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From anxiety to enthusiasm: emotional patterns among student teachers

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ABSTRACT

Studying to become a teacher is a highly emotional experience. Nevertheless, little is known about emotional patterns and emotional change. The aim of this study is to enhance the understanding of student teachers' academic emotions by exploring patterns of emotions experienced in emotionally loaded episodes. A total of 19 primary school student teachers were interviewed. The qualitative content analysis revealed five different emotional patterns: positive, negative, ascending, descending and changing. Most of the emotional patterns were positive or changing in nature. Yet all the emotional patterns were highly focused on studying and learning. Moreover, the patterns were experienced equally in short, medium-length and long episodes. Our study showed that emotional patterns were triggered by various task-related elements of teacher education: most commonly, fulfilled or unfulfilled expectations, sufficient or insufficient abilities, and experiences of social support received or not received.

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1. Introduction

There is evidence that studying to become a teacher is an emotional experience (Anttila et al. 2016). Student teachers have reported experiencing a number of emotions during their studies ranging from enthusiasm to disappointment (Timoštšuk and Ugaste 2012). Positive activating emotions have been associated with good academic performance among student teachers (e.g. Ketonen and Lonka 2012), whereas negative deactivating emotions such as boredom are suggested to be detrimental to learning (Goetz et al. 2014). Emotions also appear to vary depending on the context and the object of the activity (Averill 1980). The implication is that student teachers' emotions evolve and unfold over time (Sonnemans and Frijda 1994) depending on the activity in which they are engaged.

Nevertheless, surprisingly little is known about the kinds of *emotional patterns*, comprising a set of discrete emotions triggered by a situation or task at hand and followed by each other, that student teachers experience in their studies. An emotional pattern consists of a minimum of two discrete emotions activated by a situation or task at hand during an

academic activity such as coursework or teaching practice feedback session. Moreover, there is a lack of research on how and why student teachers' emotions and emotional patterns evolve over time (Pekrun and Linnenbrink-Garcia 2014). There is a need to enhance the understanding of future teachers' emotional patterns, not least because emotions experienced during their teacher education are likely to affect not only their learning, but also their experiences as in-service teachers (e.g. Becker et al. 2014; Eren 2013; Rowe, Fitness, and Wood 2015). Moreover, accumulating knowledge about emotional patterns will facilitate the development of learning environments in which student teachers can flourish. To gain a better understanding of student teachers' academic emotions, the present investigation focuses on addressing the following questions: (1) What kinds of emotional patterns can be identified among primary school student teachers? (2) What kind of variation is there in terms of pattern duration? (3) What triggers these emotional patterns?

2. Theoretical framework

2.1. Student teachers' academic emotions

Academic emotions refer to a set of emotions that are experienced while engaging in academic activities: typically studying, teaching and learning (Pekrun et al. 2002). They are short-lived and intense active states that arise in response to a particular stimulus (e.g. Do and Schallert 2004). Studying to become a teacher is an emotional experience that entails both positive and negative emotions (Anttila et al. 2016; Bloomfield 2010; Malderez et al. 2007). Student teachers' academic emotions have been shown to vary (Timoštšuk and Ugaste 2012) in terms of both *valence*, referring to the positive or negative charge, and *arousal*, referring to states of physiological activation (Barrett and Russell 1998; Kleine et al. 2005; Pekrun 2006, 2011). In the literature, enthusiasm, hope, pride and admiration have been identified as positive activating emotions, whereas anger, anxiety, shame and envy are defined as negative activating emotions. The positive and negative activating emotions cause high levels of arousal (Kleine et al. 2005). On the other hand, positive emotions such as relief and negative emotions such as disappointment, exhaustion, loneliness and boredom are perceived as deactivating due to the low intensity of their physiological emotional reaction. Negative emotions, such as sadness, are proposed to be neutral in terms of arousal since they are not particularly activating or deactivating by nature (Linnenbrink 2007). Satisfaction, appreciation and belonging, on the other hand, are typically defined as positive neutral emotions. Negative deactivating emotions such as disappointment, as well as negative activating emotions such as anxiety, have been reported to be the most prevalent emotions among student teachers (Anttila et al. 2016; Poulou 2007; Timoštšuk and Ugaste 2012). However, we recently found that Finnish student teachers frequently experience activating positive emotions, particularly enthusiasm and interest, and positive neutral emotions such as satisfaction were also frequently reported (Anttila et al. 2016).

Academic emotions are socially constructed and personally enacted ways of being that entail judgements pertaining to perceived success in goal attainment (Schutz et al. 2006), and therefore cannot be separated from the context in which they are embedded (Averill 1980). Previous studies have shown that taking exams, attending class, working in small groups and outside informal learning environments trigger emotions in student teachers (Anttila et al. 2016; Ketonen and Lonka 2012; Litmanen et al. 2012). It thus seems that these

emotions rarely occur in isolation, but rather arise while engaging in various interactions and practices during teacher studies. For instance, teaching practice appears to be a highly emotionally loaded experience on both positive and negative levels (Malderez et al. 2007; Timoštšuk and Ugaste 2012; Yeung and Watkins 2000). Positive emotions tend to relate to interaction with pupils, and negative emotions to teacher educators (Timoštšuk and Ugaste 2012). However, student teachers have also been found to experience admiration for teacher educators both in training schools and at university (Anttila et al. 2016; Caires and Almeida 2007). There is evidence that the complexity of social interactions during teaching and learning are commonly accompanied by intense emotional experiences among in-service teachers (Bahia et al. 2013).

It has also been found that student teachers' academic emotions are dependent on the object and the quality of the activity in question (Anttila et al. 2016) as well as their study success. Poor academic achievement is typically reported to cause negative activating emotions among student teachers (Ketonen and Lonka 2012). In some situations, such emotions may be a precondition for experiencing emotionally optimal states, to improve students' attention and learning capacity (Goran and Negoescu 2015). Some studies also imply that it may be almost impossible for student teachers to attain optimal motivational states such as flow experiences without some level of anxiety (Litmanen et al. 2012). Emotional experiences may result in different kinds of patterns depending on the dynamics between the student and the learning environment (Timoštšuk and Ugaste 2012).

2.2. Emotional patterns

Emotions may evolve and unfold over time (Sonnemans and Frijda 1994) and can result in particular patterns in a given situation. Accordingly, emotional experiences do not typically comprise one single emotion, but rather constitute a pattern of different emotions (Pekrun and Linnenbrink-Garcia 2014). An emotional pattern could last from only a few minutes up to several hours or even longer (Verduyn, Van Mechelen, and Tuerlinckx 2011). Student teachers' emotions may vary widely during a maths lecture or teaching practice session, for example. The student teachers may, for instance, simultaneously experience pride in their own performance in the lecture, admiration of the lecturer, frustration with other students' behaviour and enthusiasm for learning. The emotional pattern is triggered by a particular situation and consists of at least two discrete emotions following each other and forming a pattern. Each emotion activated by the situation has the capacity to recruit other emotions (Izard and Youngstrom 1996). Hence, the effect of the first emotion in the pattern may be minimal before other emotions come into play (Izard et al. 2000). It has been proposed that in addition to the quality and intensity of discrete emotions the impact of an emotional pattern is highly dependent on the situational and individual attributes (see e.g. Becker et al. 2014). Verduyn et al. (2009), for instance, showed that the duration of everyday emotional episodes depends on the intensity of the emotion at the beginning of the episode, and is further influenced by personality and situational factors. There are also differences in duration among different emotions: experienced gratitude is typically shorter lived than anger, for example, whereas joy and fear tend to be shorter lived than sadness (Brans et al. 2013; Verduyn, Van Mechelen, and Tuerlinckx 2011). It is suggested that emotional sharing shortens the duration of the emotion (Brans et al. 2013). Some emotions are more commonly shared than others: experiences of anger are more frequently shared than fear or sadness,

for example (Brans et al. 2013). Student teachers have been shown to have a tendency to share particularly significant burdensome and empowering experiences, entailing positive and negative emotions with their peers and emotionally supporting each other (Väisänen et al. 2017). Litmanen et al. (2012) further found that negative activating emotions such as stress, irritation and anxiety were typically shared more frequently among student teachers working in groups than among those attending lectures. This was also common for positive activating emotions such as interest and excitement (Litmanen et al. 2012).

There is also evidence that academic emotions are contagious. It has been suggested that teachers' and students' emotions are reciprocated via emotional contagion and empathy (Becker et al. 2014). Empathy is based on the idea of emotional contagion, i.e. emphasising other students' emotional states. Becker et al. (2014), for instance, showed that teachers' enthusiasm or anger has an impact on and predicts students' emotions in the classroom. An enthusiastic teacher might experience enthusiasm during a lesson, which then has a positive impact on learning. This implies that the emotional patterns might also be shared.

Not only do people have a tendency to change their emotions, they also prefer to sustain their positive emotions and avoid negative ones (Tamir 2009). In general, positive emotions are considered a source of good outcomes and a hallmark of psychological health (Fredrickson 1998; Gruber, Mauss, and Tamir 2011; Janssen, de Hullu, and Tigelaar 2008). Moreover, it has been found that the predominance of positive emotions formed while studying facilitates successful learning and helps students to grasp and assimilate the necessary knowledge (Goran and Negoescu 2015). The common goal is to maximise the utility of the emotions, and hence to experience those that foster goal achievement (Tamir 2009). Nevertheless, short-term benefits may outweigh long-term ones, and vice versa (Tamir 2009). Accordingly, student teachers should find a balance between their desire for immediate positive emotional experiences and wanting to delay the negative ones in order to attain their long-term goals. For instance, students frequently experience anxiety while working on a difficult task and this is thus seen as a natural part of problem-solving and successful learning processes. Therefore the long duration of a negative emotion is not always problematic or maladaptive if it promotes the attainment of a long-term goal. It has also been shown that in some situations it may even be more practical to maintain a negative emotion than to change it for a positive one (Tamir 2009). For example, negative activating emotions such as anger may be more effective in terms of study progress than general satisfaction, since they can trigger students' motivation to prove themselves and increase their efforts in studying, eventually resulting in better achievement. Moreover, positive neutral emotions such as happiness may be counterproductive when experienced too strongly or at the wrong time (Gruber et al. 2011).

3. The aim of the study

The objective of the present study is to enhance understanding of student teachers' academic emotions and the dynamics that contribute to their experiences. The focus is on exploring emotional patterns experienced in emotionally loaded episodes. The following research questions are addressed:

- What kinds of emotional patterns can be identified?
- What kind of variation is there in terms of pattern duration?

- What triggers these emotional patterns?

The study is part of the larger national research project: 'Learning, pedagogical wellbeing and agency in comprehensive schools' (see Soini, Pyhältö, and Pietarinen 2010, for more details).

4. Methods

4.1. Finnish teacher education

All primary school teachers in Finland must have a Master's degree with a major in either applied educational sciences or educational psychology. They typically teach in grades 1–6 (pupils between 7 and 12 years of age). They also tend to have their own class or group, teaching the majority of subjects in the curriculum, and thereby take full responsibility for the personal development of their pupils.

Teacher education is a very popular academic subject at Finnish universities, and only six per cent of applicants are admitted to the educational programme at the University of Helsinki each year (University of Helsinki 2013). The curriculum (300 ECTS – European Credit Transfer and Accumulation System) includes orientation and communication studies (25 credits), main-subject studies in education/educational psychology (140 credits), multidisciplinary studies in all subjects taught at primary school (grades 1–6) (60 credits), and one or two complementary minor-subject studies (60–70 credits). Teaching practice is an important part of teacher education. At the University of Helsinki, students have three mandatory teaching practice periods and these are organised in either practice schools or field schools. Teacher education is built on research-based teaching, including content, pedagogical practice and conducting research (Krokkfors et al. 2011). The target time for completing a Master's degree in educational sciences is five years, and the education is funded by the state.

4.2. Participants

The interview data were collected from 19 primary school student teachers who were majoring in educational science and were finishing their MA studies at the University of Helsinki (female: 14, male: 5; age: mean = 31, mode = 32, median = 29.5, min/max = 23/51 years). The following criteria were used in selecting the study participants: (1) their self-estimated time of graduation was within one year, hence they all had extensive experience in teacher studies; (2) their professional interest was to work in a primary school after graduation, i.e. they were motivated to work as teachers; and (3) their major subject was education (see Ahonen et al. 2015). The participants differed in terms of previous teaching experience and educational background, with some having only a matriculation certificate and others already having university credits. In terms of age and gender, the sample sufficiently represented the entire population of primary school student teachers at the University of Helsinki (Statistics Finland 2011).

4.3. Interviews with the student teachers

Interviews were conducted during the spring of 2011. The participants were recruited from 11 study groups (generally, Master's thesis seminars) and participation was voluntary. One

member of the research group conducted all the interviews. The interviews were based on the Student Teacher's Study and Professional Landscape inventory (Ahonen et al. 2015; Soini, Pyhältö, and Pietarinen 2010). The Professional Landscape inventory was validated in prior studies regarding teaching work and was hence chosen for the basis of the interview questions. The interview focused on three main themes: (1) *learning during teacher education*, (2) *perceptions of studying in the teacher-education programme* and (3) *perceptions of teachers' work at school*. The instrument was validated in four pilot interviews before the data-collection phase. The standardised interview comprised a total of 20 questions, including 16 questions about studying in the teacher-education programme and related emotions, and the teacher's role at school, and four questions about the participant's personal and professional background. The interviews were semi-structured: all questions were asked of each participant, and the researcher also asked clarifying questions if necessary. Each interview lasted between 60 and 120 min and was digitally recorded, then transcribed by members of the research group or trained research assistants. Prospective students were informed of the purpose of the research. The study did not require an ethics review in Finland (cf. Finnish Advisory Board for Research Integrity 2009). The interviews were conducted in Finnish and the chosen quotations were translated into English.

4.4. Analysis

The interviews with the student teachers were qualitatively content-analysed based on an abductive strategy (Figure 1) (e.g. Chamberlain 2006; Elo and Kyngäs 2007). First we developed a functional coding procedure for the analysis. We carefully read through the interviews ($N = 19$) several times to obtain an overall understanding and to become familiar with the data.

- (a) At first all the emotionally loaded episodes were coded into the same category. The criteria for the emotional episode were that it has a minimum of two emotions

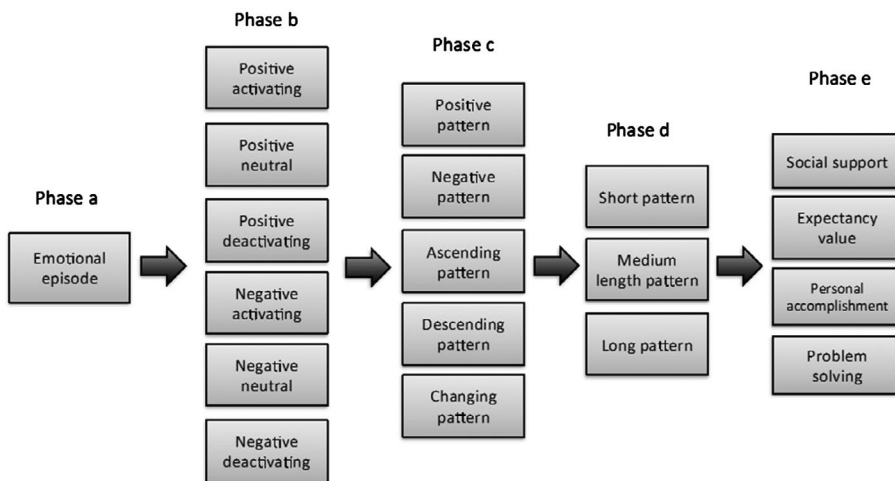


Figure 1. Phases of the analysis.

explicated by the student teacher, and the same object of the activity/situation, such as one lecture or a short encounter with peers (see Figure 1).

- (b) We placed the emotions within the episodes into one of six categories in line with the valence-arousal framework (Pekrun et al. 2002): *positive activating emotions* (including enthusiasm, pride, hope and admiration), *positive neutral emotions* (including satisfaction, appreciation and belonging), *positive deactivating emotions* (including relief), *negative activating emotions* (including anger, anxiety, shame and envy), *negative neutral emotions* (including sadness) and *negative deactivating emotions* (disappointment, exhaustion, loneliness and boredom). The criteria for identifying the student teacher's academic emotions were as follows: (1) the participants themselves had to explicate the emotion experienced in the episode, (2) it had to have valence and arousal and (3) it had to be previously identified in the emotion literature. When identifying the emotions, the researchers made extensive use of the existing emotion literature.
- (c) The emotional patterns within the episodes were constructed from these six categories. This resulted in five patterns: *the positive pattern* involving only positive emotions, *the negative pattern* involving only negative emotions, *the ascending pattern* involving first negative and then positive emotions, *the descending pattern* involving positive emotions at the beginning of the episode and negative emotions at the end, and *the changing pattern* involving both positive and negative emotions in mixed order.
- (d) The emotional patterns within the episodes were analysed in terms of duration. This resulted in three categories including *short patterns* (entailing events that ranged from short encounters to a few days), *medium-length patterns* (comprising events during one course or a training period that usually lasted for several weeks) and *long patterns* (including events that lasted for more than one period to several academic years).
- (e) Finally, we analysed the factors that initiated the emotional patterns. This resulted in four trigger categories: *social support*, *expectancy value*, *personal accomplishment* and *problem-solving*. We analysed the primary trigger for each pattern.

Researcher-investigator triangulation was utilised in developing the interview protocol (Denzin 1970, 2010). The research group validated the categories resulting from the content analysis at the end of each analytical phase (Miles and Huberman 1994). In the few cases where there was disagreement a consensus on the final categorisation was reached in discussions among the researchers. In addition, 20% of the data was subjected to an independent parallel analysis. The independent parallel analysis was based on the classification criteria. At first, the second analyst identified all emotions and emotional patterns from the data by utilising the pre-determined criteria described above. Also, the lengths and triggers of the emotional patterns were independently classified by the second researcher according to this procedure. The inter-rater agreement was 90%.

5. Results

5.1. Student teachers' emotional patterns

The analyses revealed five different emotional patterns among the student teachers' emotionally loaded experiences: *positive*, *negative*, *ascending*, *descending* and *changing* (see Figure 2). These patterns constituted a minimum of 2 and a maximum of 15 emotions, the average being 4. Characteristic of *the positive pattern* was that all the emotions throughout

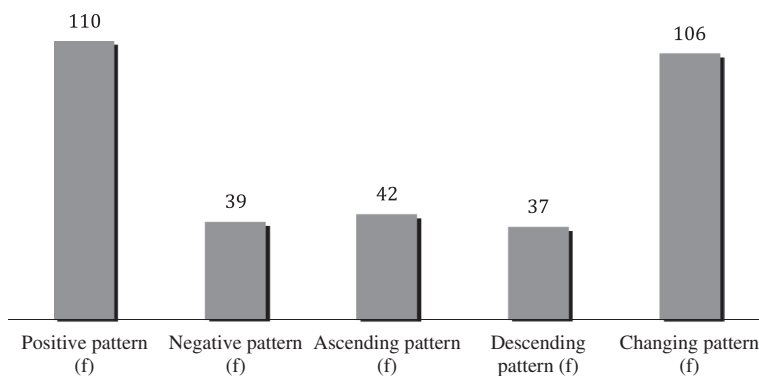


Figure 2. Emotional patterns.

the episode had a positive valence. Motivationally toned emotions such as enthusiasm and interest typically dominated these patterns. Most of the positive patterns entailed frequent experiences of enthusiasm, although other combinations of positive emotions were also detected. Positive patterns resulted from engaging in academic activities such as study success, developing new skills and knowledge, and acquiring a sense of belonging to the professional community during the teaching practice. Both peers and teacher educators seemed to have a great impact on student teachers' positive patterns.

The maths course was amazing... an amazing course and first of all I have to say that the teacher educator was a very inspiring teacher and a good example of how someone who is really interested in her subject can make us enthusiastic as well [...] And I just hope that I could be the same, that I could get my students to be enthusiastic about learning. (Positive pattern: enthusiasm, admiration, enthusiasm, hope) (Participant 1)

A typical characteristic of *the negative pattern* was that the negative emotions changed throughout the episodes. Although the valence of the emotion remained negative, the activation level tended to vary between activating and deactivating. Unlike the positive pattern, the negative one did not have a single dominant emotion. Negative patterns often emerged from friction between the students and their learning environment. Such friction appeared, for instance, when a student was disengaged from learning, lost his or her interest in studies or felt that the teacher educators did not provide adequate support. This often resulted in feelings of inadequacy, disappointment, frustration, boredom or exhaustion with respect to the pedagogy applied. Moreover, negative patterns were found where student teachers simply tried to cope with their studies, which then led to exhaustion.

The whole year was quite boring, because I just did all these courses that I should have done in previous years but I did them later this year and it was kind of surface learning and I was so exhausted. (Negative pattern: boredom, exhaustion) (Participant 6)

Further investigation showed three patterns in which the valence of the emotions varied. In *the ascending pattern* the emotions changed from negative to positive during the episode. Ascending patterns frequently appeared in learning situations where the task is first seen as either overwhelmingly difficult or useless, but through hard work was completed successfully in the end. Furthermore, students estimated their abilities as insufficient in the face of the challenge the task presented. For instance, one student teacher first described anxiety caused by problems in writing her Master's thesis, but after overcoming them experienced

pride. Another student had difficulties in coping with teacher studies and the demands of teaching but after completing the tasks experienced pride and enthusiasm about teaching.

Sometimes I get the feeling that oh no, what was I thinking, that teaching is the same as it has always been and I might not be able to cope and handle it but then later I think again, that I can do this and that I really like teaching. (Ascending pattern: anxiety, pride and enthusiasm) (Participant 16)

In the *descending pattern*, on the other hand, the emotions changed from positive to negative during the episode. The pattern characteristically entailed either one or several positive emotions at the beginning of the episode that then turned negative towards the end of it. Typically, students experienced motivationally toned positive emotions (e.g. enthusiasm) at the beginning of the episode, due to their prior experiences. Hence, their expectations were high. The negative emotion emerged later in the episode when these expectations were not met.

If you think about the first study year, my motivation first increased and then dropped, it was like I really enjoyed the autumn but then after the first term the studies started to bore me. (Descending pattern: enthusiasm, boredom) (Participant 6)

The *changing pattern* also featured both positive and negative emotions, which typically altered back and forth between the two during the episode. Some episodes, for example, comprised mainly positive emotions with only one negative one in the middle, whereas others featured many negative emotions with only one or two positive ones in the middle. Moreover, there were also patterns where the valence of the emotion changed from one emotion to the next during the episode. Finally, some patterns began positively but ended negatively, and vice versa. The difference here from the ascending and descending patterns was that there were also other changes between the beginning and the end.

And then there was the physical education course. I liked it a lot [...] so I took both of the physical education courses [...] and they were really instructive and especially when we had to go to the schools and give a class. First it was horrible, even thinking about it. But then it became really fun and it felt like wow I'm becoming a teacher and I'm going to do everything fun with them (pupils) and my kids won't have any traumatic memories about PE classes. (Changing pattern: enthusiasm, anxiety and enthusiasm) (Participant 14)

As Figure 2 shows, the most frequently reported patterns were positive ($f = 110$), followed by changing ($f = 106$). In addition, there were 39 negative, 42 ascending and 37 descending patterns.

5.2. Variations of duration in student teachers' emotional patterns

The emotional patterns varied in duration from a *short* encounter between peers or with a lecturer, through *medium-length* periods covering a whole course or training period, to even *longer* periods such as throughout the process of writing a Master's thesis or for a whole academic year. The most typical patterns were *medium-length* ($f = 156$), typically lasting several weeks, followed by *short* ($f = 102$) and *long* ($f = 78$) episodes (see Figure 3). All five patterns (positive, negative, ascending, descending and changing) were experienced in long, medium-length and short timescales. Moreover, the number of long, medium-length and short emotional patterns was almost the same, i.e. they were evenly distributed regardless of the length of the episode.

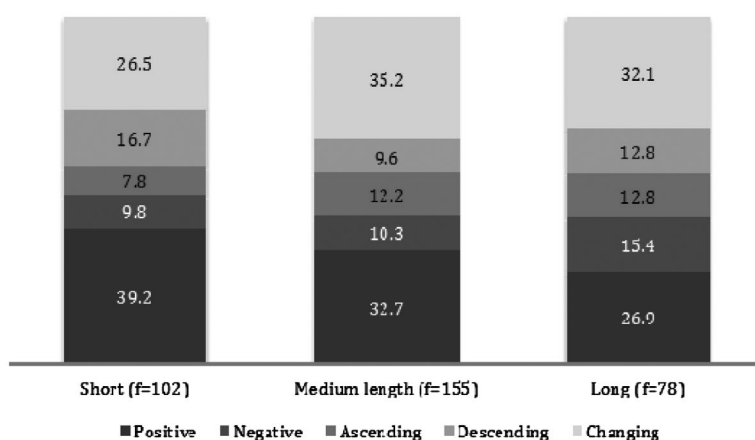


Figure 3. The duration of the emotional patterns.

5.3. The triggers of student teachers' emotional patterns

Further investigation revealed differences in what triggered the emotional patterns (see Figure 4). Four different types of triggers were identified: *social support*, *expectancy value*, *personal accomplishment* and *problem-solving*. Receiving social support and feedback (*social support*) from other students and teacher educators at university as well as in the practice schools triggered emotional patterns among the student teachers. This also involved experiences of informal and emotional support as well as experiences of belonging to the teacher-education community. The emotions thus triggered were purely positive, or became positive towards the end of the pattern.

First it was like ascending and studies proceeded quite smoothly, largely thanks to study friends [...] yeah, it was a quite nice start of studies in the sense that I got all the support for my studies that I needed, we knew what courses to take, in which order and what should be done in each of them. But it was a 300 ECT ensemble that first felt really abstract and confusing, but when we pondered things together, we got enough knowledge. (Social support) (Participant 13)

In turn, critical feedback, a lack of support from fellow students or teacher educators as well as exclusion from the community typically triggered emotions that were negative or became negative later.

The *expectancy value* trigger typically reflected fulfilled or unfulfilled expectations related to teacher education in general, the courses, the lectures, the training periods, other students and the teacher educators. Furthermore, fulfilled expectations triggered positive emotions, or emotions that turned positive in the end, whereas unfulfilled expectations triggered a negative pattern, or one that turned negative.

I got nothing out of the history didactics. He (the teacher educator) had done kind of like different exercises about historical knowledge. It showed that the teacher was not really interested [...] like he just came to give lectures. I felt that he came just because he had to. The point of the exercises remained very unclear to me, although we went through them. And we could not focus on the topics in the study groups. Maybe this happened because the teacher did not know enough about it. And on top of this he held only a 20-min lecture about doctoral studies and the importance of doctoral research. That really did not motivate me at all. (Expectancy value) (Participant 11)

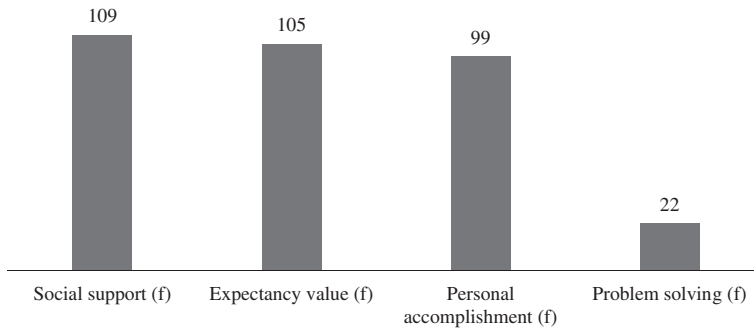


Figure 4. Triggers of the emotional patterns.

A sense of *personal accomplishment*, or a lack of it, also triggered varying emotions related to experiences of both inadequacy in terms of abilities as well as accomplishment following the acquisition of new knowledge and skills. This also entailed experiences of developing as a teacher. Triggers related to insufficient abilities typically kept the emotions negative either throughout the episode or at the end of it, whereas a sense of accomplishment triggered positive emotions.

So I experienced some kind of feelings of being worse than everyone else. I remember sometimes thinking how can they (other student teachers) say something so clever, and reflect and evaluate so well. Like, wait a second, it never even came to my mind that I could question things. But then there were times when I felt, 'Hey I can do this'. That I actually can, for example, shape something out of clay in the arts class. (Personal accomplishment) (Participant 2)

Finally, resolved or unresolved problems (*problem-solving*) triggered emotions that were commonly related to the teacher educators, the courses, the lectures or teacher education in general. When the student teachers experienced their problems as resolved, the emotional tone tended to be positive throughout the whole episode, or at least turned positive at the end of it, whereas unresolved problems kept the pattern negative or turned it negative in the end.

I was like really surprised how inflexible this was. I had already done so many of the courses, but still had to do so many substitutes. I felt like I had already done those courses but was told to do them again just because of a different book as course material. But then I went straight to the teacher educators and professors and was like, I have already taken these courses and do I seriously need to do them again; some flexibility was found and we were able to solve this problem together. (Problem solving) (Participant 3)

As Figure 4 shows, social support ($f = 109$), expectancy value ($f = 105$) and personal accomplishment ($f = 99$) were the most typically experienced triggers, whereas problem-solving triggered relatively few emotional patterns ($f = 22$).

6. Discussion

6.1. Methodological reflections

In this study a retrospective approach was applied to analyse the student teacher interviews. This approach facilitated an explorative analysis of the emotional patterns and their triggers. A limitation of the approach is that emotions, and the associated learning experiences, are

always situated in a certain time, context and overall life situation, and thus may be difficult to recall and summarise in a single interview at the end of the academic journey (e.g. Cox and Hassard 2007). Moreover, the generalisation of learning experiences and the related emotions is likely to derive from the memory effect. However, the approach also gave the student teachers a unique opportunity to reflect on their journey to become a teacher, thereby resulting in rich data. The sample represented the entire student teacher population at the University of Helsinki sufficiently well in terms of age and gender. However, the results are not generalisable to other countries given the differences in teacher education between them. Further studies are needed to validate our findings on a broader scale.

6.2. Findings in the light of previous literature

We identified five distinct emotional patterns experienced by student teachers on their study path: positive, negative, ascending, descending and changing. The results confirm the findings of earlier studies in showing valence and arousal in the patterns changed over time (Anttila et al. 2016; Barrett and Russell 1998; Kleine et al. 2005; Pekrun et al. 2002). Yet, to our knowledge, there are no prior studies of the emotional patterns among student teachers. Hence, the study provided new insights into the quality of such patterns. The results showed somewhat surprisingly that all the emotional patterns, including the negative ones, were highly focused on studying and learning. However, the majority of the emotional patterns were positive or changing in nature. The positive patterns entailed a substantial number of activating emotions, e.g. enthusiasm and interest. These typically resulted from success in studies, learning new knowledge and skills and overall professional development. This suggests that the positive patterns function as indicators of study engagement i.e. smooth study and learning. The results further imply that studying in teacher education is emotionally positively loaded, and that the emotional landscape of student teachers regarding learning and psychological health is favourable (Fredrickson 1998; Goran and Negoescu 2015; Gruber, Mauss, and Tamir 2011; Pekrun et al. 2002). One reason for the large number of positive patterns may be that the teaching profession and teacher education are highly valued in Finland. Only 6% of applicants are admitted annually to the teacher education programme at the University of Helsinki (University of Helsinki 2013). Thus, the frequency of positive patterns may be lower in countries where student teachers do not represent a highly motivated, elite group of higher-education students based on their academic record.

In addition to the positive patterns, student teachers experienced an almost equal number of changing patterns in which the emotional tone in study experience changes back and forth between positive and negative undertones. Changing patterns may be more sensitive to pedagogical interventions, since each turning point provides a possibility to initiate an ascending or even a positive pattern. On the other hand, if the opportunity is missed, changing pattern may also start a descending one or a negative pattern. Constantly changing emotions may also, especially if combined with perfectionism, be burdensome, and increase the risk of study exhaustion (e.g. Stoeber and Rennert 2008). This may further increase the risk of distancing oneself from the task at hand on-task, due to a highly emotionally ambivalent study experience. This might be particularly true regarding Finnish student teachers, since they are high achievers with excellent academic records, and are accustomed to succeeding in their studies.

Also, a fair number of ascending and descending emotional patterns were detected. Ascending patterns often entailed a constructive friction between the challenge provided by the task at hand and students' estimated abilities. Students were typically overwhelmed by the challenge and were having doubts about their abilities to handle the task, resulting in negative emotions. Overcoming such challenges increased both the students' self-efficacy and reliance, resulting in positive emotions and an ascending pattern. This implies that ascending patterns may be the most optimal in terms of new learning, since they are related to overcoming new challenges. An additional benefit in ascending patterns is that overcoming such challenges makes it easier to take up new difficult tasks in the future because of increased self-efficacy. Ascending patterns can be perceived as an emotional indicator of students working in the zone of proximal development (Vygotsky 1978). However, functioning in the zone of proximal development can make students emotionally more vulnerable. Descending patterns, on the other hand, may result from the unsolved destructive friction in the dynamics of the learning environment. In descending patterns, there seems to be either a misfit between students' expectation regarding teacher educators and peer students' contribution, or the task at hand is not seen to be challenging enough.

Furthermore, we identified negative patterns. Also, the negative patterns were highly task-related on-task related. Previous studies have shown that negative emotions may be useful to the learner if the emotions still support long-term learning goals (Tamir 2009). Accordingly, this implies that student teachers' negative emotions are not necessarily detrimental to learning. Moreover, a student teacher's goal and desire to become a teacher may further buffer the negative effects of experienced negative emotions. Hence, not all negative emotions and patterns should be seen as alarming or problematic. However, our results imply that negative patterns typically result from failure or disappointment in studying; accordingly negative patterns may indicate an increased risk of study disengagement. Particularly, prolonged negative emotions may reduce engagement in learning by increasing the reluctance to take risks, such as experimenting with teaching methods. This kind of fear of failure produces negative emotional experiences and reduces self-efficacy. Further studies are needed, however, to enhance the understanding of the effects of negative patterns on student teachers' learning.

There is evidence that emotions change and unfold over time (Barrett and Russell 1998; Kleine et al. 2005; Sonnemans and Frijda 1994). However, our findings partly contradict this evidence in showing that the pattern duration did not affect the pattern profile. Student teachers reported, for example, similar emotional patterns both in short conversations with teacher educators during lectures and in long extended discussions on writing their Bachelor's or Master's theses. Positive, negative, ascending, descending and changing patterns were experienced equally in short, medium-length and long episodes: the positive patterns were not only experienced briefly, and the negative patterns did not cumulate over a long period. This indicates that the patterns did not vary as a function of their duration.

The results showed that emotional patterns are triggered by various factors of teacher education. This is in line with earlier findings suggesting that engaging in different educational practices produces emotions in student teachers (e.g. Anttila et al. 2016; Ketonen and Lonka 2012; Litmanen et al. 2012; Malderez et al. 2007; Timoštšuk and Ugaste 2012). However, our results bring new knowledge of the triggers of emotional patterns that has been previously neglected in research. We found that four different task-related elements of teacher education triggered these patterns among our student teachers, most commonly, fulfilled

or unfulfilled expectations, insufficient or sufficient abilities, and experiences of social support received or not received. In addition, however, the problems they faced, whether resolved or not, rarely functioned as triggers. These findings imply that social support, a sense of personal accomplishment and student expectations play a central role in building a teacher-education learning environment that enables students to flourish by keeping the tone of the emotional pattern positive. Furthermore, the emotional patterns were rarely associated with the student teachers' social life, but rather related to the key elements of studying to become a teacher.

7. Conclusion

Creating emotionally optimal learning environments provides identifying emotional patterns embedded in learning. The results imply that student teachers' emotional patterns can function as indicators of successful or unsuccessful engagement in learning – they reflect how students are doing in their studies. This further implies that, in order to create emotionally optimal learning environments in teacher education, both teacher educators and student teachers would themselves benefit from developing an understanding of the function of emotional patterns in learning in general, and particularly their impact on student teachers' learning during the teacher studies. Moreover, student teachers become more skilful in creating such an environment also for their future pupils.

The results imply that student teachers flourish in learning environments where social support both in terms of guidance and advice as well as in terms of encouragement and personal acknowledgement from peers and teacher educators is received and available. This entails the quality, amount and timing of the support. Accordingly, the support provided needs to be fitted to the task at hand and students' individual needs. It must, however, be noted, that student teachers are also themselves responsible for building an emotional optimal learning environment, and thus should learn how to seek help, guidance and support from the teacher educators and their peers. Accordingly, the results imply that student teachers would also benefit from learning how to offer and receive help and surround themselves with peers that have a similar mind set.

Furthermore, our study showed that situations where there is a distance between students' current knowledge and skills and the challenges provided by the task, or friction between expectations and the reality of the learning situations, provide an opportunity and a challenge for promoting emotionally optimal learning experience. Hence, these situations should be identified and faced with great sensitivity. At its best, well placed support from the teacher educator when the student teacher is facing new challenges, may trigger an ascending emotional pattern, helping the student to cope with the task at hand. Similarly, a teacher educator who is familiar with students' expectations can utilise them as part of the learning situation, e.g. by creating space and time for an open conversation about the students' expectations at the beginning of the course. This could prevent a descending pattern or even initiate an ascending one. Also, student teachers themselves can learn to explicate their expectations and learn to regulate them, if support for learning such skills is provided. In addition, enabling experiences of success and accomplishment in challenging tasks that are still in line with students' abilities seems to enhance emotional optimal learning experiences.

Finally, teacher education should actively provide opportunities for problem-solving, since they were associated with positive and ascending emotional patterns. For example, problem-based learning (PBL) as a teaching method is shown to provide such opportunities (e.g. Hmelo-Silver 2004) in addition to experiences of success and support students learning at the zone of proximal development (e.g. Harland 2003). Moreover, students themselves can learn actively to simulate problem-solving throughout their studies and find new ways to apply knowledge and skills to the new situations.

Our study suggested that positive and especially ascending patterns are the most desirable emotional patterns while studying to become a teacher. With offering social support, creating experiences of success, providing opportunities for active problem-solving and processing and responding to students' expectations together, teacher educators can create learning environments where students' emotional patterns take a positive turn. Moreover, neglecting such factors may cause negative, descending and constantly changing emotional patterns that seem to be detrimental for learning.

There is, thus, a clear need for further research on different types of emotional patterns in other learning environments in order to fully unravel the complexity and dynamics of the emotional patterns among student teachers.

Recommendations for teacher education:

- Teacher educators and student teachers would both benefit from developing an understanding of the function of emotions and emotional patterns.
- Taking an active part in creating an emotional optimal learning environment for themselves and their peers would help student teachers to become more skilful in creating such an environment for their future students as well.
- Social support provided by teacher educators and peers should be fitted to the task at hand and students' individual needs.
- Enabling experiences of success and accomplishment in challenging tasks, would be beneficial for student teachers' study engagement.
- Student teachers' expectations should be identified and utilised, if possible, as part of the learning situations.
- Teacher education should actively provide opportunities for problem-solving.

Disclosure statement

No potential conflict of interest was reported by the authors.

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