent years (Starkey, 2020). In the local school context, teachers can utilise material and immaterial resources by using negotiation strategies and be engaged in continuous professional development (Brynildsen et al., 2022). Against this backdrop, we examine the case of a lower secondary school in Norway that introduced the collaborative platform Microsoft Teams (Teams). The project began after a group of teacher educators (TEDs) specialising in teacher PDC and information and communications technology (ICT) approached the school to participate in a joint design-based research project. The goal was to collaborate with the teachers to explore and create a cross-curricular digital teaching environment using two of the school's intertwined digital platforms: Teams and OneNote Class Notebook (ONCN).

To make sense of the described context, we adopt a socio-cultural research perspective on professional agency to explore the various forms of enacting PDC (Eteläpelto et al., 2013). This perspective assumes that teachers are active actors using various material and immaterial resources to enact PDC through negotiations in the local school context; this will serve as a guide in our forthcoming analysis. We also apply this perspective to address the following research questions (RQs):

> RQ1: How do teachers enact PDC in creating digital teaching environments?
> RQ2: How do teachers employ material and immaterial resources to create digital teaching environments?

Next, we outline the research perspective and relevant research. Then, we present the research strategies before describing the data analysis. Finally, we discuss the data and conclude.

Research perspective

To frame and explain what relevant research we engage with and wish to contribute to, we outline our understanding of agency, before exploring research on teachers' PDC and Teams and ONCN.

Defining a subject-oriented understanding of teachers' professional agency

According to Eteläpelto et al. (2013), a consensus is lacking regarding what agency means, and here, the research perspectives greatly vary. Agency can, for example, be defined as the individual's own capacity to take initiative and act. In contrast, agency is theorised differently under the concept of sociomateriality, which is an umbrella research agenda that contemplates the meaning of technology (Fenwick, 2014). Sociomateriality, which is significantly influenced by actor–network

theory (Latour, 2005), assumes that technology and people are relational, equal and symmetrical and entangled in immaterial and material activities and relations. These assumptions obviously create disputes over ontology and the agency capabilities of the material and immaterial. On the one hand, an agential realist view (Barad, 2007) assumes a relational ontology that contends that 'the social and the material are inherently inseparable' (Orlikowski and Scott, 2008, p. 456), implying that technology and humans are so neatly stitched together that they continuously affect each other (Orlikowski, 2010). On the other hand, a substantialist perspective (Leonardi, 2013) emphasises the material, perceiving the material and immaterial as mutually independent, implying that technology and humans can have agency capabilities that evolve independently of each other.

Although the above perspectives are important to recognise, we adopt another approach. The agency perspective that has inspired us is found in an emerging research stream in educational research dedicated to theorising the new concept of *professional agency* (Eteläpelto et al., 2013). Professional agency stresses a strong socio-cultural emphasis on individual agency, allowing researchers to make nuanced views on ontologies and epistemologies (Eteläpelto et al., 2013; Vähäsantanen, 2015; Virkkunen, 2006). Professional agency assumes an agency where people are active actors who, through negotiations, enact the practices and activities within socio-cultural contexts (Eteläpelto et al., 2013). Professional agency also creates nuances regarding the capacity of agency and what influences what. For example, it rejects that the individual is subjugated to larger processes, structures and contexts, instead it assumes that entities in socio-cultural contexts—tools, objects and subjects—play important roles and have varying levels of significance regarding human actions. Eteläpelto et al. (2013) also claim that professional agency has two approaches with different assumptions about individual agency. On the one hand, a strong object-oriented activity approach presumes that human practices and materialities overrule individual agency (e.g., Engeström, 1987). On the other hand, a subject-oriented position assumes the existence of strong individual agency, striving to understand the processes by which subjects construct and actively negotiate their position and practice agency and subjectivity without omitting the constraints of socio-cultural contexts (e.g., Fenwick, 2007).

Thus, our use of agency shares assumptions similar to the subject-oriented position (Eteläpelto et al., 2013). Although professional agency is designed to grasp professional identities and lifelong learning, we apply it to understanding an individual agency perspective on PDC and forms of enactment. Our perspective presupposes that individual agency is performed for certain purposes and within certain socio-cultural contexts and material conditions and can be both constrained and resourced by these conditions. That is, we assume that teachers are active actors who access and employ the available material and immaterial resources and construct digital teaching environments that are enacted in their socio-cultural contexts. Teachers, thus, negotiate and practice agency. Individual agency allows for extending teachers' reach to foster a deeper understanding of PDC and creates negotiated possibilities and room for manoeuvre. Teachers can seek out new resources and use them to collaborate, for example with each other and teacher educators and construct digital teaching environments, a point we return to in the forthcoming data analysis.

The emergence of teachers' professional digital competence

In educational research, there is a growing interest in the concept of PDC, and a development of what digital competence among teachers can potentially mean. Initial definitions of teachers' digital competence stated that it could be the ability to integrate basic ICT use and pedagogical strategies (Krumsvik, 2007). Later, such definitions have been criticised for being too tool oriented and outdated because teachers are expected to tackle multifaceted situations in the classroom (Janssen et al., 2013). Researchers have also voiced the need to separate digital competence into new

classifications, such as the teacher's generic digital competence and digital teaching competence (Starkey, 2020). However, there might be a need to enlarge such definitions because teachers will increasingly teach and work in technology-rich learning environments. This will challenge teachers to integrate technology in pedagogical practice, but also their agency and role performance. These conditions motivate researchers to introduce new understandings of teacher professionalism and digital competence, like PDC. PDC has been defined as 'a deep understanding of technology, knowledge of students' learning process, and understanding of the specific disciplinary practices and features characterising individual school subjects' (Lund et al., 2014, p. 281). These definitions open up agentic perspectives, specifically emphasizing that teachers are not passive carriers of predefined generic knowledges and skills but are active agents who use material and immaterial resources to create opportunities for learning.

Hence, we observe that researchers approach teachers' PDC from at least two perspectives. On the one hand, a body of research suggests framing teachers' PDC from a type of 'measurement approach'. Papers have evaluated and compared past and current policy frameworks for digital competence, such as the EU's DigCompEdu (Redecker and Punie, 2017), to determine how suitable they are for capturing the educational contexts in which teachers implement their professional practice (McGarr et al., 2021; Starkey and Yates, 2021). Essentially, researchers select specific topics and conduct empirical studies to examine the extent to which they fulfil particular criteria in the mentioned frameworks (Cabero-Almenara, 2021; Tømte et al., 2015). The research stream also explores how well teacher education institutions prepare student teachers to be digitally proficient (Gudmundsdottir and Hatlevik, 2018; Instefjord and Munthe, 2017). There appears to be a consensus that teacher education institutions must improve teacher educators' digital competence (Moorhouse, 2021). On the other hand, we observe a theory-driven research substream attempting to decouple from generic approaches and demonstrate that teachers utilise resources to enact PDC. It draws strongly on socio-cultural and activity theories, the reflective practice perspective and domestication theory (Engen, 2019; Helleve et al., 2020). Here, a separate research lens on agency has emerged to cultivate a refined agency perspective on the digitalisation of professional practice, namely transformative digital agency (Brevik et al., 2019; Lund and Aagaard 2020), which is situated in the socio-cultural learning theory research tradition. A goal is to grasp the implications of epistemic practices. Transformative digital agency is claimed to manifest when actors encounter challenging teaching or learning situations and attempt to overcome them by applying the available resources and ingenuity, which has also yielded important research.

Research on Teams and the OneNote Class Notebook

The relevant research on Teams and ONCN appears not to have developed an agentic perspective. Altogether, the research on Teams before COVID-19 is scarce (Martin and Tapp, 2019). However, the number of studies has increased, particularly focusing on Teams as an "emergency remote teaching platform" (Hodges et al., 2020). Researchers mainly explore Teams within higher education institutions and report students' and teachers' perceptions of using Teams in the sudden transition to online teaching (e.g., Almodaires et al., 2021; Durak and Çankaya, 2020). Overall, findings mirror the positive experiences of students and teachers using Teams during the pandemic. Others have examined using Teams to facilitate communication and collaborative learning, reflecting varied practices in synchronous and asynchronous teaching. For example, Martin and Tapp (2019) examine Teams in a computer-supported collaborative learning context to facilitate students' group work. Researchers like Buchal and Songsore (2019) and Paksuniemi et al. (2021) examine students' use of Teams as a common knowledge-building platform where they engage in collaborative writing, through shared documents, chats, etc. The results show that this enabled and deepened group dialogues, leading to a deeper understanding of teaching and learning.

Regarding the research on ONCN, only a few studies have explored its pedagogical potential. For example, Everly (2019) explores using ONCN to facilitate synchronous and asynchronous teaching and learning by focusing on how teachers delivered standardised and individualised content and how students used different modalities in tasks and received feedback. Bader et al. (2021) investigate ONCN's pedagogical potential by employing transformative digital agency as an analytical lens to examine how student teachers used ONCN in formative assessment processes.

Current status on relevant research horizon

When taking an overall look at the research perspectives, there are few studies where teachers and TEDs jointly develop digital competence together, save for Levinsen (2017). Even if collaborative designs are common in developing teacher professionalism in other aspects, they appear to be missing from our field of PDC and agency. Seemingly PDC research prefers the approach of 'doing research on' to 'doing research with'. In addition, our review establishes Teams and ONCN as useful technologies for different educational purposes. Missing are studies on Teams in school contexts outside higher education and emergency remote teaching practices. Also missing is research exploring how ONCN and Teams can be combined to design digital teaching environments. Finally, only one of the identified papers presents an agentic perspective. Thus, the conceptual perspectives the present study offers can make new research contributions.

Methodology

Overall design

We used a qualitative research approach (Creswell and Creswell, 2018) and collected data from three focus group interviews. Importantly, the study was set within a larger project inspired by short-term, design-based research methodology (Pool and Laubscher, 2016), in which the selection and creation of the intervention was a collaborative task of both practitioners and researchers (Andersen and Shattuck, 2012). The overall aim was to explore how teachers, when collaborating with TEDs, enact and foster PDC. To accomplish this, the teachers and TEDs developed, executed and reflected on a cross-curricular teaching environment in which Teams and ONCN were the main digital platforms.

The project lasted from August to October 2020 and included two preliminary meetings with the school's management, teachers and TEDs to jointly map the desired development area. During the meetings, the teachers expressed interest in exploring the pedagogical and didactical use of Teams, and this was supported by the management. The teachers and TEDs collaborated in four extensive group meetings lasting two to four hours each to discuss and develop the digital teaching environments. In between meetings, the teachers and TEDs communicated via e-mail and Teams chats. Finally, one school day was used for executing the school project and pupils presenting their work. During the project, the teachers taught their classes, while the TEDs' main role was to support teachers' work, suggest ideas and possibilities concerning pedagogical and technical aspects, provide feedback, take part in discussions and observe.

Apart from a school-based decision that the cross-curricular project should focus on the topic of young people's physical and mental health, the teaching teams determined the content and forms of assessment. The teaching environments were blended; meaning, pupils worked both in digital and nondigital spaces, at school and at home. At the end, the teachers evaluated the experience and reflected on it in the interviews.

The school context

Pine Lower Secondary School (pseudonym) had about 60 teachers and 600 pupils aged 13–16, divided into grades 8–10. Since 2017, the school management has launched several initiatives related to digitalisation, prioritising the professional development of their teachers' digital competence. At Pine, as with all Norwegian schools, school management is responsible for supporting teachers' pedagogical work to use ICT, both by developing the organisation (i.e., the school) and by providing teachers with opportunities for continuing professional development (Ministry of Education and Research, 2017). The school management has, for example, employed teachers specialising in ICT in teaching and learning, upgraded the digital infrastructure, purchased laptops for all teachers and invested in external training. At the same time, the school management involved the teachers in the implementation of new technology to promote their active engagement and pedagogical contributions. Teachers also have professional autonomy to choose teaching methods when creating teaching environments. This double aspect of school leadership and teacher involvement is reflected in the implementation of ONCN and Teams. In 2017, the teachers became interested in using ONCN, and the school management asked for volunteers to experiment with and integrate ONCN in their teaching. These teachers became 'digital ambassadors' who inspired and supported other colleagues. Later, all teachers received external training, and several teachers were assigned specific roles to assist their colleagues with technical and pedagogical support. ONCN became an integrated part of most teachers' practices.

Similarly, in 2019, the school began implementing Teams. Staff received external and internal training, but it was the COVID-19 crisis in 2020 that prompted teachers to use the platform. Teams is still considered new with unknown pedagogical possibilities.

Hence, staff at Pine were already situated in a digital context prior to this research project. Both management and teachers expressed a wish to further explore and expand the pedagogical use of Teams and ONCN. It was against this backdrop that the teachers involved wanted to increase their PDC.

Participants

Nine teachers, forming three teaching teams, participated in the study. Two of the three participating TEDs who specialised in ICT in teaching and learning were also the researchers. The teachers were recruited at a staff meeting in August 2020, where all were invited to volunteer. The participants provided informed consent, and the Norwegian Centre for Research Data approved the project. To maintain the participants' anonymity, all names are pseudonyms. Table 1 describes the teachers.

Table 1. Overview of the participating teachers

Teaching team	Teachers (pseudonyms)	Grade	Years of teaching experience
1	Roger	8	36
	Ellen	8	9
	Thomas	8	1
2	Victoria	9	2
	Martin	9	5
	Eileen	9	3
	Adrian	9	0
3	Clark	10	18
	Emma	10	11

Data collection

During the project, various data were collected, such as video recordings of the collaborative meetings, an interview with the school management and TEDs' reflection notes. To answer the research questions, however, we focused on data collected from the three concluding focus group interviews (Wibeck, 2010)—one with each teaching team. The focus groups allowed participants to reflect, build on and expand each other's experiences and knowledge. A semi structured interview guide was distributed beforehand, inviting the teachers to reflect on their digital competence, teaching practice and experience in developing teaching environments and collaborating with TEDs.

The interviews were conducted shortly after the project ended. They were audio-recorded and lasted between 80 and 100 minutes each. Recordings were transcribed by the researchers, who translated relevant quotes into English.

To provide further insights into their backgrounds and self-efficacy in digital competence, the teachers also completed a short questionnaire, which included assessing their digital competence using a scale with values ranging from 'below average' to 'average' or 'above average'.

Data analysis

Adhering to the study's qualitative approach, the data analysis was inspired by Braun and Clarke's (2006) thematic analysis and six steps to identify patterns of meaning and develop themes. First, the researchers familiarised themselves with the data by transcribing and rereading all transcripts. They also discussed and reflected on the initial topics deriving from the data. The interview data were uploaded to NVivo12. Codes were generated openly and inductively, acknowledging the active role of the researchers in developing and reporting themes (Braun and Clarke, 2006). After creating the initial themes, the codes and themes were refined and developed into new themes through ongoing analysis. Finally, the themes were reviewed and named. The analysis was iterative and collaborative, including all researchers.

Findings

The analysis shows how teachers employed their agentic capacities within the local context and make visible how they, through various negotiation strategies, used material and immaterial

resources to enact the digital teaching environments. The findings illustrate how the teachers' PDC was constituted and expressed in practice. The teachers' enactment of PDC reveals their capability of using technology to develop complex teaching environments at different levels: from the more basic technological level to facilitating their environments for pedagogical and didactic purposes and collaborating to expand their knowledge and practices. Two overall themes were developed: (1) Teaching environments as complex constructions and (2) Opportunities for enacting PDC.

Teachers' self-efficacy in PDC

Before presenting the themes, we present findings concerning the teachers' understanding of their PDC to clarify that they were already part of a socio-cultural digital context.

In the questionnaire, all teachers rated themselves as having from average (n = 4) to above average (n = 5) digital competence. During the interviews, they expressed feeling competent in integrating digital tools and methods into their teaching, albeit to different degrees, as illustrated by Emma: 'I use a lot [of digital technology], but not as much as Clark. Clark is more competent than me, but I'm not afraid of using [technology].'

The teachers described themselves as consumers of technology, using ready-made materials, but also as producers, creating content, like video tutorials, and compiling resources to meet their teaching needs. In sum, they already operated within digitally infused teaching environments.

Theme 1: Teaching environments as complex constructions

The first theme reflects the teachers' deep understanding of technology when using material resources like Teams and ONCN to construct complex digital teaching environments. It makes visible how the teachers, as agentic practitioners, enacted PDC when they selected and adapted the technology to their previous and current knowledge, needs and practices. Teams and ONCN are multifaceted technologies, without a singular or generic use, giving the teachers the possibilities to choose and redefine the tools' affordances to suit their various pedagogical purposes.

Subtheme 1: Building digital teaching environments

The teachers used Teams and ONCN as fundamental tools in their enactment of the digital teaching environments. Teams and ONCN have complex and intertwined functionalities which they made use of and adapted. During the project period, input from TEDs also expanded and changed their usage.

When enacting digital teaching environments, ONCN seemed to be the most important tool, or 'frame', and 'Teams was on top of that', according to Victoria. Yet other digital tools and learning resources, besides these Office 365 apps, were also included when deemed necessary, revealing the teaching environments to be complex and constituting an array of material resources. The teachers created their teaching environments, layer upon layer, with ONCN and Teams as the core technologies.

One level of the teachers' technological insights was revealed in their understanding of Teams and ONCN as playing varying roles in their teaching environments. Teams was primarily used for communication, while ONCN supported teacher-centred practices intended to create and facilitate pupils' learning trajectories, where the teachers, rather than pupils, were largely the actors. For example, the ONCN Content Library was described as an important technological infrastructure in which all teachers created and distributed content to pupils:

> I often distribute pages [in OneNote]. For example, […] I have made a list of 'You are going to read this, answer these questions, explain these concepts' and so on. Then, I've added some links to videos and [other content] and distributed that. (Eileen)

The teachers' PDC was made visible in their talk of adding content to the teaching environments. The teachers selected, added and curated relevant resources to meet their pupils' needs. For example, they added multimodal content to create meaningful and diverse learning experiences. Eileen mentioned adding video links, and Clark explained that providing pupils with varied content was important for their learning: '[I] believe in variation, like using sound and images'.

The teachers actively adapted the technology to suit their teacher-centred practices. For instance, they used ONCN to gather teaching content and pupils' assignments in one place, implying that they appreciated having control over both. They also valued being able to easily access and monitor pupils' work. 'You put everything in [OneNote]', Roger noted. 'Plain and simple […] The great thing about OneNote is that while they are working on something, we can see what is going on'.

Furthermore, after a TED suggested using private channels in Teams, grade 9 teachers used this to facilitate pupils' collaboration; however, still focusing on features placing the teachers in controlling positions:

> Martin: I think the [private] channels are a great way for pupils to collaborate. Everything is nice and tidy; [the teacher] can be a member of the channel; see the written logs and everything. So, yeah, you have good control of the group.

> Victoria: Yeah, and the other pupils can't enter and interfere. […] If you do something like that in OneNote, in the Collaboration Space, they can all go to the different pages and mess up each other's work.

When discussing Teams, the reflections demonstrate that, rather than using Teams to create learning paths, the teachers used the platform to facilitate communication and collaboration within the teaching environments. They experienced that Teams enabled pupils to actively engage in conversations. Features like the conversation tab, chat and video meetings were commonly used and perceived as important by both teachers and pupils: 'Everybody experiences [Teams] as an important and useful communication channel, so everybody engages in whatever happens there' (Ellen).

Similar to the teacher-centred practices in ONCN, it was mainly the teachers who posted messages and information on Teams. However, pupils could post questions or comments and help each other: 'They ask questions, like "When do we start tomorrow?" and then other pupils tend to answer. So they communicate in there as well' (Ellen).

The teachers used chat channels and groups to communicate with pupils working outside the classroom, and pupils sometimes created chat groups themselves. Some pupils independently created new teams to communicate and collaborate.

In summary, this analysis shows multiple levels of teachers' enactment of PDC in practice. Teams and ONCN are complex technologies enabling teachers to actively adapt and utilise them to combine functionalities, add relevant content, and so forth. Teams and ONCN were seen as entangled, but playing distinct roles in the teachers' practices, laying the foundation for how they developed their teaching environments.

Subtheme 2: Diverse pedagogical approaches

The teachers displayed advanced enactment of PDC when using Teams and ONCN to support diverse pedagogical and didactic purposes, such as pupil involvement, class management, differentiated teaching and assessment for learning. The findings reflect how the teaching teams, although using the same fundamental tools, designed teaching environments that took on very different approaches.

For example, the three teaching teams differed in terms of facilitating pupil involvement. Grade 8 teachers promoted a great degree of active engagement by allowing pupils to choose their own topics to work on, partners, products to turn in and (partly) assessment criteria. Besides Teams and ONCN, the pupils were also allowed to select from an array of other digital tools that they themselves deemed relevant. This, again, reflects how the teachers were not limited, but rather empowered, by diversity and made use of all the relevant and available technology. Grade 9 teachers framed their project more tightly by, for example, determining the overall content and groups, but they also involving the pupils by allowing groups to collaborate in private channels in Teams, create their own research questions and hand in different products for assessment. Grade 10 teachers had an even more teacher-centred approach, designing the task, forming the groups, preparing assessment criteria in ONCN and asking the pupils to hand in specific products (e.g., video recordings of group conversations) in Teams channels.

The teachers used Teams and ONCN for different class management purposes. For example, to promote a good learning environment, grade 9 teachers used private channels to facilitate pupils' group collaboration, but also to stop them interfering with each other's work. The teachers expressed different strategies for stopping unwanted behaviour in Teams and ONCN, including confiscating pupils' computers, talking to pupils in person or posting written comments.

Several teachers were preoccupied with how Teams and ONCN could facilitate differentiated teaching to meet individual pupils' needs. For example, Eileen said she used video meetings in Teams to teach a small group of students who could not attend class. Emma reflected on how using ONCN enabled dyslexic pupils to record sound files rather than write. Ellen also explained how she used ONCN with other digital tools to create text that could be read aloud to pupils with dyslexia or who spoke Norwegian as a second language. Adrian described creating video tutorials on math and publishing them in ONCN, thus freeing him to help pupils in class:

> Many [pupils] are at different levels, and it is a problem. Especially when doing exercises, they ask, 'How do I do this?' And then I have to spend two minutes with this pupil while four others sit there doing nothing. […] So, I recorded some videos where I demonstrated how to do the exercises. I published them in OneNote together with the different exercises so they could have a look during class […].

Finally, the teachers designed teaching environments in ONCN and Teams to facilitate assessment for learning practices. For example, they provided written feedback in ONCN while the pupils worked individually in their Student Notebooks and collaboratively in the Collaboration Space or Teams channels. Grade 9 teachers had pupils write reflection memos in Teams, which served as self-assessment and provided the teachers with important knowledge of the pupils' learning process. Grade 10 teachers wanted to use video recordings in Teams to record pupils' group discussions as a new form of oral assessment.

Theme 2: Opportunities for enacting PDC

The second theme exemplifies the other aspect of our agentic perspective and how collaboration provided opportunities for both enacting and expanding teachers' PDC. The teachers employed negotiation strategies to enact digital teaching environments by managing immaterial resources at

their disposal. Specifically, when they collaborated with TEDs or each other to explore new possibilities, they used the resources embedded in these social ties to expand their digital understanding.

Subtheme 1: Collaboration between teachers and TEDs

Collaboration, as valuable for learning, was on display during the project and, in fact, exemplified how the teachers were challenged to reassess their assumptions about their pedagogical practices. Moreover, collaboration reflects the observations of the teachers' appropriating ideas and practices from each other and the TEDs, serving as immaterial resources to develop their PDC.

Although the TEDs' expressed intent was not to serve as 'experts' but collaborate and learn together with the teachers, the teachers expected the TEDs to take the role of outside experts of Teams. Emma noted, 'You were coming to us, and we were going to use Teams, so I thought you knew things about Teams that I didn't. […] That you would come and give us an overview of what I'd missed'. Eileen stated that, whenever someone from a university college came, she expected to receive concrete tips to 'get something out of it'. Thus, instead of understanding TEDs as co-workers, they were viewed more as advisers. Clark explained that the opportunity to get feedback was valuable: 'We've been making some plans and wanted your input on them, and then, we tried to change them according to your feedback'. Eileen and Victoria also illustrated this by labelling the TEDs as a 'kind of partner and guide' with whom they could have a dialogue and who would listen to them.

In terms of pedagogical input, the teachers used negotiation strategies to extend their knowledge of technology and pedagogical practice. This was expressed in various ways, from being informed about new features in Teams to being able to articulate tacit knowledge of pedagogical practice and new educational concepts. During the project, the teachers received tips on new features in Teams, like private channels, and as Victoria said, 'That opened a lot of doors, in a way, with lots of opportunities'. In addition, making tacit pedagogical practices visible and providing theoretical perspectives was a type of input offered by the TEDs. Emma stated, 'I feel you have challenged us to think new [thoughts]', referring to a discussion about learning designs. This concept played a prominent role in the project, but the teachers did not explicitly use it. Emma added:

> I hadn't heard of the terms that you have taught us now [learning design and flipped classroom]. This made me think that it matters how things are presented [in class]. I've started to think that next time I distribute an assignment [...] maybe it shouldn't simply be a list of tasks, but have a pedagogical design, like you say.

Another example of how the teachers enacted PDC using input from the TEDs, is when they tested features in Teams for assessment purposes. For example, on the suggestion of a TED, a group of teachers tested a video feature in Teams. The pupils were to record a video meeting of themselves at home discussing a topic that would be assessed by the teachers. Another teacher, Clark, stated the following:

> What I have gotten out of this [project], and especially after this conversation, is that I want to try making learning paths with [OneNote] pages. […] We've been challenged. […] I think about what we could have done. I've got some new ideas, and I want to explore a bit more'.

Emma exemplified how the conversations made her critically appraise her own pedagogical practices: 'We've discussed our use of Teams [during the project]. I've become better. I've increased my digital competence, but whether I've used [Teams] in a pedagogical way? I've given that some thought. And I haven't been too good at it'.

Subtheme 2: Making use of colleagues and school-based initiatives

This subtheme shows the teachers as active actors pursuing negotiation strategies when collaborating and employing school-based initiatives. During the project, when the TEDs were not present, the teachers continuously communicated and collaborated between lessons, in spontaneous conversations, by doing in between work in Teams and ONCN and so forth. In other words, they did not passively wait for the next collaborative meeting with the TEDs. Data also reflects that the teachers were part of both an informal and more formal collegial support culture, demonstrating the capacity to overcome situations perceived as constraints. Roger explains:

> It's like Ellen says: What's so nice about [our school] is that there's always someone you can ask for help. You're never reluctant to ask anyone. People are always there. We're good at slightly different things. Whether it be digital technology or subjects or whatever—you always get help. [...] I also think that we have ICT people at our school who are quite far ahead and who have 'pushed' us a little bit. The approach is [that] we all work together. [School management] haven't said that everyone must start at the same time. Those who wanted to start with OneNote a few years ago did. And now, with Teams … we all gradually built on it.

The second part of Roger's quote highlights the teachers' use of supportive systems facilitated by the school management, like the 'IT people'—that is, the aforementioned ICT teachers assigned by the headmaster to assist the other teachers. Importantly, the collaborative project between the TEDs and teachers was made possible because school management facilitated it and encouraged teachers to participate. By actively choosing to take part in this school-based initiative to collaborate not only with colleagues, but also with TEDs, the teachers had more opportunities to develop PDC by testing, discussing and being challenged by outsiders:

> You [TEDs] have challenged us. We've worked quite hard to think, 'Okay! Now we're going to use Teams. We're going to try to figure out a new way of using Teams which we haven't tested before'. So, I feel we have had a good learning outcome from [the project]. (Ellen)

Thomas echoed the teachers' view when reflecting on how learning to use Teams was something they 'had to do'. Participating in the project provided the time and opportunity to learn. Adrian explained that the project was a valuable resource for learning:

> I hadn't used [Teams] before I started here. So, I've learned everything from this project. […] I had no clue what it was until messages started popping up from the pupils. Then I thought, 'Oh, that's what we use it for'. I then found out that there was more, much more.

In sum, this subtheme reveals how the teachers employed immaterial resources—namely, TEDs, colleagues and school management initiatives—embedded in their local professional context to expand their digital understanding.

Discussion

The present study raises the important question of how researchers conceive of digital competence among teachers. For example, some assess digital skills against the fulfilment of predefined generic knowledge and skills. This analytical angle is challenging because researchers do not always agree on what digital competence means. Also, generic knowledge and skills cannot account for the complex workday of the teacher, ongoing changes in technologies and the fact that digital competence varies across contexts and subjects. Instead, researchers have started to differentiate the meaning of digital competence (Starkey, 2020). In this discussion, teachers' PDC has been introduced and defined as a deep understanding of technology, learning processes, and subjects

(Lund et al., 2014). Our interpretation is that theory-driven perspectives have similarly been introduced to capture that depth (Engen, 2019; Helleve et al., 2020) because they manage to capture how teachers display their digital competence in local socio-cultural contexts, a matter that generic and (universal) definitions might not. Here, transformative digital agency has emerged as a promising theoretical perspective (Brevik et al., 2019; Lund and Aagaard, 2020) because it is a process approach that can capture the local and complex dynamics of technology, pedagogy and subjects across educational contexts.

To contribute a new understanding to the above research, the present study attempted to apply an agentic perspective to teachers' PDC, which differs from other agency perspectives. As noted above, digital transformative agency is one refined agency perspective for understanding teachers as agentic practitioners. It can be viewed as a change process perspective; assuming that teachers can face challenging situations in learning and can break away while having the capacity to change individual and collective actions and practices, which can manifest in situations involving conflict, contradictions and disturbances (Haapasari et al., 2016; Sannino, 2010). In contrast, we used a socio-cultural research lens on individual agency, also called professional agency (Eteläpelto et al., 2013), to think differently about the digitalisation of schools and how teachers are digitally competent, agentic practitioners. Professional agency suggests expanding how agency can be applied to capture digital competence. Our research perspective has tried to make visible that digital competence can emerge through acts of negotiation strategies in local school contexts. This is foremost demonstrated through the fact that the teachers were active actors, making decisions on engaging with digital technologies to support their pedagogical practices.

The latter point becomes apparent when our agentic perspective is viewed against the study's research questions. PDC emerged as a type of resource management in which the teachers employed various complex negotiation strategies. For example, the teachers drew on various material and immaterial resources in their local school context, facilitated by school management, using this to enact digital teaching environments. The digital teaching environments appeared multifaceted, flexible and shaped according to how the teachers fostered them in their professional practice. For example, ONCN was suggested as a core element in organising learning materials, learning activities and assessment forms, while features in Teams were used for teacher and pupil communication. Moreover, the understanding of digital teaching environments could be modelled and shaped according to the various collaborative strategies the teachers enacted. Altogether, the study has revealed that the teachers' enactment of PDC provided a deep understanding of technology and pedagogical practice.

Regarding our research contributions, the study must be viewed in light of the relevant research. The present study adds new insights to two research streams. First, it contributes new research knowledge on teachers' PDC. We applied a more human-centric agentic approach by analysing PDC as part of an embedded context and that PDC is made visible through negotiation strategies. Furthermore, the study adds new research by using a research design in which teachers and TEDs try to understand digital competence by working together. This provided mutual insights; Teachers used theory to articulate pedagogical practices, while the TEDs learned about the teachers' enactment of PDC in practice. Second, there is little research on Teams and ONCN. Also, by using an agentic perspective to grasp how these tools can support pedagogical practices, new insights are added. This consists of teachers making decisions, selecting relevant features from and adapting them to their teaching practices, which become parts of the enacted digital learning environments.

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Conclusion

Teachers' digital competence has been deemed a moving target and challenging to define (Tømte et al., 2013). Researchers have argued for splitting it into generic knowledge and skills, a teaching component or a combination of deep understanding of technology, learning processes and subjects (Lund et al., 2014; Starkey, 2020). That being said, this will equally challenge researchers on the question of suitable analytical frameworks. Here, we believe that process perspectives are valuable. In the current paper, we have attempted to apply an agentic perspective aimed precisely at making a process approach visible. Our findings indicate that teachers are indeed active actors in making complex decisions in their local school contexts, where they employ both immaterial and material resources to enact digital teaching environments that represent the possibilities and constraints to express their PDC.

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