

## **Student teachers' emotional landscapes in self- and co-regulated learning**

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Emmi Saariaho<sup>a\*</sup>, Henrika Anttila<sup>a</sup>, Auli Toom<sup>a</sup>, Tiina Soini<sup>b</sup>, Janne Pietarinen<sup>c</sup> and Kirsi Pyhältö<sup>da</sup>

<sup>a</sup> *Faculty of Behavioural Sciences, University of Helsinki, Helsinki, Finland*

<sup>b</sup> *School of Education, University of Tampere, Tampere, Finland*

<sup>c</sup> *School of Applied Educational Science and Teacher Education, University of Eastern Finland, Savonlinna, Finland*

<sup>d</sup> *Faculty of Educational Sciences, University of Oulu, Oulu, Finland*

\*Corresponding author:

MA Emmi Saariaho  
Faculty of Behavioural Sciences, University of Helsinki  
P.O. Box 9 (Siltavuorenpenger 1A), 00014 University of Helsinki, Helsinki, FINLAND.  
E-mail: emmi.saariaho@helsinki.fi  
Tel. +358 50 3059610

Other authors:

MA Henrika Anttila  
Faculty of Behavioural Sciences, University of Helsinki  
P.O. Box 9 (Siltavuorenpenger 1A), 00014 University of Helsinki, Helsinki, FINLAND  
henrika.anttila@helsinki.fi  
Tel. +358 41 5270986

Dr., Auli Toom  
Faculty of Behavioural Sciences, University of Helsinki  
P.O.Box 9 (Siltavuorenpenger 5A), 00014 University of Helsinki, FINLAND  
Tel. +358 50 4154852  
auli.toom@helsinki.fi

Prof. Janne Pietarinen  
School of Applied Educational Science and Teacher Education, University of Eastern Finland  
P.O. Box 111 (Yliopistokatu 2), 80101 Joensuu, FINLAND  
janne.pietarinen@uef.fi  
Tel. +358 50 4650642

Dr., Research Director, Tiina Soini

School of Education, University of Tampere  
Virta (Åkerlundinkatu 5), 33014 University of Tampere, FINLAND  
Tel. +358 40 1901753  
tiina.soini@uta.fi

Prof. Kirsi Pyhältö  
Faculty of Educational Sciences, University of Oulu  
Yliopistonkatu 9, 90014 University of Oulu, FINLAND  
Research Director, Faculty of Behavioural Sciences, University of Helsinki  
P.O.Box 9 (Siltavuorenpenger 5A), 00014 University of Helsinki, FINLAND  
kirsi.pyhalto@helsinki.fi  
Tel. +358 50 4150132

# **Student teachers' emotional landscapes in self- and co-regulated learning**

## **Abstract**

Self- and co-regulation are central elements in skillful student teacher learning. Studies have confirmed the interrelation between positive academic emotions and student engagement in self-regulated learning (Pekrun et al., 2002; Saariaho, Pyhältö, Toom, Pietarinen, & Soini, 2016). There are also indicators of student teachers experiencing co-regulative learning activities as highly significant (Saariaho et al., 2016). Yet we know surprisingly little about the emotional landscape of the self- and co-regulation of learning among student teachers. Hence, in this study we explore the kinds of academic emotions that primary school student teachers experience during self- and co-regulated learning. Altogether 19 Finnish primary school student teachers were interviewed. The data were qualitatively content analysed. The results showed that both self- and co-regulated learning experiences were emotionally activating. Student teachers reported primarily positive emotions (80%) in self- and co-regulated learning. The results also showed that positive activating emotions, such as enthusiasm, were emphasized in all regulatory phases: goal setting and task-analysis, strategy use and monitoring, and reflection. Our findings on the high frequency of various positive emotions embedded in self- and co-regulated learning confirmed that positive activating emotions are essential elements in student teachers self- and co-regulated learning. The findings imply that self- and co-regulated learning can trigger a positive cycle in student teacher learning in terms of both emotions and productive learning.

## **Keywords**

*Self-regulation; Co-regulation; Academic emotions; Student teachers*

## **Introduction**

Self- and co-regulation are key to effective student teacher learning (Saariaho et al., 2016). At the core of both self- and co-regulated learning is active and intentional management of one's own learning, but in co-regulated learning activities peers and teachers are closely involved in the regulation processes (Hadwin & Oshige, 2011). Self- and co-regulative learning skills are important for future teachers in order to foster their own pupils' regulation skills and overcome professional challenges in teaching (Kremer-Hayon & Tillema, 1999; Pietarinen, Pyhältö, Soini, & Salmela-Aro (2013). Also, an interrelation between positive academic emotions, for instance enjoyment, and self-regulated learning has been detected (Pekrun, Goetz, Titz, & Perry, 2002). Emerging evidence shows that student teachers experience co-regulated learning activities as a highly meaningful part of their learning (Saariaho et al., 2016), and that positive emotions expand cognitive and social activity in learning (Rowe, Fitness, & Wood, 2013). Research into teachers' emotions has grown over the past decade (Uitto, Jokikokko & Estola, 2015), and research has been done on student teachers' self- and co-regulated learning (e.g. Endedijk, Vermunt, Verloop, & Brekelmans, 2012; Saariaho et al., 2016), on the emotions that student teachers experience during their learning (e.g. Anttila, Pyhältö, Soini, & Pietarinen, 2016; Anttila, Pyhältö, Soini, & Pietarinen, 2017; Timoštšuk and Ugaste, 2012), and on student teachers' emotional regulation during teacher education (Järvenoja & Järvelä, 2009). Yet, we know surprisingly little about the emotional landscape of the self- and co-regulation of learning among student teachers. Hence, the present study focuses on exploring the academic emotions, – emotions experienced in academic settings – that are embedded in self- and co-regulated learning activities during pre-service teacher studies.

### *Self- and co-regulation in student teacher learning*

Self-regulated learning (SRL) entailing individual's' cognitive, behavioural, motivational and emotional processing (Pintrich, 2004) is suggested to be a precondition for the intentional management of new learning (Zimmerman & Schunk, 2011). It has been associated, for instance, with high self-efficacy beliefs (Bandura, 1997) and better academic achievement (Mega, Ronconi, & De Beni, 2014). Self-regulated learning consists of three complementary phases: (1) goal setting and task-analysis (setting goals for learning and analysing the task at hand); (2) strategy use and monitoring (using diverse learning strategies and monitoring learning); and

(3) reflection (assessing learning strategies and the learning outcomes) (Puustinen & Pulkkinen, 2001). Student teachers' self-regulated learning is shown to vary depending on the learning contexts: learning tends to be regulated more actively during teaching practice or in courses where theory and practice are actively combined, than in university courses emphasizing theory (Endedijk et al, 2012; 2014; Kramarski & Michalsky, 2009; Saariaho et al., 2016). Support from peers and teacher educators, for instance in teaching practice, is also shown to be an important factor in promoting student teachers' self-regulated learning (Michalsky & Schechter, 2013; Perry et al., 2008; Saariaho et al., 2016). Providing support for student teachers' self-regulated learning further promotes their abilities to later utilize teaching methods that foster their own pupils' self-regulated learning skills (Kremer-Hayon & Tillema, 1999).

Skillful learning is not merely an individual act, but is also highly socially embedded. Learning new knowledge and skills often requires collective efforts from participants (Volet, Vauras, & Salonen, 2009). Co-regulated learning (CoRL) refers to a high level of social regulation in which individuals make decisions and share thoughts together in order to combine different kinds of expertise and the distributed control of the task, aiming at developing the participants' self-regulatory learning skills (Hadwin, Järvelä, & Miller, 2011). Although self- and co-regulated learning share the same principles of regulated learning, including its goal-directed nature and metalevel processes (e.g. monitoring, controlling and evaluating), they differ in terms of who is actively involved in the learning: either one person or more (Hadwin et al., 2011; Schoor, Narciss, & Körndle, 2015). In self-regulated learning, individual's activity plays a key role, whereas in co-regulated learning, peers and teachers are an essential and inseparable part of the regulation process (Hadwin et al., 2011; Schoor et al., 2015). Researchers have widely recognized that as collaborative and cooperative learning practices are getting to the core of teaching and learning in both at schools and universities, the research into individual activity emphasizing SRL is not adequate enough and research into co-regulated and other forms of socially regulated learning is needed (Schoor et al., 2015). However, it is also recognized that the ability to self-regulate one's own learning is still a highly important skill, and intentional co-regulated learning practices are found to be effective ways to foster these abilities (Saariaho et al., 2016; Schoor et al., 2015). Furthermore, for Finnish student teachers the ability to regulate their own as well as others' learning is an important skill as teachers in Finland have high-autonomy in classroom and they are also active in national curriculum design, i.e. teacher

profession in Finland requires constant and active teacher learning that enables supporting of both pupils' regulation skills in classroom as well managing the changing circumstances in continually developing curriculum (Pietarinen, Pyhältö, & Soini, 2017; Toom & Husu, 2012). However, working as a primary school teacher is very demanding and independent profession worldwide, and the importance of learning how to self- and co-regulate are not only for Finnish student teachers: before teachers are able to manage and support others' learning, they have to be able to manage themselves (see e.g. Perry et al., 2008).

There is evidence that self- and co-regulated learning can be both rewarding and challenging (Järvenoja & Järvelä, 2009; Volet, Summers & Thurman, 2009). Self-regulated learning has been associated with positive emotions, and shared positive emotions are suggested to play one of the key roles in high-level co-regulated learning (Pekrun & Linnenbrink-Garcia, 2012; Volet, Summers & Thurman, 2009). Highly demanding socially shared regulation (SSRL) has been found to be emotionally challenging for student teachers, and even seemingly favourable emotional balance within a group as well as well-proceeded shared regulation can be easily disturbed by, for instance, disagreement during a group task (Järvenoja & Järvelä, 2009; 2013). Hence, emotional challenges in social regulation typically emerge, for example, from differences between group members' viewpoints about the task or the learning goals, which might cause emotional distress among the group members (Järvenoja & Järvelä, 2013). Conversely, student teachers have been shown to perceive co-regulated learning as highly meaningful during their studies (Saariaho et al., 2016a). Self- and co-regulated learning are suggested to be best facilitated in a learning environment where students' learning skills and learning objectives match, and where students are challenged in a positive atmosphere with constructive friction occurring (Järvenoja & Järvelä, 2013; Vermunt & Verloop, 1999). It has been proposed that if university students' skills and the challenges set for learning are both high and balanced, an active and positive emotional experience results (Inkinen et al., 2014). However, to facilitate student teachers' active and intentional self- and co-regulated learning, and foster a positive atmosphere in the learning environment, more research on the diversity of emotions triggered in student teachers' self- and co-regulated learning is required.

### *Academic emotions in student teacher learning*

Learning is more than a cognitive endeavor: the emotions are also strongly intertwined with regulated learning processes (Schutz & Pekrun, 2007). “Emotions” refers to intense and short-lived active reactions that arise as responses to stimuli, and, compared with long-lasting moods, are clearly dependent on the object of activity (Schutz, Hong, Cross and Osbon, 2006). Emotions arise from appraisals about perceived successes when attaining goals, or maintaining standards or beliefs during activities (Schutz et al., 2006). Emotions have traditionally been defined and categorized into such universal discrete types as joy, surprise, sadness, disgust, fear and anger (see e.g. Frijda, 1988), but these have been complemented with “interest” as one of the basic emotions as well (Izard, 2007). Emotion research has recently taken an even wider look at the emotional landscape people experience, pointing out that emotions experienced in educational settings might be richer than previously assumed (Anttila et al., 2016; Pekrun, 2005; Rowe et al., 2013). *Academic emotions*, i.e. emotions experienced in academic settings when learning and teaching, are multidimensional constructs including an affective core, physiological and expressive elements, and cognitive and motivational components (Frenzel & Stephens, 2013). They are constructed from two fundamental dimensions: those of valence, i.e. positive and negative emotions, and arousal, i.e. physiologically activating or deactivating states (Feldman Barrett & Russell, 1998; Pekrun, 2006). Emotions are bipolar in nature and can be categorized in two-dimensional space where they are placed within four broad categories: positive activating (e.g. enthusiasm), negative activating (e.g. anger), positive deactivating (e.g. relief) and negative deactivating (e.g. boredom) (Pekrun 2006). A few neutral emotions also exist, for example, sadness, which are characterized as neither activating nor deactivating (Linnenbrink, 2007).

Positive emotions are suggested to occur, for instance when learning new knowledge and skills as well as in affiliative behavior (Izard, 2007). Furthermore, positive activating emotions, especially enjoyment and interest, have been shown to increase students’ commitment to self-regulated learning (Pekrun et al., 2002). Joy experienced when learning has been found to have different tones, and highly activating enthusiasm or excitement provides initial energy in engagement, while more latent enjoyment seems to maintain this engagement (Rowe et al., 2013, see also the cluster analysis of 135 types of emotion by Shaver, Schwartz, Kirson, & O’Connor, 1987). Interest as an emotion is closely linked to enjoyment and excitement (see e.g.

Ainley & Hidi, 2014). However, many emotion theorists have included interest in their lexicon of emotions (Ainley, 2007) and it is a highly important emotion in effective and intentional learning because it is triggered as a “response to novelty, change, and the opportunity to acquire new knowledge and skills” (Izard, 2007). Self-efficacy beliefs, on the other hand, constructed from many elements but including the strongly emotional feeling of being capable of managing one’s own learning actions, i.e. efficacy, are closely related to active self-regulated learning (Bandura, 1997). Altogether, positive emotions are highly beneficial in learning because they broaden students’ cognitive and social activity, which promote creativity (Fredrickson, 2004; Rowe et al., 2013). However, learning and teaching sometimes involve much more than feelings of joy, interest or pride, – one also has to deal with many negative emotions, for instance anxiety and shame, that learning and studying can trigger (Anttila et al., 2016b; Anttila et al., 2017). Furthermore, experiencing negative emotions when learning may, for instance, reduce academic performance by decreasing motivation and study success (Ketonen & Lonka, 2012).

Due to the active and intentional nature of self- and co-regulated learning, achievement emotions play a central role in them (Pekrun et al., 2002). According to the control-value theory of achievement emotions, consistent with the circumplex models (see Feldman Barrett & Russell, 1998), that arrange affective states in a two-dimensional valence x activation space, students’ affective appraisals of perceived personal control in the learning situation and the value given to learning are the key elements in the arousal of achievement emotions (Pekrun, 2006). There are two types of achievement emotions: (1) Outcome emotions concerning the outcomes of achievement-related activities, encompassing both prospective anticipatory emotions, such hope for success, and retrospective outcome emotions, such as pride in success (Pekrun, 2006). In (2) activity emotions the focus is on the learning actions, not on the outcomes, and when a student experiences excitement or even flow when learning, he or she is strongly focused on the activity (Pekrun, 2006). Positive achievement emotions, for instance enjoyment and pride, are found to be positively associated in self-regulated learning, which indicates that positive activating emotions play a key role in constructing students’ academic agency (Pekrun & Linnenbrink-Garcia, 2012). Furthermore, academic emotions and regulated learning comprise a bidirectional relationship with each other (Pekrun & Linnenbrink-Garcia, 2012). Individuals’ cognition and emotions are in continuous a feedback loop, where “cognitive activity causally precedes an emotion in the flow of



psychological events, and subsequent cognitive activity is also later affected by that emotion” (Lazarus, 1991, pp. 127). In other words, at the same time as the enjoyment of learning facilitates self-regulated learning and the use of creative learning strategies, the intentional and self-directed engagement in the task further promotes the enjoyment experienced when learning (Pekrun & Linnenbrink-Garcia, 2012). Hence, as a cognitive mechanism, the regulation of learning strongly mediates the effects of emotions on learning (Pekrun et al., 2002). However, empirical evidence on concerning student teachers’ academic emotions when regulating learning individually or with others is still scarce (Pekrun & Stephens, 2010).

Research has shown that studying in teacher education is an emotionally loaded journey (Anttila et al., 2016). For example, enthusiasm and interest are frequently experienced positive emotions among student teachers, while disappointment and anxiety have been the most prevalent negative emotions (Anttila et al., 2016; Timoštšuk & Ugaste 2012). Furthermore, challenging learning situations during teacher education have been linked with negative emotions among student teachers (Litmanen, Lonka, Inkinen, Lipponen, & Hakkarainen, 2012). However, a highly motivational and emotionally activating state, such as flow, might involve experiences of anxiety as well (Litmanen et al., 2012), and mild feelings of exhaustion and anxiety are shown to be better for student teachers’ learning than being completely carefree during a course (Ketonen & Lonka, 2012). Furthermore, previous studies have shown that the diversity and the tone of the emotions experienced while studying in teacher education are meaningful in terms of teacher learning as they direct the activities towards, or conversely, away from learning (Anttila et al., 2017), i.e. promote or hinder optimally regulated learning when becoming a teacher.

Although research into teachers’ emotions has grown rapidly (Uitto et al., 2015), to our knowledge, no research on the emotions embedded in student teachers’ self- and co-regulated learning activities exists. Therefore the present study focuses on exploring the spectrum of academic emotions that primary school student teachers experience in self- and co-regulated learning and addresses the following research questions:

1. What kinds of academic emotions are embedded in self- and co-regulated learning activities during teacher education studies?
2. How are academic emotions divided between the different phases of self- and co-regulated learning?

### 3. What triggers student teachers' academic emotions in self- and co-regulated learning activities?

## **Method**

### *Teacher education in Finland*

The teaching profession is very popular in Finland. Only approximately ten per cent of applicants are accepted yearly into the University Helsinki teaching programmes (VAKAVA 2014). All primary school teachers must have Master of Arts degree with a major either education or educational psychology. In Finland, primary school teachers handle grades 1- to 6, (children from 7 to 12 years old). The primary school teacher degree (300 ECTS – European Credit Transfer and Accumulation System) includes orientation studies (25 credits), main subject studies in education or educational psychology (140 credits, including teaching practice of 20 credits), compulsory minor subject studies (multidisciplinary studies in subjects and cross-curricular issues taught in primary schools, 60 credits) and optional studies (75 credits). The studies are usually completed in five years.

### *Participants*

The participants were 19 primary school student teachers (Female: 14, Male: 5, Age: 23-51 years, Mean 31 years) at the end of their teacher education studies. They were selected on the basis of three criteria: (1) graduation within a year, (2) interest in working in comprehensive school after graduation, and (3) majoring in education (Ahonen, Pyhältö, Pietarinen & Soini, 2015). Student teachers at the end of their studies were chosen, because the aim was to ask about their experiences during the different phases of their approximately five years of teacher studies, i.e. throughout the entire study path. Choosing students at the end of their study path made it possible to ask them to recall and reflect on their studies and experiences from the beginning to the end. There were differences in the participants' background: some had entered teacher education directly from upper secondary school, while others had previously worked as substitute teachers. The distribution of

males (26 %) and females (74 %) sufficiently represented the primary school student teacher population at the teacher education institute.

### *Data collection*

The data were collected in 2011. The students were briefly introduced to the study, and those who were interested in participating gave their contact information to the researcher, who later interviewed them one by one.

The interviews were conducted using a contextually modified version (Ahonen et al., 2015) of the Teachers' Professional Landscape Inventory (TPLI) (Soini, Pyhältö, & Pietarinen, 2010). The interviews focused on three broad themes: (1) student teachers' key learning experiences in teacher education, (2) perceptions of the studies, and (3) perceptions of teachers' work (Ahonen et al., 2015). Each interview included 16 questions about teacher studies and teachers' work at school, and four background questions.

The participants were asked to sketch a visualization of their study path as they had experienced it, and to mark both positive as well as challenging key events that had affected their studying in teacher education (Tripp, 2012). They were then interviewed based on their drawings. The researcher posed clarifying questions such as what happened in a particularly critical learning incident and what he or she may have learned from it. In addition, the student teachers were asked how they had felt during these situations, which helped them to also describe the emotions they had experienced. Asking the student teachers how and why they had felt as they had, and how they had reacted to some of the emotions they had felt in the learning situations, gave them an opportunity to also reflect on how they had regulated their cognitive actions. Hence, we did not ask the participants how they had exactly regulated their learning during their studies; rather, we used the in-depth interviews to investigate critical learning incidents along the entire study path and gave the participants the opportunity to freely recall and explain how they had studied as well as what they had learned and felt during these critical learning incidents. During the interview student teachers were asked to remember and reflect in

detailed what they have done, thought and felt throughout the critical learning incident (see Appendix 1 for the interview protocol and the interview questions). By not asking explicitly about regulated learning practices we ensured that participants did not answer questions in a way they thought would be “suitable” or according to what they believed the researcher would like to hear about optimally regulated learning, but instead, as they had experienced their learning activities during the critical learning incidents and in their own words. Furthermore, we were not interested on student teachers’ conceptions on regulated learning, but instead we wanted to draw their attention in the particular incidents and their experiences throughout the incident, and by doing that to get closer on student teachers’ meaningful learning incidents and the self- and co-regulated learning activities they included.

### *Analysis*

The data were qualitatively content analysed (Chamberlain, 2006; Elo & Kyngäs, 2007). Four independent but complementary analyses were carried out concerning: (I) student teachers’ self-and co-regulated learning incidents (Saariaho et al., 2016), and (II) student teachers’ academic emotions (Saariaho et al., 2016). The analyses were combined to explore (III) the emotional spectrum in student teachers’ self- and co-regulated learning. Finally, (IV) the triggers for emotions experienced in self- or co-regulated learning were examined.

- I) In the first independent analysis all key learning experiences *including* self- or co-regulated learning were coded into two exclusive main categories using a deductive strategy drawing on SRL literature (Puustinen & Pulkkinen, 2001; Zimmerman, 2002).
  - a. The text segments entailing primary self-regulated activities including personal (a) goal setting and task analysis and/or (b) strategy use and monitoring, and (c) regulative reflection on learning (i.e. reflection on previous regulative phases or how to improve performance in the future), were coded into the same category.
  - b. Then, text segments entailing co-regulated activities characterized by students’ joint (a) goal setting or task analysis, and/or (b) joint strategy use and monitoring and (c) regulative reflection in learning together were coded into the same category.

Episodes were coded as self- or co-regulated, if either goal setting and task analysis or strategy use and monitoring was reported, or if reflection combined with the latter four was described. This phase involved 85 self- ( $f=53$ ) and co-regulated ( $f=32$ ) key learning experiences. An independent parallel analysis of 30% of the data was carried out by one coder. The inter-rater reliability measured with Cohen's kappa ( $\kappa$ ) with regard to the self- or co-regulated learning was 1.0, indicating complete agreement, and with regard to the phases of regulated learning 0.74, indicating adequate agreement (Saariaho et al., 2016).

- II) In the second independent analysis phase all text segments in which the students described emotional experiences during their studies were identified using a deductive strategy (Anttila et al., 2016). Drawing on valence-arousal theory (Pekrun, 2006) the emotional experiences were coded based on the valence of the experience (positive and negative emotions) and of the arousal, i.e. the intensity of the physiological emotional reaction to the experience (activating, neutral or deactivating) (Feldman Barrett & Russell, 1998; Linnenbrink, 2007).
- a. The analysis resulted two basic categories based on the valence of the emotion: (a) positive emotions, including efficacy, enthusiasm, enjoyment, interest, admiration, surprise, satisfaction, belonging, amusement and longing; and (b) negative emotions, including irritation, anxiety, fear, exhaustion, disappointment and inefficacy.
  - b. The arousals of the emotional experiences were categorized into three groups: (a) activating, (b) neutral and (c) deactivating.

An independent parallel analysis of 20% of the data was carried out and the inter-rater agreement was 92% (Anttila et al., 2016). Due to three-dimensional nature of the student teachers' academic emotions analysis (i.e. the extensive number of identified emotions, the positive and negative valence of emotions and arousals of the emotional experiences) the inter-rater reliability was analyzed by calculating the percent agreement that is directly interpretable (e.g. McHugh, 2012). Accordingly, an independent parallel analysis of 20% of the data was carried out and the inter-rater agreement was 92% (Anttila et al., 2016).

- III) In the third phase, the first and second analyses were combined resulting in experienced emotions embedded in the different dimensions of student teachers' self- and co-regulated learning, i.e. in goal setting and task- analysis, strategy use and monitoring, and reflection.
- IV) In the final phase, the triggers of emotional experiences embedded in the self- and co-regulated learning were categorized, based on the focus of the triggers, in to three groups by applying an abductive strategy. This analysis resulted in three categories: (a) facing challenges, (b) social support, and (c) innovative learning and knowledge construction.

## **Findings**

Both self- and co-regulated learning experiences were found to be emotionally loaded. The number of reported emotions during regulatory learning experiences ranged from one to four. The participants reported primarily positive emotions (80%) in both self- and co-regulated learning activities, most typically enthusiasm, enjoyment and interest. Negative emotions (20%) were less frequently described. The reported emotions were distributed evenly between self- (53%) and co-regulated (47%) learning activities.

### *Emotions in self- and co-regulated learning*

The clear majority of emotions that the student teachers reported in both self- ( $f=49$ ) and co-regulated ( $f=42$ ) learning activities were positive activating (73.4%). Enthusiasm was the most frequently reported positive activating emotion in all phases of self- ( $f=31$ ) and co-regulated ( $f=21$ ) learning. Typical of self-regulated learning incidents in which enthusiasm was described was the students dealing with learning tasks that encouraged them to reflect on their future work as teachers. Experiences of enthusiasm embedded in co-regulative activities such as planning and conducting lessons together with peers were typically reported to be related to teaching practice. However, qualitative differences were noted in reported positive activating emotions between self- and co-regulated learning. For instance, interest was reported more frequently in self- ( $f=10$ ) than co-regulated learning ( $f=3$ ) activities. On the other hand, enjoyment was more typically reported in co- ( $f=12$ ) than self-regulated ( $f=6$ ) learning activities. Positive neutral emotions, such as satisfaction or

belonging i.e. feeling of togetherness during teaching practice period with close peer students, were rarely reported in self- ( $f=4$ ) and co-regulated ( $f=3$ ) learning activities. The positive deactivating emotion, of longing in situations where the teaching practice period including active co-regulation of learning was so successful that the student teacher had felt nostalgic about it already at the end of the teaching practice was reported only once during one co-regulative incident. Negative deactivating emotions, such as exhaustion (in self-  $f=8$  and co-regulation  $f=8$ ) were reported slightly more frequently than negative activating emotions such as anxiety (in self-  $f=5$  and co-regulation  $f=4$ ). Negative emotions embedded in self-regulated learning were typically related to anxiety, or exhaustion from teaching practice. However, these typically shifted into positive emotions after a difficult start. In co-regulated learning, negative emotions emerged for instance in situations where student teachers had together invested heavily in planning and implementing lessons, but received negative feedback from the teacher educator on their performance. Emotions associated with self- and co-regulated learning are presented in Table 1.

Table 1.  
Valence and arousal of academic emotions in self- and co-regulated learning.

Valence and arousal of emotions	Self-regulated learning	Co-regulated learning	Total
Positive activating <i>e.g. enthusiasm, enjoyment, admiration</i>	$f=49$ 39.5%	$f=42$ 34%	$f=91$ 73.4%
Positive neutral <i>e.g. satisfaction, belonging</i>	$f=4$ 3%	$f=3$ 2.4%	$f=7$ 5.6%
Positive deactivating <i>longing</i>	- -	$f=1$ 0.8%	$f=1$ 0.8%
Negative activating <i>e.g. anxiety, irritation</i>	$f=5$ 4%	$f=4$ 3%	$f=9$ 7.3%
Negative deactivating <i>e.g. exhaustion, disappointment</i>	$f=8$ 6.5%	$f=8$ 6.5%	$f=16$ 12.9%
Total	$f=66$ $\approx 53\%$	$f=58$ $\approx 47\%$	$f=124$ $\approx 100\%$

### *Emotions in different phases of self- and co-regulated learning*

The results showed that in terms of self-regulated learning emotions were distributed quite evenly between regulatory phases (Goal setting & task-analysis:  $f=24$ ; Strategy use and monitoring:  $f=20$ ; Reflection:  $f=22$ ), while in co-regulated learning the participants reported a variety of emotions slightly more frequently during reflection (Goal setting & task-analysis:  $f=16$ ; Strategy use & monitoring:  $f=19$ ; Reflection:  $f=23$ ). Positive activating emotions were emphasized in all regulative phases in both self- and co-regulated learning. The same emotion, for instance enthusiasm, was typically reported at least during two regulatory phases. However, a slight difference was noted between the phases where positive activating emotions were reported in self- and co-regulated learning. In self-regulated learning positive activating emotions were distributed quite equally throughout all phases of regulated learning. In co-regulated learning on the other hand, positive and activating emotions were reported most often during joint strategy use and monitoring as well as in reflection on learning (Goal setting and task-analysis:  $f=10$ ; Strategy use and monitoring:  $f=16$ ; Reflection:  $f=16$ ). The participants reported very few positive neutral or deactivating emotions in self- and co-regulated learning activities. However, self-regulated learning those few non-activating positive emotions were reported during all regulatory phases, but in co-regulated learning only during the reflection phase. In terms of the regulatory phases only a very slight difference was noted in how negative activating and deactivating emotions were divided between self- and co-regulation. The valence and arousal of reported emotions in the different phases of self- and co-regulated learning activities are shown in Table 2.



Table 2. Valence and arousal of reported emotions in different regulatory phases in self- and co-regulated learning activities.

Regulatory phases	Arousal of the emotion	SRL Positive ( <i>f</i> )	SRL Negative ( <i>f</i> )	CoRL Positive ( <i>f</i> )	CoRL Negative ( <i>f</i> )
<i>Goal setting &amp; task-analysis</i>	Activating	18	4	10	2
	Neutral	1	-	-	-
	Deactivating	-	1	-	4
<i>Strategy use &amp; monitoring</i>	Activating	14	1	16	1
	Neutral	1	-	-	-
	Deactivating	-	4	-	2
<i>Reflection</i>	Activating	17	-	16	2
	Neutral	2	-	3	-
	Deactivating	-	3	1	1
<i>Total</i>		53	13	46	12

#### *Triggers of emotional experiences in self- and co-regulated learning*

The student teachers' academic emotions in self- and co-regulated learning activities were triggered, for instance, when (1) *facing challenges* during teacher studies. Typical was that the few negative emotions reported in self-regulated learning activities, such as anxiety, were triggered by doubts about personal abilities. However, succeeding in studies because of one's efforts, such as careful planning, triggered positive activating emotions. Sometimes student teachers did not find studying tasks very attractive at the outset (e.g. preparing for exams), but once engaged with them (e.g. reading the material), enthusiasm or interest was triggered. However, in some incidents that include self-regulated learning, negative emotion, such as, feeling of inefficacy emerged despite active self-regulation. Student teachers, for instance, reported inefficacy when writing bachelor's and master's theses that progressed slowly despite their strong investment in them, or in teaching practice where they felt they were stuck using the same teaching methods. In terms of co-regulated learning, student teachers reported challenges, for instance feelings of inefficacy or exhaustion at the beginning of teaching practice, when the lesson plans proved to be ineffective. However, co-regulated re-planning, monitoring and reflecting on the challenges faced, helped them to solve problems in their lesson plans, resulting in enthusiasm and enjoyment.

As well, (2) *social support* from peers or teacher educators often triggered emotions during student teachers' self- and co-regulated learning activities. Co-regulated learning while planning and implementing lessons during teaching practice, for example, with more capable or skillful peers, triggered long-lasting enthusiasm that was sustained throughout regulative learning incidents. Accordingly, support and encouragement from peers inspired students to try new teaching methods, and challenged novice teachers to outdo themselves. This further contributed to feelings of enthusiasm and enjoyment stemming from the successful experiences. Supportive and demanding teacher educators also played a central role in triggering positive activating emotions, such as enthusiasm and admiration. The few negative emotions reported in co-regulated learning incidents, however, also typically involved teacher educators' negative or critical feedback, or a lack of support from them.

Further investigation showed that (3) *innovative learning and knowledge construction* triggered emotions in self- and co-regulated learning. Students reported how they had realized that theoretical studies or making lesson plans for teaching practice could be interesting and inspiring, although at the beginning of their studies many found theoretical studies concerning teaching practices and pupils' learning not as attractive as practical courses. What triggered positive and activating emotions (i.e. enthusiasm, interest or enjoyment) in those kinds of self- and co-regulated learning activities was the students realizing that translating pedagogical theories into practice was possible, and that it greatly helped them with their performance. However, the common element in the majority of both self- and co-regulated learning activities entailing positive and activating emotions was that the incident included a constructive friction between student teachers' skills and the learning environment. This friction emerged as teacher educators or peers provided the help that enabled the students to utilize their prior knowledge in order to practice and improve their performance. Being successful in tasks supported by a more skillful peer or teacher educator, and feelings that one was truly learning and constructing new knowledge and practical teaching skills for one's future profession, that is to say, experiencing the development of professional agency, triggered positive activating emotions in the self- and co-regulated learning activities. See Appendix 1 for two authentic interview excerpts.

## **Conclusions**

### *Methodological reflections*

Interviews on the subject of student teachers' key learning incidents along their study paths were used to analyze the student teachers' regulated learning and emotions experienced during their studies. Hence, a retrospective approach was applied (Cox & Hassard, 2007). The approach might have affected the data in terms of accurate recall, including the possible generalization of key learning experiences, and challenging incidents might have been interpreted more positively afterwards. However, the chosen approach also offered an opportunity to freely reflect on the entire study path, and allowed for the identification of emotionally significant and meaningful learning experiences (Tripp, 2012). The approach resulted in rich data and the interview protocol offered student teachers an opportunity to reflect deeply the learning activities used and emotions experienced during the significant learning incidents. In terms of age and gender, the sample represented the whole student population well; however, generalizing these findings to teacher education in other contexts should be done on a more theoretical level due to differences between the programmes. Our study contributes to the literature on pre-service teachers' emotions (Uitto et al., 2015), by being among the first to explore the emotional landscape of student teachers' self- and co-regulated learning. However, further studies using multiple methods are needed.

### *Theoretical reflections and educational implications*

Our results on the high frequency of positive and activating emotions embedded in student teachers' self- and co-regulated learning imply that both self- and co-regulated learning can generate motivationally activating emotions. The results confirmed prior findings (Pekrun et al., 2002) suggesting that students' engagement in self-regulated learning is related to positive academic emotions. Our results complement the prior research by showing that co-regulated learning triggered mainly positive activating emotions. The results confirm that both the social environment, including a supportive and positive atmosphere, and individual regulatory elements (e.g. achievement- and control-related) are sources of positive emotions in learning (Rowe et al., 2013). The findings imply that self- and co-regulated learning can trigger a positive cycle in student teacher learning.

Our previous study (Anttila et al., 2016) confirmed that mere discrete emotions are not enough to fully depict of the emotional landscape that student teachers experienced during their teacher studies, and student teachers

reported a much wider range of emotions than just discrete ones (see also Timoštšuk & Ugaste 2012) . Student teachers, for instance, reported both enthusiasm and enjoyment. Enthusiasm was the most typically reported positive activating emotion in both self- and co-regulated learning. This implies, that actively regulated learning triggers highly activating emotions such as enthusiasm and excitement. Although enjoyment has been recognized as one of the basic positive emotions fostering students' engagement in learning (Mega et al., 2012; Pekrun et al., 2002), our study showed that joy experienced in learning can also lead to slight differences in activation. Further, challenging and personally valuable learning tasks combined with perceiving high control and value, was found to trigger enthusiasm (see also Keller et al., 2014; Rowe et al., 2013). On the other hand, more “static” enjoyment was occasionally experienced in co-regulated learning incidents with a peer student in teaching practice, which were perceived as very enjoyable. There is some evidence of differences in activation between experienced enthusiasm/excitement compared to enjoyment, with the former being found to provide the initial energy to engage in learning and the latter functioning to maintain this engagement (Rowe et al., 2013). Our study confirmed that experienced enthusiasm includes stronger motivational elements than experienced enjoyment. In addition to enthusiasm, the student teachers also reported interest including very strong personal emotion as well as commitment to the task especially in self-regulated learning incidents, while more latent enjoyment was reported more often in co-regulated ones, thus confirming the differences between activation among positive emotions and self- and co-regulated learning. This finding also confirms that interest contains emotional features and is related to strong personal engagement in the task as well as desire to learn new knowledge and skills, which, if successful, triggers enthusiasm (Ainley & Hidi, 2014). However, in our study, student teachers particularly reported long-lasting enthusiasm in both self- and co-regulated learning. Experiencing enthusiasm in pedagogical situations is beneficial for future teachers, because feeling enthusiastic about teaching has been found to increase the pupils' enjoyment and intrinsic value in learning (Keller, et al., 2014).

Our results showed very slight differences between self- and co-regulated learning and in the phases where positive activating emotions were reported. In self-regulated learning positive activating emotions were distributed evenly throughout all phases, while in co-regulated learning positive and activating emotions were reported most often during joint strategy use and monitoring, and in reflection. Self-regulated learning may

trigger positive activating emotions throughout the regulated learning incident. However, in co-regulated learning, for instance, successfully implemented group work or teaching lessons with peers in teaching practice engenders positive activating emotions when shared learning experiences are monitored during the learning situation or reflected on afterwards. Setting shared goals for learning and co-planning might create emotional and cognitive challenges for the group members, which in turn might hinder the positive activating emotions at the beginning of co-regulated learning tasks (Järvelä & Järvenoja, 2011). However, interesting differences were noted in the reported emotions compared to previously recognized typical emotions in different phases of learning. For instance, Pekrun and colleagues (Pekrun et al., 2002; Pekrun & Stephens, 2010; Pekrun & Linnenbrink-Garcia, 2012) have frequently identified retrospective outcome emotions, such as pride, which were not reported during regulated reflection among our Finnish student teachers. The result may reflect cultural differences: in Finland it is not suitable to “brag” about your success. The question still remains of why the previously recognized prospective outcome emotions were rarely reported. Actively regulated learning triggers activity emotions in particular, such as enthusiasm, enjoyment and interest, throughout the regulated learning phases. Accordingly, our findings imply that when student teachers actively and intentionally regulate their learning, they perceive their personal control in the learning situation and the value of the learning as high (Pekrun, 2006). In our study, the regulated learning also triggered enthusiasm still in the reflection phase, suggesting that regulated reflection is future-oriented and adaptive in nature, and that learning incidents including active self- or co-regulated learning supports future teachers’ sense of professional agency.

The student teachers rarely reported negative emotions in self- and co-regulated learning. This might be partly due to the retrospective approach taken: they may have interpreted less favourable learning experiences more positively later. In addition, Finnish student teachers are an elite group, based on their academic record. The teacher education programme emphasizes optimal student teacher learning, and might not be as emotionally challenging as in some other countries (see e.g. Timoštšuk and Ugaste, 2012). On the other hand, the negative emotions, for instance disappointment that student teachers reported during co-regulated learning were more persistent than in self-regulated learning, where students’ negative emotions typically changed towards positive ones during the incident. In other words, in self-regulated learning the student teachers were

sometimes able, after difficult start, to monitor their learning strategies and change them appropriately by themselves, while in co-regulation perceived unfair feedback from the teacher educator, for instance, as well as the fact that innovative lesson plans had to be changed because of the pupils behavior, triggered disappointment throughout the learning incident. In addition, although previous research has shown that the sense of efficacy is closely linked to regulated learning (e.g. Bandura, 1997), in our study student teachers reported inefficacy more often. Furthermore, student teachers sometimes experienced strong feelings of inefficacy in self-regulated learning during strategy use and monitoring as well as in the reflection phase, but conversely during co-regulation only in goal setting and task- analysis. This might imply that although co-regulated learning may cause problems at the beginning when group dynamics are being negotiated, it offers social resources for problem solving during strategy use. However, although positive academic emotions have been shown to foster students' engagement in the self-regulation of learning (Mega et al., 2014; Pekrun et al., 2002), this does not mean that negative emotions have no role in meaningful learning. In fact, the effect of negative activating emotions and positive deactivating emotions is double-edged, and for instance, exam-related anxiety may even increase one's motivation to invest significant effort in learning in order to avoid failure, whereas positive deactivating emotions, such as feeling relaxed, may diminish task-attention (Pekrun et al., 2002; Pekrun & Linnenbrink-Garcia, 2012). It has been showed that difficulties, for example in the co- and shared regulation of learning, lead to emotionally challenging situations and hinder group members' learning (Järvenoja & Järvelä, 2009; 2013; Volet, Summers & Thurman, 2009). Further investigation is required to determine what characterizes the kind of learning environment that provides enough constructive frictions and scaffolding to facilitate student teachers' regulated learning, even when facing challenges and experiencing deactivating emotions.

Finally, our study found three main triggers (*facing challenges, social support, and innovative learning and knowledge construction*), for the emotional experiences that were embedded when student teachers' self- or co-regulated their learning. Common to all of them was that a constructive friction occurred, such as a personal challenge which had to be overcome, or the construction of deeper pedagogical knowledge and skills with peers, for instance, in teaching practice. Constructive friction indicated that the student teachers had to widen their previous knowledge and skills in a positively challenging learning environment, where support from

teacher educators or peers was also available. Hence, our findings confirm that if university students' skills and challenges set for learning are at the same time high and in balance, they will trigger active and positive emotional experiences (Inkinen et al., 2014). Combining old knowledge with new information and developing new deeper understanding has been shown to trigger excitement and interest (Rowe et al., 2013). The student teachers in our study reported positive activating emotions also when challenged to construct new knowledge in terms of teacher learning and improve their teaching skills, both individually and with others. It is therefore important to support future teachers' self- and co-regulated learning skills in order to strengthen their abilities with respect to active and innovative knowledge construction in their future profession.

However, the results of our study revealed that student teachers' self- and co-regulated learning also included such neutral or deactivating emotions as longing, belonging or satisfaction. This implies that although self- and co-regulated learning triggers activity emotions in particular, the deactivating and neutral emotions that are triggered by the object and the context of the experience emphasizing their emotional nature, are sometimes involved in student teachers' critical incidents including regulated learning. Accordingly, all of the emotions triggered in academic settings are not achievement emotions (see e.g. Pekrun & Perry, 2014), although in our study most of the emotions that the student teachers reported in their self- and co-regulated learning were activity emotions, that include elements of intentional goal setting and a high value given to learning, meaning that activity emotions (both positive and negative) and achievement emotions strongly overlapped each other.

However, the active regulation of learning skills cannot be taken for granted even among university students, and even as highly a select group as Finnish student teachers might need concrete advice and support regarding how to set goals, as well as plan, control and reflect on their learning. Helping student teachers to regulate their learning in challenging or frustrating learning situations during their studies gives them helpful tools for when they will inevitably face challenges in supporting the development of pupils' regulated learning skills in their future work in the classroom. Research on student teachers' co-regulated learning practices is highly important because the problematic learning situations in the everyday school environment are shared between teachers and pupils, meaning that problem solving and creating solutions should be shared as well. Furthermore, pre-service teacher education should be designed to support student teachers' knowledge both of the zones of cognitive and emotional proximal development, so that they could create engaging tasks for pupils and at the

same time monitor the emotional arousal that the learning situation triggers (Boekaerts, 2011). Moreover, our study confirms the link between self- and co-regulated learning and positive activating emotions. This implies that actively and intentionally self- and co-regulated learning should be supported among student teachers, as regulated learning appears to trigger mainly positive activating emotions, which in turn have been shown to expand both cognitive and social activity in learning (Fredrickson, 2004; Rowe et al., 2013).

An overall positive affective atmosphere in teacher education, and encouragement from teacher educators, contribute to the use of diverse regulative strategies. Consequently the following two essential components in learning – regulation of learning and positive academic emotions – strengthen each other and construct a firm bidirectional relationship, i.e. skillful regulation triggers positive emotions, which in turn strengthens engagement in regulated learning (e.g. Lazarus, 1991; Pekrun & Linnenbrink-Garcia, 2012). Clear and personally valuable goals for learning, a sense of control over one's own learning activities, as well as an ability to reflect individually and with others are the key elements in active, intentional and engaging teacher learning.

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## **Appendix 1: The interview questions**

### Introduction for the interview

Today we are going to go through your experiences during teacher education and thoughts regarding teachers' work.

The interview data will be treated confidentially, and only the members of the research group will handle it. Also the identity of the participants will be protected and they cannot be identified from the reported results.

The interview is divided into three parts: first I will ask you some background information, then we will discuss your experiences during teacher education and at the end I would like you to reflect on your future work as a teacher.

### **I I as a teacher and my teaching experience**

1. What kind of teacher qualification will you receive after completing your teacher education? Are you studying to become a primary school teacher or a subject teacher?
2. What made you want to become a teacher?
3. How much do you currently have experience on teachers' work? Do you have any other teaching experience in addition to compulsory teaching practice included in teacher education programme? If so, what kind of experience and how much experience do you have?

### **II Conceptions of your own agency in teacher education**

4. You will graduate soon. What are your thoughts concerning the teacher education, and how do you feel regarding your studies?
5. Describe and visualize your learning path in teacher education to this paper. The image may be a timeline or other suitable way to describe the study path. Mark the significant events of your study path to the visualization. The situation may be:

-positive/inspiring or negative/frustrating situation

-a single encounter with a person or a longer course / study period, during which you have learnt something essential for your future work.

The following questions are support questions for visualization-based interview. Each event was recalled by addressing these questions.

- What happened? Can you tell more about the event? Who was there?

- What made the event particularly significant?

- What changed during the event (thought or activity)? What did you think first? How did your thoughts change after the event? What made you change your thought or actions? How did you feel?

-What essentials did you learn about teachers' work and being a teacher?

- How typical / atypical was the study situation you described? If the situation was atypical, what is the typical learning situation in teacher education?

-In addition to the above-mentioned situations, do you have in mind any longer episodes that influenced your thoughts of being a teacher or alternatively, situations that in a surprising and quick way influenced your conceptions of being a teacher?

6. Have your thoughts changed during the teacher education? If, how? Would you describe briefly how your thoughts have changed during your study path? What did you think in the beginning of your studies, and what do you think now?

7. How would you describe teacher education from a student's perspective? How is the studying here? Describe a typical day of studying, and what happens during the day?

8. How do you think that a teacher educator perceives the learning environment? How is the everyday work of teacher educators here?

9. How would you describe a typical situation of education in teacher education? What happens? What does the teacher educator do?, What do the student teachers do?
10. Which of your strengths has the teacher education supported?
11. Is there any kind of challenge / question / issue that wonders you regarding your future work as a teacher? If so, where do you get support at the moment?
12. Do you think that teacher education should be further developed? If yes, how? What should be done to reach that aim you just described?

### **III Perceptions about teacher's professional agency in primary school**

13. How is the everyday life in schools from a teacher's perspective? Describe a typical work day. What happens during the day?
14. How is the everyday life in schools from a pupil's perspective? Describe a typical school day. What happens during the day?
15. You are almost a qualified teacher. What do you consider your core tasks as a teacher? Why? How do you act in order to achieve your goals and to fulfill your core task?
16. Describe a typical lesson in your future class. What happens? What does the teacher do?, What do the students do?
17. How do you perceive the importance of the professional community for your future work?
18. How would you like a) your pupils b) the parents c) the headmaster and other teachers to describe your working as a teacher?
19. Do you think that primary schools should be developed further? If yes, to what direction? How would we get into a situation you described?
20. Is there still something that you would like to tell me or clarify further?

Thank you!



## Appendix 2: Two examples from the student interviews

Authentic data excerpt: Key learning experience described by a student teacher	Type of regulation	The trigger of the emotional experience	Experienced emotion(s) in different regulatory phases
<p><i>Example 1:</i></p> <p><i>“I did my Bachelor’s thesis on teachers’ wellbeing and coping at work; I mean I didn’t want to do anything connected with classes or children. I wanted a topic that would really motivate me and I ended up in the adults’ world and with teachers, because at that time I felt I wasn’t coping well enough as a student teacher and I was experiencing anxiety about it. I had to find a topic that would motivate me or I just couldn’t do it. I’ve also had these kinds of experiences in my family, like depression and even burn-out, and I felt really motivated, like this is a good topic for me (1). And then, I got an OK grade for it, and I actually felt a bit sorry at the end of the process, because if I had more time I would have got a better grade, maybe the best possible (2). I felt really enthusiastic about studying and I realized that hey, I’m good in this! I liked to do the research and I felt very alive there in the ‘caves of the campus (3)”</i></p>	<p><i>Self-regulated learning</i></p>	<p><i>Facing challenges</i></p>	<p><i>Goal setting &amp; task analysis: anxiety and interest (1)</i></p> <p><i>Strategy use &amp; monitoring: enthusiasm (2)</i></p> <p><i>Reflection: enthusiasm (3)</i></p>
<p><i>Example 2:</i></p> <p><i>My partner in the teaching practice was very different from me; she had been teaching for many years in high school and came back to university just to get qualified as a class teacher. She is a lovely person, but in a happy-go-lucky – way, like she never plans anything and just goes and does it. At first we were sort of like on a collision course, but on the other hand, I learned that I, too, didn’t need to plan everything around the clock. We liked each other and shared the same values (1). We had such fun when we evaluated our teaching methods, the purpose of our teaching and the children there, and we were surprisingly honest with each other (2). The experience was really instructive, and confirmed my thoughts about wanting to co-teach in the future. We discussed many things all the time and gave feedback to each other, like “you just said it this way, but you could’ve say it that way”, or “there is also another perspective here”. And we had a lot of fun with the children as well. Of course I can’t say anything about those pupils’ long-term learning outcomes, maybe we got the children all messed up, but at least we held fun lessons and it was great! I really hope that I could find that kind of co-teacher sometime in the future. I mean, that s/he would have good self-esteem and would be able to give and take constructive feedback (3).</i></p>	<p><i>Co-regulated learning</i></p>	<p><i>Social support</i></p>	<p><i>Goal setting &amp; task-analysis: enjoyment (1)</i></p> <p><i>Strategy use &amp; monitoring: enjoyment (2)</i></p> <p><i>Reflection: enjoyment (3)</i></p>

