

Prospective Mathematics Teachers' Emotions and Identity

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Received: 10 February 2020 Accepted: 22 September 2020

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This article presents an in-depth study illuminating prospective teachers' (PTs) emotions and identity in their development of becoming mathematics teachers. The participants study at a general teacher education programme and have chosen to specialise in mathematics. The theoretical framework in this study is based on Ricoeur's (1992) and Nussbaum's (2001) theories on identity and emotion. The main argument for using this framework is the link between ethics, eudaimonia, value judgment, emotions and identity. These terms are closely related with the question of a person's well-being and flourishing. Through this framework, this study tries to make an innovative approach in the field of mathematics education. The findings indicated an emerging identity towards a reform mathematics teacher when analysing the participants' emotions, well-being and their flourishing.

Keywords · Personal narrative identity · emotions · value judgment · ethics · eudaimonia · reform mathematics teacher

Introduction

The process of becoming a mathematics teacher has for some proved to be troublesome, especially for prospective elementary teachers (PETs). Personal experiences from the past have led to negative emotions towards mathematics and can thus be a challenge when attending teacher education. Studies have shown that becoming a mathematics teacher is an emotional process which affects identity (Lutovac & Kaasila, 2018). Negativity regarding the subject seem to be disruptive in the process of becoming a mathematics teacher. Nevertheless, studies have shown that PETs want their negative emotions towards mathematics to change during their time in teacher education (Di Martino & Sabena, 2011). However, research on identity and emotions are still rare in the field of mathematics education (Lutovac & Kaasila, 2018). This article focuses on the emotional nuances and identity building of prospective teachers (PTs) during their process in becoming mathematics teachers. The framework used in this study relies on Ricoeur's (1992) theory and definition on personal narrative identity and Nussbaum's (2001) description of the intelligence of emotions. Using these theories, this study attempts to make an innovative approach to identity research in the field of mathematics education where participants' emotions and identity are analysed from a perspective that looks at what the participants strive for in becoming a mathematics teacher. Identity and emotions are here related to ethics in striving for the good, both in relation to their own self-development and in relation to others.

Earlier studies have shown that a reform-oriented teaching approach has developed positive emotions towards mathematics. PETs have expressed that they have gone from being negative to

positive when they have experienced a change in methodology from traditional to reform teaching. Related to this, PETs also expressed a desire to become a better mathematics teacher than what they themselves experienced (Di Martino & Sabena, 2011). The approach in this article contributes to a broader insight in the emotions toward teaching approaches in mathematics, particularly related to the participants well-being and identity as future mathematics teacher.

The qualitative research took place in Norway at a general teacher education program. In Norway there are two separate four-year teacher education programs for the compulsory education; grades one–seven and grades five–ten. This study focuses on the general teacher education grades five–ten, for upper primary (grades five–seven) and lower secondary (grades eight–ten). The mathematics course in this program is optional. The participants in this study chose to specialise in mathematics. The participants qualify to teach mathematics for both upper primary and lower secondary. Hence, the prospective teachers in this study will further be shortened as PTs. In-depth interviews from PTs during their time in teacher education are analysed. Two research questions led this study. The first question was: What emotional nuances emerge in PTs' narratives as they talk about their journey to become a mathematics teacher? Then, the second research question guided from the first question was: Which identity seems to evolve from the emotional nuances, in pursuit of becoming the mathematics teacher they want to be? To answer these questions, two levels of the analytical process were conducted.

The paper is organised as follows. The next section discusses relevant parts of the literature before deliberating on the theoretical framework. This is followed by a discussion of the research strategy and methods before the empirical findings are introduced. In the section on empirical findings, the participants emotions are described in relation to the first research question and the first level of analysis. Then, the second research question related to the next level of analysis, will be considered in the discussion section. A model, which developed from the analysis of emotions and identity, is here presented. This section also discusses how the findings might contribute to the existing literature. In the final section, concluding thoughts are presented.

Literature Review

Studies have shown that emotions can affect PETs identity in their process of becoming a mathematics teacher and hence influence teaching practice (Hannula, Liljedahl, Kaasila & Rösken, 2007; Hodgen & Askew, 2007). Even though few studies deal with both identity and emotion on an individual level there has been an increased interest in emotional studies in mathematics education over the last decade (Lutovac & Kaasila, 2018; Schukajlow, Rakoczy, & Pekrun, 2017). Many of these studies focus on participants' emotions during mathematical tasks, engagement during exercises, and learning and problem-solving (Goldin, 2014). These studies often define emotions as cognitive processes, functional, and involving physiological reaction (Hannula, 2002, 2015). This article takes the approach that emotions are parts of emotional judgment; thoughts directed towards particular objects or situations of great importance to the persons own well-being. Emotions involve moral and ethical judgments, which means that this study looks at participants emotions as part of the ethical values concerning their journey in becoming a mathematics teacher (Nussbaum, 2010).

Identity research which builds upon sociocultural and poststructural perspectives has, over the last two decades, become a major area of research in the field of mathematics education (Darragh, 2016; Losano & Cyrino, 2017; Lutovac & Kaasila, 2018). The majority of these studies

draw on Wenger's (1998) definition on identity. While Wenger (1998) looked at the ways in which identity is constructed through participation and engagement in social groups, this study relies on Ricoeur's (1992) definition of identity. Identity is here defined as personal narrative identity, as self-understanding reflected in the form of stories where events are understood in relation to each other. This article tries to contribute to the knowledge of personal identity, raised by Lutovac and Kaasila (2018). Personal identity studies in mathematics education are still in the early stages. Nonetheless, we know from studies reporting on personal identity, that it is possible to make changes when it comes to PETs view of mathematics. For instance, the research from Lutovac and Kaasila (2011; 2012; 2014), where PETs that had negative experiences with mathematics throughout their schooling, demonstrated an opportunity for a change in their identity development through specific narrative tools during their time in teacher education, addressing past, present and future self. They saw the possibility of changes in the participants' views of mathematics and ways for them to cope better with the negativity and resistance to the subject. Therefore, studies with the focus on personal identity bring up the awareness of the need to implement, for instance, teacher identity work and construction within teacher education, either through mathematics courses, online communities, or in teaching practice (Gibbons et al., 2018; Gomez, 2018; Goos & Bennison, 2008; Lutovac & Kaasila, 2014).

In the practice of learning to become a teacher, PTs are disposed to different emotions, where both positive and negative emotions influence their identity as teachers and what they consider as good and bad teaching (Day & Leitch, 2001; Keller et al., 2014; Meyer, 2009; Timošćuk & Ugaste, 2010; Yuan & Lee, 2015). Teachers want to replace the bad teaching with the good. Teachers' considerations of good and bad teaching are influenced by their view of teaching as a moral enterprise (Hansen, 1998). Research in the field of general education has shown that the emotion of hope has played an important role in the development of teacher identity in relation to teaching and instruction (Bullough & Hall-Kenyon, 2012). PTs mentioned feeling hopeful about teaching in the future and have shown a strong sense of personal responsibility for teaching (Eren, 2014; Lauermaann & Karabenick, 2013).

When it comes to emotional studies within mathematics education, PETs' negative emotions towards mathematics are well documented (Bibby, 2002; Di Martino & Sabena, 2011; Di Martino et al., 2013; Hannula, 2002; Hodgen & Askew, 2007; Itter & Meyers, 2017). PETs express a great deal of negative emotion towards the subject, where some are fraught with anxiety. Hannula et al. (2007), explored a therapeutic approach to help PETs cope with and change this negativity towards mathematics. The results showed that it was possible to change this negative affect through narrative and reflective writing. Di Martino and Sabena found in their 2011 study a connection between PETs' negative emotions towards mathematics and their personal experiences as mathematics students in the past. Whereas the participants had strong negative emotions towards the subject they also had a desire to convert these negative emotions during teacher education (Di Martino & Sabena, 2011). This desire was investigated further in the study of Di Martino, Coppola, Mollo, Pacelli, and Sabena (2013), who argued that such studies are important to teacher educators, so they might "break the chain connecting the negative past school experiences with the negative feelings towards mathematics" (p. 226). With a narrative approach focusing on the past and the future, they found that the participants showed "a strong desire to become a better teacher than their own teachers, to spare their future students from "*math-pain*" (p. 229). Similar findings were found in the study of Itter and Meyers (2017) where the majority of PTs experienced the feelings of fear, resistance, and ambivalence towards learning and teaching in mathematics, based on their past experiences. Mansfield and Volet (2010) also

argued that emotions often were rooted in PTs own experiences as pupils. Memories of negative experiences in school strengthened the PTs' motivation to build positive relationships with their pupils, hoping to save them from having negative school experiences. However, Itter and Meyers (2017) also illustrated that a reform-oriented learning environment could be more encouraging.

A reform-oriented teaching approach involves problem-solving and active participation, including dialogue, discussions, and explanations around mathematical thinking. For many PTs this means the adoption of new strategies from what they have previously learned, not only for teaching mathematics, but also for learning mathematics themselves (Ball, 2001). The studies from Itter and Meyers (2017), Drake (2006) and Drake, Spillane, and Hufferd-Ackles (2001) also showed that elementary teachers' ability to embrace reform mathematics teaching was connected to teachers' reflection on positive and negative emotions regarding past experiences in teaching mathematics. Teachers who revealed negative experiences from the past were all committed to making mathematics learning a better experience for their students. They believed in changing the teaching approaches from what they, themselves, had experienced (Drake, 2006; Drake et al., 2001). This was also found in the study by Hodgen and Askew (2007), where one PET changed her emotions toward teaching mathematics. When teaching mathematics in a more reform-oriented way, a positive view of the subject was created by the participant.

Most of the studies discussed in this review section go more in depth with the resistance and negativity regarding teaching and learning mathematics, showing that there is possibility for a positive change in either identity or in the emotions. In the present study, there is a focus on both emotion and identity since it is known that emotions affect teachers' identity (Lutovac & Kaasila, 2018; Yuan & Lee, 2015; Zembylas, 2003, 2005). Furthermore, the nuances of participants' emotions are analysed through a framework that looks at what the participants strive for in becoming a mathematics teacher. Through this framework, this article tries to make a new contribution in the field of mathematics education where identity and emotions are related to ethics and values and how the participants aim for a good life as a future mathematics teacher.

Theoretical Framework

Narrative identity and Emotions

In this paper, I combine Ricoeur's (1992) theory of personal identity with Nussbaum's (2001) understanding of emotion.

Ricoeur's theory on identity is used to understand PTs' identity, where a person's identity is defined through their narratives of their past, present and future. This study takes the position that PTs' stories are closely related to their ongoing identity construction as future teachers in mathematics, which gives insight into their professional identity development. In Ricoeur's *Oneself as Another* (1992), he saw narratives as the constructs of personal identity; a self-understanding across time, reflected in stories. Narratives are rooted in life and lived experience, and our self-understanding is presented in the form of stories where events are understood in relation to each other. He argued that even though we cannot access the past, we deal with making sense of the past and our continual connection with our earlier experiences, where traces of the past remain in the present. Identity also includes stories about the future. Stories about future mathematics education and the PTs as teachers co-constitute the PTs' identity. Stories about the future include conceptions of good (i.e., good practices and good teachers). The underlying basis of narrative

inquiry is the belief that people make sense of themselves and their world by telling stories. The story by which we construct our own identity shows that our life is always linked to others. Ricoeur (1992) presents narrative identity as social as he emphasises the importance of others in self-understanding. He also recognises the relevance of emotions through narratives, their connection to social life and, consequently, their impact on identity. Narratives always involve other people and teach us something about ethical commitment to other people in a larger context where emotions are relevant (Ricoeur, 1992; Nussbaum, 2001).

Nussbaum (2001) offered a new perspective for analysing emotions in empirical studies. In her book *Upheavals of Thought: The Intelligence of Emotions* (2001), emotions are intentional thoughts directed towards particular objects or situations. Emotions towards particular objects or situations are type of thoughts about something or someone of great importance for the person. Further, she argued that what is of great importance for a person, have a value and are therefore not morally neutral. Because of this, Nussbaum (2001) explained that emotions are connected to our moral reasoning and how we think about right or wrong. She argued further that emotions are kind of judgments, being part of our value judgments. Value judgments are in her book defined as something general and broad that are related to thoughts towards people or things of great importance to our own well-being. In this sense, emotions can be seen as an individual experience, where feeling good or bad depends upon how a person evaluates it (Zembylas, 2007).

In this paper PT's emotions are regarded as part of their value judgment towards specific things like their previous teachers or their practicum (Nussbaum, 2001). Value judgements are understood to be something broader; for instance, their general view on teaching in mathematics.

Identity and emotions both have a narrative structure and are connected through their desire for a good life, well-being and flourishing. These elements are to find in Aristotle's conception of eudaimonia, where the greatest goal for all individuals is a state of a good life, where a person's identity and emotions are related to their well-being and flourishing. It is through this premise that Ricoeur's and Nussbaum's theories form the theoretical frame in this study.

Eudaimonistic theory

In the eudaimonistic theory, the fundamental question is how persons should live their life to achieve a good life, well-being and flourishing. Eudaimonia refers to activities in pursuing virtue and excellence in living a worthwhile life (Huta & Waterman, 2013). This understanding of eudaimonia is based on the Aristotelian principle that the greatest goal for all individuals is a state of a good life, where a person's identity and emotions are related to their well-being (Nussbaum, 2001; Ricoeur, 1992).

Both Ricoeur (1992) and Nussbaum (2001) emphasise the eudaimonistic theory in their development of theories on identity and emotion. The main argument for using the framework of Ricoeur (1992) and Nussbaum (2001) is the link between emotions, value judgment, ethics, and identity, where these terms are closely related and held together in eudaimonistic theory. Given that emotions are an important part of value judgments, they subsequently relate to ethics, a person's moral judgment and their well-being (Nussbaum, 2001). Moreover, it is in the search of one's own identity, who you are and who you want to be, that you search and aim for eudaimonia and the good life (Ricoeur, 1992).

Ricoeur and Nussbaum help explain how value judgment and identity are theoretically related in the concept of eudaimonia. From an eudaimonistic perspective, a person develops both through self and in relation to others. To operationalise this perspective of eudaimonia,

participants' descriptions of who they want to be as mathematics teachers, was in this study analysed both in relation to their own self-development and in relation to others.

This theoretical framework was developed in order to analyse the participants' emotions in a larger context and to understand emotions in light of what the participants are striving for; the good in becoming a mathematics teacher. This framework links together these five aspects; value judgment, the good, ethics, emotions and identity and makes it possible to analyse how participants associate emotions and striving for the good with their mathematics teacher identity.

In the context of this study, the position on eudaimonistic theory unfolds itself in the PTs' narratives about what is good teaching in mathematics in relation to their values and how they aim for eudaimonia in their future work. The analysis of the data material has searched for what is valuable in a professional context for the PTs; looking for the things that are emotionally important for them, and how they articulate this. This was established through an inquiry of how the participants expressed positive and negative views about what was relevant for them in their role as future mathematics teachers and their views on teaching.

Method

Focus of the study

The focus here is to understand PTs' emotional nuances in their identity building process in becoming a mathematics teacher, what they strive for, and what kind of mathematics teacher they want to be. The study followed a hermeneutic phenomenological approach. It is phenomenological as it tries to get close to the personal experience of the participant, and it also relies on double hermeneutics, "trying to make sense of the participants trying to make sense of what is happening to them" (Smith, Flowers, & Larkin, 2009, p.3). The main research strategy was to use in-depth interviews with the analysis techniques of Interpretive Phenomenological Analysis (IPA). IPA is relevant as an analytical approach as this provides opportunity to build rich pictures of subjectively felt experiences of meaning. IPA focusses on the person's life as lived and experienced, in which the lived experience is linked to cognition and emotion (Smith et al., 2009). The phenomenon of the study is personal identity and emotion, where the unit of analysis is a PT's narrative. Central to this study is making sense of PTs' meaning and experience, where meaning and experience are closely linked to the understanding of the human being as a sense-making being. The expressive features of participants' narratives are also highlighted in hermeneutic phenomenological approach, emphasising the importance of attending to participants' language, focusing on understanding participants' accounts within the context of their lifeworld (Ricoeur, 1992). The participants' emotions, being part of value judgments, are integrated in the participants' narratives about who they want to become and who they are; their identity. The narratives bring these aspects together at the same time, which is why narratives in this study are examined (Nussbaum, 2001; Ricoeur, 1992; Van Manen, 1990; Zembylas, 2003).

Context and participants

Ten PTs from two different university colleges in Norway were interviewed in depth. The teacher education program where the PTs participate is a general education program for upper primary (grades five–seven) and lower secondary (grades eight–ten). The reason behind interviewing this

group of students is that, through recent years of reforming Norwegian general teacher education program, those who now choose to become general educated teachers choose to specialise in different subjects. Those who select mathematics want to become specialist mathematics teachers. Those who choose to specialise in mathematics must complete a 60-credit mathematics course. This is a mathematics course that qualifies for teaching in lower secondary (grades eight–ten) and upper primary (grades 5–7).

Participants volunteered to take part in this study and the group consisted mostly of mature students, many of them with a prior tertiary degree. Some of them were parents and had experienced mathematics teaching from a parenting perspective. Unintentionally, it was a homogeneous group of participants; this may be because the participation was voluntary (Patton, 2002). For this article five participants with the pseudonyms; Jolene, Brenda, Henry, Irene, and Alice, were selected due to their rich descriptions about their past, present and future. Although the group is homogeneous, there is a particular distinction between these five participants. One part of the group enjoyed mathematics in the past and talked about their top grades in mathematics (Brenda, Henry and Jolene). The other part of the group (Alice and Irene) expressed how they disliked the subject and had problems with the subject when they were young. Either way, they all wanted to be a part of changing their approach to teaching mathematics.

Interviews

The interviews took place when the PTs had been through their two first practicum-periods; the first one consisted of observation and some teaching, while the second one lasted four weeks with full responsibility for the class. The participants are in the process of completing the mathematics course in a four-year teacher education study. In order to participate in the research, the subject teachers at both university colleges handed out a written explanation of what the research entailed, how the data would be used, and how and to whom it would be reported. In the written form, they were given confirmation of confidentiality and that the participants could, at any time, withdraw from the research. This confirmation was given to them so that they would fully understand the process in which they were to be engaged.

The interview covered an exploration of participants' experiences of attending teacher training. Semi-structured and open-ended questions were used to generate a detailed narrative that was meaningful for them, such as, "Can you tell me about your mathematics experience before you started teaching education, and how it was to begin with mathematics in teacher education?" This kind of question would make it possible for the participants to talk about events and experiences important to them. All interviews were audio-recorded and transcribed verbatim and lasted around 90 minutes.

Analytical Process

When transcription was completed, the participants' narrative was thematically analysed in accordance with the analysis techniques of IPA (Van Manen, 1990). This approach recognises that the meaning of participants' narratives may not always be obvious to the participants, though meaning can be made from the narratives produced by them. The thematic analysis first involved reading each transcript in its entirety and writing a phrase or phrases that captured the overall significance of the participant's story. Then, a more selective approach was taken that emphasised the participant's statements that seemed particularly revealing. Themes were then derived from each of the individual narratives. Initially, a general code of positive or negative sequences was

used. Ultimately, common themes across participants' stories emerged to represent one of the products of this study. This analytical process took place at two different levels. The first level was to thematically analyse the data to answer Research Question 1. In the process of analysing and coding the emotional nuances, codes were developed from both explicit words and descriptive sentences (Van Manen, 1990). The second level of analysis, to answer Research Question 2, in-depth studying of meaning making of the participants' narrative was then conducted. Meaning making according to Van Manen (1990) was used to summarise the descriptions of aspects of the phenomenon. In order to move forward in this coding, a conceptual apparatus was needed to encode and analyse the emotional nuances. It was in this second stage, PTs' eudaimonia was analysed to identify where their value judgments and identity emerged in the narratives about their professional roles as future mathematics teachers.

Ricoeur and Nussbaum's theories were used to understand how value judgment and identity is theoretically related in the concept of eudaimonia. From an eudaimonistic perspective, a person develops both through self-development and in relation to others. To operationalise this perspective of eudaimonia, participants' descriptions of who they want to be as mathematics teachers, were analysed both in relation to their own self-development and in relation to others.

Table 1 provides an overview of parts of the process of first and second level analysis within the approach of IPA, as outlined by Van Manen (1990).

Table 1
The data analysis process

	Example: The emotion "excitement".	Example: The emotion "disappointment".
Key terminology	"exciting to teach" "calling" "make people master the subject"	"it's just negative memories from the past" "not being seen by the math teacher" "no good math lessons in the past"
Level 1: Thematical coding	From explicitly narratives: The excitement to teach in the future. From descriptive narratives: Describing a call to make pupils master mathematics was coded to be "excited about something to be performed in the future".	From descriptive narratives: Describing negative memories of their math teachers, and of being overlooked evolved to the shared and interpreted emotion of "disappointment".
Level 2: Meaning-making through the lens of the eudaimonistic theory	"Excitement" covers the stories of something of great importance regarding the future role as a mathematics teacher and their responsibility of choosing the teaching techniques to help pupils master the subject. Expressing an excitement towards a reform-oriented teaching approach, talking about influencing a positive change.	"Disappointment" covers the stories about previous math teachers and math lessons within a traditional classroom. The narratives cover the great importance for the participants to make a change from what they experienced in the past, and to become a different teacher than what they experienced; a teacher that is present for their pupils.

Findings and Discussion

Research Question 1

The following describes the findings related to the first level of analysis and the Research Question 1: What emotional nuances emerge in participants' narratives as they talk about their journey to become a mathematics teacher?

Disappointment

Similar to the study from Di Martino and Sabena (2011), the participants connected negative emotions towards mathematics with their personal experiences in the past. The participants in this study also shared some form of disappointment when they described previous experiences. The disappointment was aimed specifically at former mathematics teachers and teaching approaches. Jolene, for example, could not recall any mathematics teachers in a positive way after 13 years of schooling:

Not one math teacher. No one, not in a positive sense. Either it's negative or they have not been there. I've fixed math so well on my own. But there are other teachers who have made an impression. And it's the teachers who have seen us. Seen us, the students, as humans. Seen us and cared about us. So that is what I think is an important role. I have not had that experience with math teachers. Clearly, we are the grown-ups for these students almost all day. Seeing them something other than "getting the right answer" is important. (Jolene)

Jolene's descriptive absence of former mathematics teachers is here understood as disappointment, a disappointment in a mathematics teacher that was "not there". Jolene's disappointment seemed to be amplified in her mention of other teachers that cared about their students. Hence, it is not that she did not remember any teachers in a positive sense. When she described other teachers, who did not teach mathematics, she used the phrase to "see the students as human beings" being "more than just numbers".

Both Jolene and Brenda expressed confidence in the subject of mathematics; however, they articulated the same emotion of disappointment when they described how they were "not seen" by their previous mathematics teachers. "Not being seen" is the opposite of being seen, analysed as being ignored or overlooked. Being ignored or overlooked can be interpreted as an absence of care from the teacher.

I have experienced being seen in the classroom as a student; I have also experienced not being seen. [...] I got the top score on all the tests and went out with top marks in the grade book, but I had not been seen. So those grades were not fun, because I had not been seen. There were not any good math lessons. So that's an experience. [...] I think so much about my own schooling and the teachers I've had. And I've had so many bad teachers. So, I take all my experiences and try to keep them in mind when I teach. So, it's kind of the way to become the person I am today, the experiences that I'm trying to take with me, reflecting on the past. (Brenda)

There were several layers of disappointment in Brenda's narrative. Brenda's narrative and description of not being seen might give the impression that she felt she did not matter. For both Jolene and Brenda, being overlooked or ignored by their own teachers is interpreted as disappointment. Even though disappointment is implicitly narrated, the emotion is directed unambiguously towards the teacher.

In contrast to Brenda and Jolene, Irene struggled with mathematics from previous schooling. Whereas Brenda and Jolene talked about being ignored by their mathematics teachers, Irene talked about being overlooked in a different way than Brenda and Jolene. Her story gives an impression that the mathematics teachers were being derogatory.

It was typical that everything had to be according to the standard algorithm. [...] And if you ask for help, you have ... I have often experienced that if you ask for simple things then, because I have not been so strong in math, they have been like: "Oh, you cannot solve that?" And they roll their eyes, and they just continue: "Well, you just have to try and read in your book to see if you are able to understand it compared to what's written there. And maybe you ask a friend as well". So, I've got a lot of that in the past. And you don't feel great, so that's what I hope I can change. (Irene)

In Irene's story about her struggle with the subject from the past, she also gave rich descriptions on how she experienced the body language of her former mathematics teachers. Irene highlighted her interpretation of patronising body language and rejection in her narrative. She portrayed the teachers as condescending in the way they approached her, both through questioning her ability to solve tasks and through body language by rolling their eyes. She made clear that she did not feel good when that happened. This is a story that is analysed as communicating disappointment, the disappointment of being overlooked and neglected by the teacher. But there is also another element, an element of vulnerability. As previous pupils, Brenda, Jolene, and Irene all shared stories of being ignored by their mathematics teachers. But, in Irene's narrative, there is an extra element of vulnerability. The story is about the student versus the teacher, which puts the student in a vulnerable situation.

Excitement

Most of the participants started their narratives describing their current excitement to become mathematics teachers. With their focus on teaching approaches, they had a clear consideration of what they thought good teaching was (Hansen, 1998). Their excitement lay in the change, and when describing this, they quickly shifted to their backgrounds and their reason why they wanted to become mathematics teachers. Their stories revealed the connections between excitement and experience when they talked about why they wanted to become mathematics teachers. Looking at teaching as a moral enterprise, they wanted to replace the bad teaching with the good (Hansen, 1998). The significant absence of "good" mathematics teachers or "good" mathematics lessons from their own schooling are a substantial argument in their reasoning for becoming mathematics teachers. The grounds for change were placed on previous teaching and former teachers. In their narratives, the expressions of excitement emerge when the participants explained why they were ready to become mathematics teachers. They were ready to make a difference, and they expressed an excitement thinking that they might make a change in the future. They were excited to become participating parties in this change. There is no doubt in the participants' quotations that they wanted a change in teaching approaches. The emotional excitement is aimed at the teaching of mathematics.

I find it very exciting to teach, and I really enjoyed being out in the school. I've always loved math. [...] So, my motivation to become a math teacher; it's self-interest, and that I see that there is a need to do something, a change in the math lessons. I see that it is possible to do it differently. For it is clear that not everyone at the lower secondary school gets as much out of it with just getting a formula handed out. (Jolene)

Jolene explicitly stated her excitement for teaching mathematics. She was clear about her motivation of becoming a mathematics teacher, and her reasoning was two-sided. Firstly, she had a self-interest in the subject, which was analysed as to be directed inward, towards herself and her own excitement. Secondly, her statement was about the need for change. This statement was about the pupils' opportunity to learn, indicating that it is time for a transformation in mathematics lessons. It is in the opportunity to do things differently that she expressed motivation for change. Here, this is understood as an outward excitement directed towards the possibility to teach mathematics in a different way than the traditional approach that she mentioned in this quotation. From the participants' narratives, their past relations to mathematics lessons and teachers seems fundamental to their decision to become mathematics teachers:

I think my calling in mathematics education is to make people master the subject. That's why I'm studying to be a math teacher now, to change it: To become a better math teacher than I experienced as a student. (Brenda)

In this quotation from Brenda, there is no explicit mentioning of excitement. Brenda talked about her call. Calling is a strong word and something that is analysed as part of Brenda's passion. A passion towards her future pupils of mathematics and towards the methods of teaching, where the aim is to make pupils successful in mathematics. In this setting, calling is interpreted as excitement. In her argument, her call is so strong that it is why she chose this education: her excitement to become a mathematics teacher and to make a difference; to become a "better" teacher for the pupils. Brenda's quotation is an example of an implicit statement of excitement in contrast to what was found in Jolene's quotation above. Similarly, in Henry's statement:

I feel like I want to do this, I have become more and more sure of this during my first year. Because I see that there are so many opportunities to make teaching mathematics much better than what I experienced myself. (Henry)

Henry, like Brenda, is explicit regarding his role in improving the teaching of mathematics. Henry's excitement is here analysed in what he referred to as the "opportunity". In this opportunity, Henry "felt like" he wanted to be a part of making the teaching of mathematics "better", and like Brenda, Henry implicitly stated excitement towards the future.

Hope

In this section, the participants elaborated on their relations to teaching, how they wanted to practice as mathematics teachers and their view on mathematics teaching for the future.

It was really WOW! I did not expect that. So, they [the teacher educators] have really inspired me to engage in mathematics teaching and become proficient in teaching and convincing students that math is fun. [...] Well, they [the teacher educators] put a lot of emphasis on dialogue and talking mathematics. And I think that's very important because I think that's something I and too many others have not experienced. We just know that mathematics is typical that you work for yourself and write and think inside your head. (Brenda)

Brenda expressed the nonexpectation from the mathematics lessons in teacher education. The WOW-experience is about being encouraged and inspired. There is a focus on a new way of teaching that she has not experienced before. It is in this inspiration for the present and the future that hope emerged and was analysed. The hope lies in teaching mathematics through dialogue with the pupils, working together on tasks and making the pupils explain how they are thinking. Aside from what the participants talk about regarding hope in teaching, these quotations also

have a commonality in that they attach hope to time: Hope applies to the present and the future (i.e., a hope that goes from past to present and future). The hope lies in changes from what was before, the traditional, to the present-day teacher education focusing on reform teaching.

Like here at the university college, where they focus on the concrete; transitions from concrete to abstract. Where they focus on solution strategies and problem solving, and to teach the children how to solve problems. [...] Not only formulas but teach them solution strategies. (Alice)

Alice's optimism regarding new ways of teaching are analysed as hope for a better relationship with the students working together and teaching them solution strategies through activities and more enjoyable teaching. In Alice's narrative, hope seemed also related to student outcomes, hoping for more mastery. Unlike Brenda, Alice directed her emotions towards the students and not the teacher educators. In Irene's narrative, the emotion of hope also seemed directed towards the students:

So, it is very rewarding. Seeing the students who struggle and do not get it, and the teacher may not be able to help them. They are a little forgotten. And when making them feel that mastering; "Wow, I actually do it better than he who is the best in class". It's awesome, and you get a little like that, touched, and yes you get such a pleasure. You get a little bit, at least for my part, who has always been the one who does not manage and does not dare to raise my hand because I never got enough help, to see that they actually manage to perform so strongly. When you manage to do teaching by just turning a few things around, it is very rewarding. (Irene)

Her assertion described the reward of seeing pupils that struggled with the subject getting a sense of mastery through practical, open and rich tasks and activities. Here, hope emerged and was analysed. In addition, this experience brought overwhelming emotions back to Irene: She was moved and touched to see that students who struggled in the subject got the experience of managing the subject. The interpretation of her narrative illustrates positive emotions that alternate between the pupils and her as a teacher.

Frustration

In the previous section, the participants associated hope to the teaching approaches learned in their teacher education programme. In the practicum, they were faced with conflicting visions, both from a personal stance and in relation to what they learned in the teacher education programme. They seemed surprised in a negative sense when they learned that the teaching in mathematics had not changed much from their own schooling. Frustrations arose when they saw that traditional teaching was still used in school today. Traditional teaching for the participants was described as "black-board teaching" and "handing over solutions strategies" for the pupils to work on "individually". In analysing Henry's narrative, a frustration seemed to evolve when he learned that traditional teaching was a method used in the mathematics classroom today:

That means it has stood still in that generation. And then I start researching a bit how the teaching has evolved; and yes, we have changed a little from my grandfather's time, who now is at the age of 90, but the changes are physical punishment. But the way the math is taught, it's the same. (Henry)

The frustration here was aimed towards traditional teaching. Henry was surprised and expressed his frustration of the lack of development. This frustration seemed to be caused by the nonfulfillment of his hope and expectation from when he started his education as a mathematics

teacher. As Henry, Alice also narrated her frustration when she found that traditional teaching was still used at school:

It's traditional teaching, and no one checks the understanding of the students. There is so much wrong. Where should you start when you are out in school? With this traditional teaching, I get frustrated because I see that 20% may be involved, and the others are not understanding. [...] I'm sad when I see that they [the students] do not understand math, and I see that they are struggling. And many students just give up. (Alice)

Alice was explicit in her frustration, while Henry expressed his frustration through negative description when he talked about traditional teaching still being taught in school. Alice elaborated on students struggling and giving up on the subject. She got "sad" and "frustrated" observing this. She explained:

I got frustrated because you see that 20% may follow, but then the rest do not understand, and they never get the opportunity to understand. Because you have a test, and then you go on to the next topic. So, you'll never get to learn the topics if there is something you could not understand. I do not feel that the teaching is individually adapted to that class. [...] We have a fifth grade at home. And I see what she has in her math book. That's what students struggle with in the ninth grade. There were many students in the ninth grade who did not understand the math topics for the fifth-grade level. (Alice)

Alice's follow-up substantiated the emotions of being frustrated about the traditional teaching and her sense of inability to change or achieve something; she urged that changes had to happen, and uttered frustration over not knowing where to start to solve the problem.

Drawing on the participants' narratives, this study reveals the complex and challenging emotions during their time at teacher education. From their stories, their emotions are influenced by their teacher education program, their practicum and their relationships with former and present teachers. Teaching approaches evoke strong emotions in their narratives and seem to be unified in the PTs' view of their professional roles as mathematics teachers. Similar to the study of Di Martino et al. (2013), the participants want to become good mathematics teachers, and they want to break the chain of negativity. Here, teaching approaches seemed to be the singular most important factor in their role as future mathematics teachers. Their emotions are directed towards teaching approaches in mathematics referring to teaching as a moral enterprise (Hansen, 1998). This seemed to come from their strong will to change the teaching approach from what they expressed as "bad" and "good"; from "bad traditional teaching" to "good reform teaching".

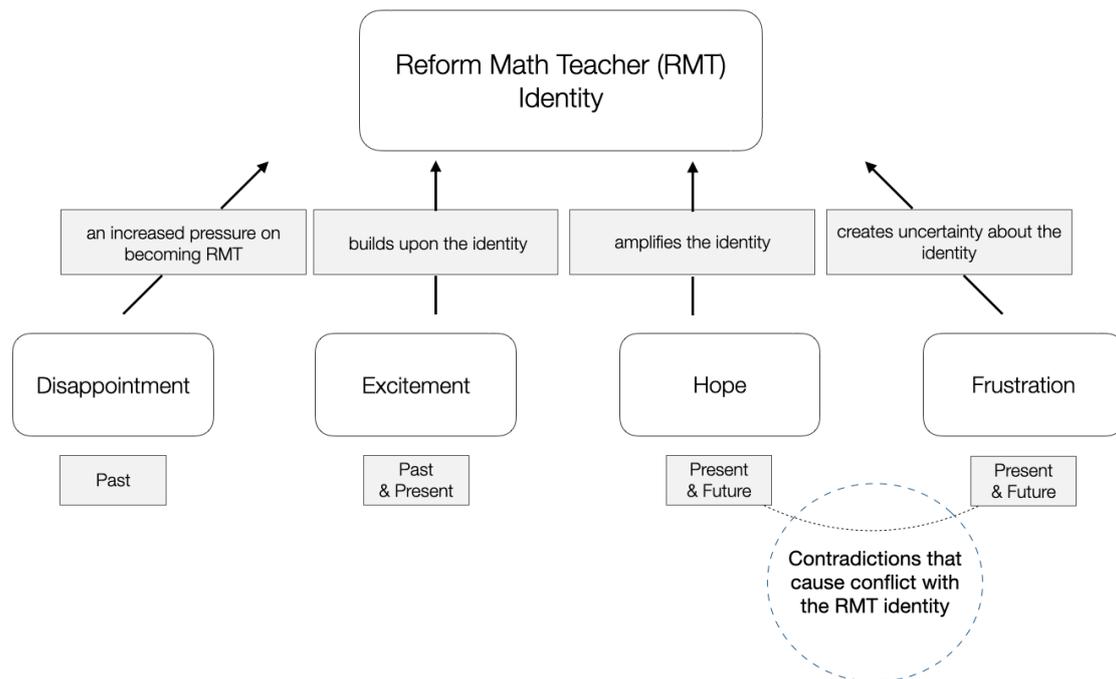
Research Question 2

The following describes the findings related to the first level of analysis and the Research Question 2: Which identity seems to evolve from the emotional nuances, in pursuit of becoming the mathematics teacher they want to be?

From this study's theoretical point of view, a person's emotions are related to their identity, their value judgment, and their well-being. Emotions, identity, value judgment and well-being are closely related and held together in the eudaimonistic theory. Through the eudaimonistic theory the central question is how persons should live their life to achieve a good life (Nussbaum, 2001; Ricoeur, 1992). Hence, this section looks into the participants' emotions related to their well-being and good life as a mathematics teacher.

Following from eudaimonistic theory, the participants value judgement and their identity were drawn towards the teaching approaches of reform mathematics, suggesting the identity of a reform mathematics teacher (RMT). Learning from previous studies on emotion and reform mathematics teaching we know that negative emotions towards mathematics can change to positive emotions. Teachers of elementary class have changed their negative emotions towards mathematics to positive emotions when embracing a reform-oriented approach in teaching the subject. Further, these elementary teachers argued that their negative emotions were related to past experiences as students of traditional classrooms (Drake, 2006; Drake et al., 2001; Itter and Meyers, 2017). The same result was shown in a research on emotions on one PET (Hodgen & Askew, 2007). The findings from these previous studies have some similarities to the finding in this study.

In this study, both negative and positive emotions seemed to affect the RMT identity in different ways. The participants narrated their good life as mathematics teachers, for themselves and for others through the reform-oriented approach in teaching the subject. Overall, the participants in this study related their negative experiences to traditional teaching and their positive emotions to reform-oriented teaching. There were, however, some negative emotions expressed towards an RMT identity. Analysing the participants emotions of disappointment, excitement, hope, and frustration through the lens of eudaimonistic theory, a model was developed (Model 1). The model below attempts to illustrate these emotional nuances and the identity of a reform mathematics teachers that emerged from the participants narratives.



Model 1: The participants' professional identity of Reform Math Teacher (RMT) evolving from their emotions.

Diverse emotions indicated an emerging RMT identity as illustrated in Model 1. The positive emotions of excitement and hope strengthen this identity. Excitement builds on the RMT identity, where the focus was on the past towards the future, while the sense of hope for the future reinforced this identity. In addition, the negative emotion of disappointment also seemed to increase the RMT identity. While disappointment, which derived from previously experienced traditional teaching, seemed to reinforce the pressure to become a future teacher of reform, the negative emotion of frustration seemed to shake this identity. Frustration arose in their narratives of present-day experiences from practicums and created uncertainty whether the RMT identity would succeed. When looking at the negative emotions, one can see some conflicts in building an RMT identity.

The participants in this study seemed eager to practice their views on teaching, believing that this would help giving positive experiences in mathematics learning, similar to the findings from Keller et al. (2014). The participants expressed hope for a change from traditional to reform teaching. This change was connected to their hope and optimism, which would help them as future teacher to "see" all the students, which again seemed like a vision to protect the students from the same occurrences as their own past experiences with traditional teaching. In the research by Drake (2006) and Drake, Spillane, and Hufferd-Ackles (2001), the participants believed in a change from their own past experiences of traditional teaching and, hence, was positive to reform-oriented teaching. In their research, Mansfield and Volet (2010), demonstrated that emotions were often rooted in teachers' own experiences as pupils. Memories of emotionally negative experiences from their own schooling strengthened their motivation to build positive relationships with their pupils to protect them from the same experiences. This is similar to the findings in this study and can also be related to the research from general education studies in which PTs mentioned being hopeful, showing a strong personal responsibility for teaching (Eren, 2014; Lauermaann & Karabenick, 2013).

Additionally, studies have shown the "reality shock" PTs may experience (Veenman, 1984, p. 143) related to differences in learning approaches from their teacher education to the practicum. Through experiences with the reality shock in practicum, the participants' frustration seemed to distress their RMT identity. Here, the emotions went from hope to disappointment, and the changing context and contradictory emotions had a negative effect on their identity (Zembylas, 2005). Even though it is known that PTs face contradictions between changing social contexts and their own beliefs (Sutton & Wheatley, 2003; Zembylas, 2003, 2005), the participants' narrative identity as RMTs appeared to become fragile.

In this article, the participants were disposed to a variety of emotions, from excitement to disappointment and from hope to frustration, which play an essential part in the process of learning to teach (Bullough & Hall-Kenyon, 2012; Day & Leitch, 2001; Meyer, 2009; Timoštšuk & Ugaste, 2010; Yuan & Lee, 2015). The findings would suggest, in alignment with Itter and Meyers (2017) and Hodgen and Askew (2007), that being a student in teacher education is a highly emotional experience with both negative and positive emotions, especially when it comes to teaching methods (Day & Leitch, 2001; Timoštšuk & Ugaste, 2010).

As illustrated in Model 1, the emotions of excitement and hope, versus disappointment and frustration, interfered with PTs projections of themselves towards an RMT identity. The framework links together value judgment, ethics, emotions and identities and makes it possible to analyse how participants associate emotions and striving for the good with their mathematics teacher identity. Within the theoretical framework of eudaimonia, the PTs saw the "good life" in their future job for their pupils if they reformed the teaching practice in mathematics. However, if their

future workplace uses traditional teaching in mathematics, the PTs could not clearly see or project the good life with and for others. Their flourishing (Nussbaum, 2010) was disrupted between traditional and reform teaching in mathematics.

The findings indicate that good teaching implies a good life, both for themselves, their self-development, and for their pupils, which refers to teaching as a moral enterprise. In this case, identity and emotions are related to ethics and striving for the good.

Conclusion

The findings indicated a relation to good versus bad teaching and emotion.: The participants were emotionally engaged in their future roles, searching for the good in emotions; which is of great importance for their own "flourishing" (Nussbaum, 2001, p. 22). The quest for a good life, as Ricoeur (1992) argued, "with and for others, in just institutions" (Ricoeur, 1992, p. 172), seemed to be reflected in the participants' desire to be good and just teachers for all the pupils. From their narratives, this could only be done through teaching mathematics within a fair and just classroom, where they identified this as exercising a reform-oriented approach. Using Nussbaum's (2001) and Ricoeur's (1992) frameworks in the pursuit for the "good life" in their professional role, the participants aimed for eudaimonia through the identity of a reform mathematics teacher.

In the context of this study, the position on eudaimonistic theory unfolds itself in the PTs' narratives about what is good teaching in mathematics in relation to their values and how they aim for eudaimonia in their future careers, which is of significance of this research. The analysis of the data searched for what is valuable in a professional context for the PTs, and how the participants expressed positive and negative views about what was relevant for them, their role as future mathematics teachers and their views on teaching. The analysis identified the factors that were emotionally important for the PTs, and how they articulate them. The model developed illustrates the role that emotions played in the participants professional identity development.

This type of research is in its early development and suggests further studies in this area would be worthwhile. From this specific study, it can be concluded that teacher education needs to develop greater support and tools for the PTs in terms of identity-building and for dealing with various emotions, especially in the transition between education and practice.

This qualitative study had a small number of participants. In addition, the sample group was rather homogeneous, which may have resulted in uniform narratives and, hence, affected the result in one direction. Further research should, therefore, be recommended to look at a wider range of different participants, not only to find out more in depth about their professional identities that are being developed in teacher education, but also to look for greater range of emotions.

References

- Ball, D. L. (2001). Teaching, with respect to mathematics and students. In T. Wood, B. S. Nelson & J. Warfield (Eds.), *Beyond classical pedagogy: Teaching elementary school mathematics* (pp. 11-22). Mahwah NJ: Lawrence Erlbaum Associates.
- Bibby, T. (2002) Shame: An emotional response to doing mathematics as an adult and a teacher. *British Educational Research Journal*, 28(5), 705–721.

- Bullough, R. V., & Hall-Kenyon, K. M. (2012). On teacher hope, sense of calling, and commitment to teaching. *Teacher Education Quarterly* 39(2), 7–27.
- Darragh, L. (2016). Identity research in mathematics education. *Educational Studies in Mathematics*, 93(1), 19–33.
- Day, C., & Leitch, R. (2001). Teachers and teacher educators' lives: The role of emotion. *Teaching and Teacher Education*, 17, 403–415.
- Di Martino, P., Coppola, C., Mollo, M., Pacelli, T., & Sabena, C. (2013). Pre-service primary teachers' emotions: the math-redemption phenomenon. In A. M. Lindmeier & A. Heinze (Eds.), *Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 225–232). Kiel, Germany.
- Di Martino, P., & Sabena, C. (2011). Elementary pre-service teachers' emotions: shadows from the past to the future. In K. Kislenko (Ed.), *Current state of research on mathematical beliefs XVI* (pp. 89–105), Tallin: Tallinn University.
- Drake, C. (2006). Turning points: Using teachers' mathematics life stories to understand the implementation of mathematics education reform. *Journal of Mathematics Teacher Education*, 9(6), 579–608.
- Drake, C., Spillane, J. P., & Hufferd-Ackles, K. (2001). Storied identities: Teacher learning and subject-matter context. *Journal of Curriculum Studies*, 33(1), 1–23.
- Eren, A. (2014). Uncovering the links between prospective teachers' personal responsibility, academic optimism, hope, and emotions about teaching: A mediation analysis. *Social Psychology of Education*, 17, 73–104.
- Gibbons, L., Feldman, Z., Chapin, S., Batista, L. N., Starks, R., & Vazquez-Aguilar, M. (2018). Facilitation practices in mathematics teacher education and the mathematical identities of preservice elementary teachers. *Mathematics Teacher Education and Development*, 20(3), 20–40
- Goldin, G. A. (2014). Perspectives on emotion in mathematical engagement, learning, and problem-solving. In R. Pekrun & L. Linnenbrink-Garcia (Eds.), *International handbook of emotions in education* (pp. 391–414). London: Routledge Press
- Gomez, C. N. (2018). Identity work of a prospective teacher: An argumentation perspective on identity. *Mathematics Teacher Education and Development*, 20(1), 43–61.
- Goos, M. E., & Bennison, A. (2008). Developing a communal identity as beginning teachers of mathematics: Emergence of an online community of practice. *Journal of Mathematics Teacher Education*, 11(1), 41–60. doi:[10.1007/s10857-007-9061-9](https://doi.org/10.1007/s10857-007-9061-9)
- Hannula, M., Liljedahl, P., Kaasila, R., & Rösken, B. (2007). Researching relief of mathematics anxiety among pre-service elementary school teachers. In J. Woo, H. Lew, K. Park & D. Seo (Eds.), *Proceedings of the 31st Conference of the International Group for the Psychology of Mathematics Education*, (Vol. 1, pp. 153–156). Seoul, Korea: PME
- Hannula, M. S. (2002). Attitude towards mathematics: Emotions, expectations and values. *Educational Studies in Mathematics*, 49, 25–46.
- Hansen, D. T. (1998). The moral is in the practice. *Teaching and Teacher Education*, 14, 643–655.
- Hodgen, J., & Askew, M. (2007). Emotion, identity, and teacher learning: Becoming a primary mathematics teacher. *Oxford Review of Education*, 33(4), 469–487.
- Huta, V., & Waterman, A. S. (2014). Eudaimonia and its distinction from hedonia: Developing a classification and terminology for understanding conceptual and operational definitions. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being*, 15(6), 1425–1456.
- Itter, D., & Meyers, N. (2017). Fear, loathing and ambivalence toward learning and teaching mathematics: Preservice teachers' perspectives. *Mathematics Teacher Education & Development*, 19(2), 123–141.
- Keller, M. M., Frenzel, A. C., Goetz, T., Pekrun, R., & Hensley, L. (2014). Exploring teacher emotions: A literature review and an experience sampling study. In W. Richardson, S. A. Karabenick, & H. M. G. Watt (Eds.), *Teacher motivation: Theory and practice* (pp. 69–82). New York: Routledge.
- Lauermaann, F., & Karabenick, S. A. (2013). The meaning and measure of teachers' sense of responsibility for educational outcomes. *Teaching and Teacher Education*, 30, 13–26.

- Losano, L., & Cyrino, M. C. C. T. (2017). Current research on prospective secondary mathematics teachers' professional identity. In M. Strutchens et al. (Eds.), *The mathematics education of prospective secondary teachers around the world* (pp. 25–32). New York: Springer.
- Lutovac, S., & Kaasila, R. (2011). Beginning a pre-service teacher's mathematical identity work through narrative rehabilitation and bibliotherapy. *Teaching in Higher Education*, 16(2), 225–236.
- Lutovac, S. & Kaasila, R. (2012). Dialogue between past and future mathematical identities. *Nordic Studies in Mathematics Education*, 17(3–4), 125–139.
- Lutovac, S., & Kaasila, R. (2014). Pre-service teachers' future-oriented mathematical identity work. *Educational Studies in Mathematics*, 85(1), 129–142.
- Lutovac, S., & Kaasila, R. (2018). Future directions in research on mathematics-related teacher identity. *International Journal of Science and Mathematics Education*, 16(4), 759–776.
- Mansfield, C. F., & Volet, S. E. (2010). Developing beliefs about classroom motivation: Journeys of preservice teachers. *Teaching and Teacher Education*, 26, 1404–1415.
- Meyer, D. (2009). Entering the emotional practices of teaching. In P. A. Schutz & M. Zembylas (Eds.), *Advances in teacher emotion research* (pp. 73–91). Dordrecht: Springer.
- Nussbaum, M. (2001). *Upheavals of thought: The intelligence of emotions*. Cambridge: Cambridge University Press.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: SAGE.
- Ricoeur, P. (1992). *Oneself as another*. Chicago, IL: University of Chicago Press.
- Schukajlow, S., Rakoczy, K., & Pekrun, R. (2017). Emotions and motivation in mathematics education: Theoretical considerations and empirical contributions. *ZDM*, 49(3), 307–322.
- Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method, and research*. Thousand Oaks, CA: SAGE Publications.
- Timošćuk, I., & Ugaste, A. (2010). Student teachers' professional identity. *Teaching and Teacher Education*, 26, 1563–1570.
- van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy*. Albany, NY: State University of New York Press.
- Veenman, S. (1984). Perceived problems of beginning teachers. *Review of Educational Research*, 54, 143–178.
- Wenger, E. (1998). *Communities of practice: learning, meaning and identity*. Cambridge: Cambridge University Press.
- Yuan, R., & Lee, I. (2015). The cognitive, social and emotional processes of teacher identity construction in a pre-service teacher education programme. *Research Papers in Education*, 30, 469–491.
- Zembylas, M. (2003). Emotions and teacher identity: A poststructural perspective. *Teachers and Teaching*, 9(3), 213–238.
- Zembylas, M. (2005). Discursive practices, genealogies, and emotional rules: A poststructuralist view on emotion and identity in teaching. *Teaching and Teacher Education*, 21, 935–948.
- Zembylas, M. (2007). Theory and methodology in researching emotions in education. *International Journal of Research & Method in Education*, 30(1), 57–72. DOI 10.1080/17437270701207785

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