Active Learning and Self-Regulation Enhance Student Teachers' Professional Competences

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Abstract: The study identifies the relationships between active learning, student teachers' self-regulated learning and professional competences. Further, the aim is to investigate how active learning promotes professional competences of student teachers with different self-regulation profiles. Responses from 422 student teachers to an electronic survey were analysed using statistical methods. It was found that the use of active learning methods, such as goal-oriented and intentional learning as well as autonomous and responsible group work, are strongly and positively related to the achievement of professional competences. To develop the best competences, student teachers need high learning motivation and excellent self-regulation strategies. The mean scores in professional competences of highly motivated student teachers with excellent self-regulated learning were significantly higher when their experiences of active learning increased. Moreover, student teachers with high motivation and moderate self-regulation also benefited significantly from the use of active learning methods.

Introduction

Crucial questions for teacher education (TE) include the following: How does TE prepare student teachers for the future as well as to meet ongoing changes? How can beginning teachers support their students to cope with these changes? Several organisations have pondered these questions. For example OECD within the Definition and Selection of Competences (DeSeCo) project (OECD, 2001; 2005b), UNESCO (Delors, 1996), the American Association of Colleges for Teacher Education (AACTE, 2010), and the European Union (2006), and have determined what kinds of competences schools should provide to students. In Asian countries (e.g. Singapore (Wei Li, 2013), Malaysia (Jarvis, Dickerson, Thomas, & Graham, 2014) and China (Lau & Chen, 2013)), competences that are needed for the future have also been recognised. There are some variations regarding how these competences are defined and what skills are emphasised (Shi, Liu, Liu, et.al, 2016). However, they are most commonly labelled as either 21st century competences, future skills, core competences, key competences or transferable skills and competences (Voogt & Roblin, 2012). Common threads amongst these competencies are the emphases on active learning and skills for collaborative knowledge creation. These competences call for students to develop self-regulated learning, to self-direct and to manage their learning processes (Tan, Chua & Goh, 2015). Teachers should include these future competences as integral parts of their professional work. Therefore, how can TE prepare student teachers to become professionals who are capable of encouraging their students to develop in self-regulation by active

learning? This topic has not been widely investigated in the area of pre-service teacher education.

Previous research (Gonzáles et al., 2017; Rots, Aelterman, Devos, & Vlerick, 2010) has shown that supporting pre-service teachers' autonomy in TE enhances professional competences and the self-efficacy of student teachers. Teacher self-efficacy is essential to teachers' successful academic performance (White & Bembenutty, 2013). It has also been demonstrated that student teachers' professional learning is positively affected by the use of active learning methods (e.g. Aksit, Niemi & Nevgi, 2016; Kramarski & Michalsky, 2009; Lonka & Ketonen, 2012; Niemi, 2002a; 2012) and the learner's SRL is key to promoting taking control of their own learning (e.g. Vermunt, 2005; Zimmerman & Schunk, 2008). In addition, some previous studies have explored how separate components of self-regulation (e.g. either self-efficacy or specific active learning methods) can affect a student teacher's development (Boulton, 2014; Jones, 2010; Oakley, Pegrum & Johnson, 2014; van Wyk, 2017).

However, only few attempts have been made to explore how SRL and active learning are related to the professional development (Kramarski & Michalsky, 2009). To our knowledge, there are no studies that explore the relationship between active learning methods, various components of SRL and the achievement of professional competences. More research is needed to find out how the various factors affect the achievement of professional competences among student teachers in order to improve TE. In addition, theorists (e.g. Boekaerts, 1997; Winne 2005) have indicated that it is important to study how effective and less-effective self-regulatory students differ. The main aim of this study is to gain new knowledge regarding how student teachers' self-regulation in learning and their experiences of active learning are related to the achievement of professional competences. In addition, we aim to provide new scenarios for developing TE for the future. In the following sub chapters, the core concepts are discussed and described in detail.

Conceptual Frame
Active Learning Supporting Professional Competences

Active learning has been defined from different perspectives, some focusing on methods that promote active learning. Prince (2004) defined active learning as any instructional method that engages students and includes them as active participants in the learning process: Students themselves are agents of the learning, and the teacher facilitates this process. Learners structure their knowledge actively; their approach to learning and knowledge is critical, and learners reflect on and control their learning process. In addition, active learning theories stress the social elements of learning (Niemi, 2002a, 2012), such as cooperative action and collaborative problem solving as tools for attaining deeper learning processes. Watkins, Carnell, and Lodge (2007) proposed that active learning includes three dimensions: behavioural, cognitive and social. Drew and Mackie (2011) considered a fourth dimension— affect— which is related to a 'mindful' (Salomon & Globerson, 1987) approach to a task. Active learning as a concept can vary in different cultures. 'Active' can be considered as 'active in mind', especially in Asian cultures, in which learners personally construct and reconstruct meaning from their experiences of phenomena and from their teachers' inputs (Fensham, 2004); however, these learners are not either verbally nor visibly active.

Twenty-first century skills in school require teachers to be capable of enhancing active learning, for example, guiding pupils to become responsible for their learning and understanding, synthesising, analysing and interpreting the worth of different aspects of

knowledge. This means that student teachers must adopt an inquiry habitus in their teaching (O'Grady et al., 2013).

The use of active learning methods in TE has proven to have several positive effects on student teachers' learning. It promotes the acquisition of professional competences (Kramarsky & Michalsky, 2009), affects positive engagement in learning (Lonka & Ketonen, 2012; Preston, Harvie, & Wallace, 2014), initiates the process of lifelong professional growth (Niemi, 2012; Niemi & Nevgi, 2014), improves professional development (Niemi, 2002a), and professional identity (e.g. *feel as a teacher* and *act as a teacher*) and strengthens the ownership of learning (Aksit et al., 2016, p.98) by both changing student teachers' personal views and images of teaching and by presenting new perspectives of the teaching profession.

Self-Regulated Learning of Student Teachers

Active learning and self-regulated learning (SRL) include several common elements. In both learning situations a learner is active, critical and reflective, and a teacher facilitates and encourages learners. While active learning involves teaching and learning methods proposed by a teacher, SRL includes processes that are steered by the learners themselves. Bembenutty, White, and Vélez (2015) found that SRL helps student teachers to become teaching professionals.

A dual self-regulation role for teachers was recently identified. Kramarski and Kohen (2017) stated that teachers should become proficient in SRL themselves and must learn how to teach it, which is known as self-regulated teaching (SRT). However, they stated that research has paid relatively little attention to the expertise required to create high-SRL environments and ways in which teachers can acquire such expertise.

In this study, SRL is based on Pintrich's (1995, 2000a) and Zimmerman's (1989, 2000) theories. Teachers' self-regulation *as learners* involves constructive processes, whereby teachers and student teachers set goals and attempt to monitor and evaluate their own cognition, motivation, and behaviour (Pintrich, 2000a). Self-regulation *as a teacher* is similar, whereby teachers explicitly and proactively *help students* construct personal SRL strategies. The focus of this study is on how student teachers perceive themselves as learners at the beginning of the learning process, often called a *forethought of learning,* and how they use different *strategies* or *performance regulations* in monitoring and controlling their learning (Pintrich, 2004; Winne & Perry, 2000; Zimmerman, 2000).

The *forethought* includes a task analysis and self-motivational beliefs. The task analysis leads to strategic planning and goal-setting for learning, and it is based on one's self-motivational beliefs and on the evaluation of task difficulty (Zimmerman, 2000). Self-motivational beliefs consist of personal beliefs of self-efficacy, outcome expectations, intrinsic interest, task value and affective factors (e.g. anxiety). Anxiety in performance situations causes emotional reactions and interfering thoughts, which may decrease the cognitive capacity to complete the assignment to the best of one's ability (Pintrich, 2000b).

The *performance regulations* include awareness of, monitoring, selecting and adapting several processes and strategies, for example, metacognition, effort, use of time, help seeking, and changing task and context conditions (Zimmerman, 2000).

There are variations in how different cultures see learning, and comprehending these differences may help illuminate the variances in the use of SRL strategies. Pillay, Purdie, and Boulton-Lewis (2000) stated that the notion of self in SRL is highly influenced by a learner's cultural environment. While the self is an individual construct in some cultures, in other cultures, it also encompasses the community. In collectivist societies, self-regulation may

include the responsibility to the community that is placed on the learner, perhaps through encouraging the learner to try harder and to persist despite difficulties (Pillay et al., 2000).

Regardless of cultural differences, SRL (or learners' self-directedness) has recently been widely discussed in educational psychology worldwide. It is now mentioned in educational plans and/or teacher standards in Western world and for example, in Singapore (NIE, 2009), Australia (Griffin, McGaw, & Care, 2012), and China (Tan, 2017). However, the instruments used for measuring SRL are often based on theories that were developed in Western cultural contexts.

Kramarski and Kohen (2017) and Kramarski and Michalsky (2010) present that it is difficult for pre-service teachers to regulate their own learning and that SRL is not spontaneously acquired by student teachers. However, there is evidence that SRL can be developed through programmes that provide opportunities to control their own learning and teaching (Kramarski, 2008; Kramarski & Kohen, 2017; Styles, Beltman, & Radloff, 2001; Vrieling, Bastiaens, & Stijnen, 2012), such as by using active learning methods (Heikkilä et al. 2012; Kramarski & Michalsky 2009), like a mind map as a planning tool (Tanriseven, 2014) or active reflection (Oakley et al., 2014), which is a major tool that is used to support explicit self-regulation (Kramarski & Michalsky, 2010; Pintrich, 2002). In addition, student teachers' SRL and SRT strategies have been developed by using prompts, which is a specific scaffolding method (Kramarski, 2008; Kramarski & Kohen, 2017).

Per Bembenutty (2007), in 2007, little was known about teacher candidates' engagement in SRL. In the same study, he found positive correlations between student teachers' SRL components, such as task value, intrinsic interest, self-efficacy of learning and teacher self-efficacy. Pre-service teachers with a high sense of efficacy also strategically selected ways to approach learning, such as their use of metacognitive strategies, which included the effective planning, self-monitoring, and self-evaluation of their academic progress. In addition, effective control of time and study environment correlated positively with efficacy beliefs regarding learning and teacher self-efficacy. White and Bembenutty (2013) stated that self-efficacy is essential to teachers' successful academic performance. Their results revealed that students' tendencies to seeking help varied according to their teachers' self-efficacy beliefs and the use of self-regulatory strategies. Pendergast, Garvis and Keogh (2011) found evidence that self-efficacy is important in developing effective teachers.

Wide Professional Role: Knowledge Creators Who Develop Their Profession

The Organisation for Economic Co-operation and Development (OECD, 2005a) has summarised that quality in teaching consists of wide professional responsibilities. Teachers need to help young people to take responsibility for mapping out their own learning pathways throughout life. Teachers also have a responsibility to develop new knowledge about education. In a context of autonomous lifelong learning, their professional development implies that teachers continue to reflect on their practice in a systematic way and undertake classroom-based research. They should also incorporate into their teaching the results of classroom and academic research, evaluate the effectiveness of their teaching strategies and amend them accordingly, and assess their own training needs.

Niemi (2007) has summarised teachers' professional competences adapted to the Finnish context, as follows. Teachers should be familiar with the most recent knowledge and research about the subject matter and be able to transform it in relevant ways to benefit different learners and help learners to create foundations on which they can build lifelong learning. Teachers should have a thorough understanding of human growth and development, and they need knowledge of the methods and strategies that can be used to teach different

learners. In addition, teachers must be familiar with the curricula and learning environments in educational institutions, but they should also know about learning in non-formal educational settings, such as in open learning and labour market contexts.

In this study, we consider the teacher's professional role to be a broad and responsible task. It requires a wide combination of competences. Recent research emphasises the need for teachers to work in collaboration and in partnership with different stakeholders and other educators (Epstein & Sanders, 2006; Jeynes, 2007; Lamote & Engels, 2010; Niemi, 2011). The teaching profession's strong ethical component emphasises not only the teachers' role as key promoters for equity and well-being in society, but also the responsibility for the new generation to have a capacity for active learning and 21st-century skills (e.g., Darling-Hammond, 2005, 2010; Niemi, 2002a). The teaching profession can develop only through capable and committed professionals who are lifelong learners themselves. This point of view includes aspects such as the reflective teacher, the teacher as researcher and skills that are based on paradigm of inquiry-oriented learning (Niemi, 2002a, 2012; Scardamalia, 2000 (as cited in Niemi, 2011). In this study, professional competences are investigated using the following categories of competences: a) pedagogical work in classroom, b) cooperation with partners in education, c) ethical commitment to profession, d) acknowledging pupil diversity and preparing them for the future, and e) teacher's own professional learning.
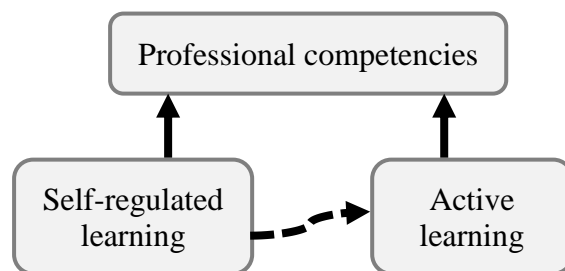

Figure 1. Conceptual Frame of the Study.

Research Questions

The goal of this research is to determine how active learning methods and student teachers' SRL qualities are related to their professional competences, such as being able to design instruction and syllabus, to work together with colleagues and parents, to have a strong ethical commitment to the teaching profession, to acknowledge pupil diversity and to prepare them for the future society, and to continuously develop professionally (Niemi, 2012). We set the following research questions:

1. What kinds of SRL profiles can be identified among student teachers?
2. How can student teachers with different SRL profiles and active learning experiences achieve professional competences?
3. What kinds of relationships can be identified between active learning, SRL and professional competences among student teachers?
4. Which active learning methods and student teachers' SRL strategies can predict the achievement of professional competences?

Method
Context of Study

The study took place in the primary and secondary teacher education programmes of two large and comprehensive universities in Finland that are well-known for their high quality TE. Finnish TE programmes consist of a five-year programme of 300 ECTS (European Credit Transfer System), including a BA degree (180 ECTS) and MA degree (120 ECTS). The aim of the programmes is to educate high-standard professionals who have the capacity not only to work in classrooms, but also to develop the teaching profession. The objectives are that teachers internalise a research-oriented attitude towards the teaching profession, have authentic research experiences in TE and learn to reflect on their profession. A teaching career is much sought-after in Finland, and students must pass high criteria in entrance examinations that measure academic abilities, thinking skills, motivation and interaction skills. Only 10–15% of applicants are accepted (Niemi & Jakku-Sihvonen, 2011). This study is part of a large research and evaluation project that was partially reported earlier (Niemi, 2011).

Data Gathering and Subjects

The data were collected in TE programmes in May 2010 through an electronic questionnaire. Departmental electronic mailing lists were used to invite student teachers to participate and twice to remind them. However, of the 605 student teachers who visited the web-based questionnaire, some did not complete the entire extensive set of questions. The Professional Competences Instrument was completed by 454 respondents, the SRL Instrument by 422 respondents and the Active Learning Experiences Instrument by 341 respondents. Table 1 illustrates some demographic backgrounds of the participants who responded to the SRL Instrument and who were selected for this study. The participants' ethnic background was quite homogenous, with all originating from Finland.

The study was conducted following the ethical guidelines of the National Advisory Board on Research Ethics in Finland. The principles are in line with the ethical guidelines of the European Educational Research Association (EERA) for upholding high academic and professional standards.

	Demographics	*F*	*%*
University	Students in the first target university	168	40
	Students in the second target university	253	60
Gender	Male	66	16
	Female	355	84

Table 1. Demographic background of the participants (N = 422).

Electronic Questionnaire and Instruments

The electronic questionnaire comprised questions on subjects' demographic backgrounds and the three instruments. The Active Learning Experiences Instrument was developed by the Niemi (2012), and it is based on theories that consider learning a constructivist and collaborative process. Active learning consists of independent inquiry, structuring and restructuring knowledge, problem-solving orientation, critical approaches and evaluations of knowledge (Niemi, 2011). The student teachers were asked to assess how often in their TE university studies (not during periods in the teacher training school) they

had experienced active learning by applying the following scale: 1 = almost never, 2 = once or twice a year, 3 = about once a month, 4 = about once a week and 5 = nearly daily. Factor analyses (Principal Axis Factoring, Varimax rotation) revealed two-factor and three-factor models. The three-factor model was selected for further analyses and three sum variables were constructed: A1 = Goal-oriented and intentional learning (eight items), A2 = Autonomous and responsible group work (seven items), A3 = Shared and collaborative problem solving (four items) (see Tab. 2).

The Self-Regulation in Learning Instrument is based on MSLQ and it encompasses Pintrich's (1995; 2000a) Motivational Components of Forethought and Cognitive Strategies. It was originally developed for the Finnish Virtual University context as an online questionnaire in the 2000s (Niemi 2002b; Nevgi 2002). In this study, a slightly modified version was used comprising two separate inventories: *Forethought of learning* (20 items) and *Strategies in learning* (39 items). The student teachers were asked to evaluate the items in terms of how they described their motivation and strategies in learning using the following scale: 1 = very weakly, 2 = weakly, 3 = fairly, 4 = well and 5 = very well. Based on factor analyses, the validated subscales presented in Table 2 were used in the analyses.

The Professional Competences Instrument was developed by the Niemi (2012) and analysed at the item level using descriptive methods. The instrument is based on a wide view of teachers' professional roles in school as well as on the paradigms of the reflective teacher, the teacher as researcher and inquiry-oriented TE (Niemi, 2011), consisting of 40 items. The participants were asked to assess how well their TE programme prepared them for teacher profession by applying the following scale: 1 = very weakly, 2 = weakly, 3 = fairly, 4 = well and 5 = very well. The five-factor model was selected and sum variables were constructed (Tab. 2).

Sum-scales	α	Examples of items for scales
Active learning		
A1 Goal oriented and intentional learning	.89	We try to understand matters and phenomena even though it would take time. We set objectives for ourselves and our learning.
A2 Autonomous and responsible group work	.81	We have to take the responsibilities for planning and carrying out fairly large projects. We have to seek almost all knowledge independently from different information sources.
A3 Shared and collaborative problem solving	.82	We experiment and elaborate on new solutions to problems. We plan together the contents and working methods of study unit.
Forethought of Learning		
F1 Expectation of success	.79	I am certain that I shall succeed well in my studies.
F2 Self–efficacy	.75	I can learn even the most difficult topics, if I do my best.
F3 Intrinsic interest	.76	I get satisfaction when I have a change to study some issues in-depth.
F4 Task value	.78	I believe that my university studies will benefit me later.
F5 Performance anxiety	.71	In performance situations, I am preoccupied with possible failure and its consequences.
Strategies in Learning		
S1 Time management	.85	I always stick to the study schedule that I have made.
S2 Self-management	.85	I set learning goals to be able to direct my studies.
S3 Persistency	.71	I often feel so lazy or bored studying course literature that I quit before finishing (reversed).
S4 Help seeking and collaboration	.81	I strive to cooperate with my fellow students when doing assignments or preparing for an exam.
S5 Self-assessment	.75	I reflect on things thoroughly and think through what I have really learned.
Professional Competences		
P1 Designing instruction	.76	How well TE programme has prepared you for designing instruction?

P2 Cooperation–teachers working with others	.81	… for working in a school community (teaching staff and other school personnel)?
P3 Ethical commitments	.86	… for the education of a student's whole personality?
P4 Diversity of pupils and preparing them for the future	.86	… for intercultural education?
P5 Teachers' own professional learning	.85	… for cooperative action research?

Table 2. The sum-scales of the instruments with examples of the items.

Analyses

To investigate how active learning promotes the achievement of professional competences of student teachers with different SRL, the subgroups of SRL were identified by a clustering-by-cases procedure. The K-means algorithm was used to define the initial cluster centres. As well, groupings of two to four with iterations were examined. The best solution comprising three clusters is presented in Table 3 with the significance test results of the means of each SRL scale.

A one-way multivariate analysis of variance (MANOVA) was conducted to find out if there were mean differences in professional competence scores between the three SRL profile groups and the three groups with different active learning experiences. A one-way analysis of variance (ANOVA) was used to explore the significance of the mean differences on professional competency scores between the three SRL profile groups with different active learning experiences.

To examine the relationships between active learning, SRL and professional competences, descriptive statistics and Pearson's correlation coefficients were calculated (see Tab 6 in appendix). Based on the results of correlation analysis, linear regression analyses with the Stepwise method were performed to further explore these relationships.

Results
Student teachers' SRL profiles

The clustering analysis showed that the differences between the SRL profile groups were moderate. The first student teacher group (*n* = 138) was labelled *Moderate SRL*. These students scored moderately on learning motivation and on all regulation strategies, but displayed some difficulties in reflecting, monitoring and controlling their learning process (see Tab 3). The low score in self-assessment reveals that they rarely reflected upon their learning to improve their study strategies. However, their scores in persistency and in help-seeking and collaboration indicate that they did not give up easily and sought help when necessary.

The second group (*n* = 122) was labelled *Dissonant SRL*. These student teachers were highly motivated and had high expectations of their success. However, in contrast, they scored moderately on time management, self-management and persistency, indicating that they had difficulties in planning and organising their studies. They were also socially oriented, willing to collaborate and sought help.

The third group (n = 120) was labelled *Excellent SRL*. These students had very high expectations for their success and were highly intrinsically interested in studying. They scored high on time management and persistency and low on anxiety, indicating that they met challenges of studies with the confidence to overcome them. The three different SRL profiles are illustrated in Figure 2.

Scale	All M (S.D.)	Moderate SRL (n = 138) M	Dissonant SRL (n = 122) M	Excellent SRL (n = 120) M	F (2, 285)
Expectation of success	3.62 (.63)	3.16	3.68	4.08	114.75***
Self-efficacy	3.95 (.60)	3.56	3.98	4.34	79.57***
Intrinsic interest in learning	3.80 (.68)	3.29	3.91	4.24	104.64***
Task value	3.85 (.69)	3.46	4.13	4.02	45.28***
Performance anxiety	2.36 (.67)	2.40	2.55	2.16	11.70***
Time management	2.92 (.88)	2.47	2.61	3.73	119.55***
Self-management	3.00 (.71)	2.50	3.10	3.51	97.70***
Persistency	3.38 (.67)	2.99	3.22	3.99	120.90***
Help-seeking and collaboration	3.29 (.85)	2.89	3.89	3.10	62.14***
Self-assessment	3.29 (.83)	2.63	3.58	3.72	101.76***

Table 3. Student teachers' mean scores and profile scores in SRL: Cluster centres of the three cluster solutions and significance testing of means of individual scales by clusters.
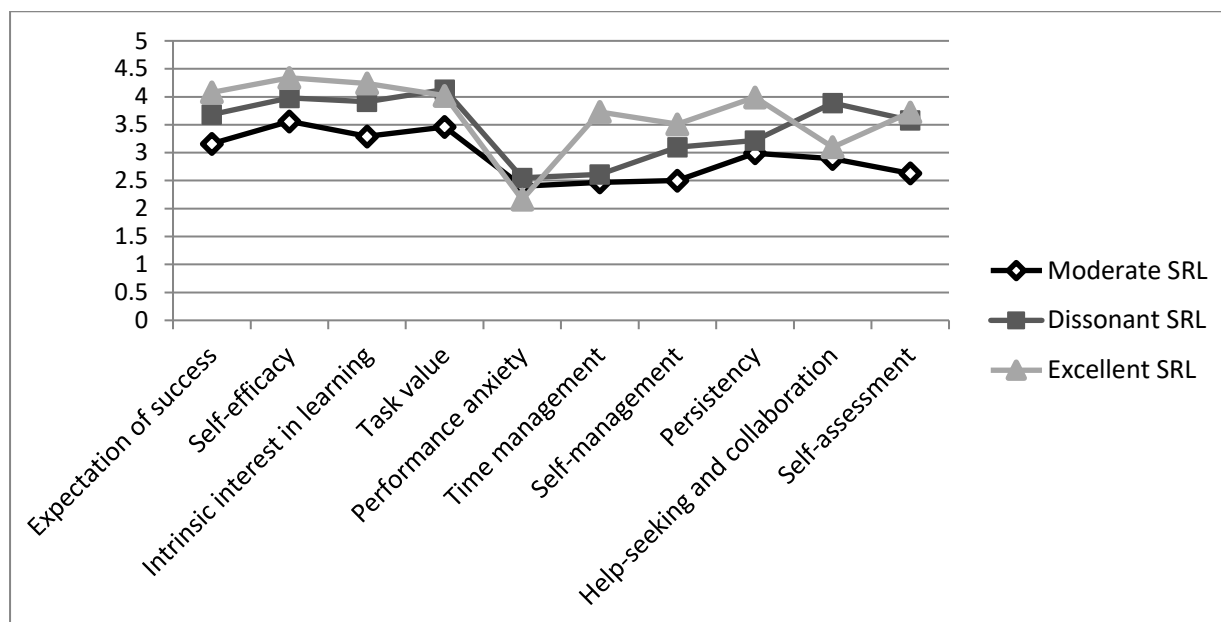

Figure 2. Student teachers' SRL profiles

Differences in Professional Competences in Student Teachers' SRL Profile Groups and Groups with Different Active Learning Experiences

Next, the achievements of professional competences were investigated between student teacher groups with different SRL in situations where they had different active learning experiences. It was found that, in general, when student teachers' experiences of active learning increased, they achieved better professional competences. The one-way ANOVA, with Tukey's post hoc test with its significant difference procedure ($\alpha = .05$), revealed several significant mean differences between the scores of professional competences within the three SRL groups when compared with subgroups with different active learning experiences (see Tab 4).

First, the highly motivated student teachers with excellent SRL profited substantially from the use of active learning methods and scored significantly higher at .000 level on all

five professional competences when experiencing more active learning. Among these students, the experiences of active learning affected most strongly the development of competences such as 'Diversity of pupils and preparing them for the future' (F[2,89] = 14.82 p = .000) and 'Teacher's own professional learning' (F[2,86] = 16.47, p = .000).

Among the student teachers with moderate SRL, the experiences of active learning promoted most strongly the development of competences such as 'Diversity of pupils and preparing them for the future' (F[2,95] = 7.63, p = .001), and 'Teacher's own professional learning' (F[2,91] = 7.29, p = .001).

Finally, student teachers with dissonant SRL profiles scored somewhat higher on professional competences as they acquired more active learning experiences. Significant differences between the groups were found on competences such as 'Cooperation—teachers working with others' (F[2,91] = 5.60, p = .004), 'Ethical commitments' (F[2,88] = 5.29, p = .007), and 'Teacher's own professional learning' (F[2,92] = 12.07, p = .000).

Professional competences	SRL profile groups	Active learning experiences M (S.D.)			
		A little	Mediocre	A lot	F
P1	Moderate SRL	2.65 (0.43)	2.83 (0.38)	2.94 (0.46)	5.25**
	Dissonant SRL	2.59 (0.49)	2.78 (0.56)	2.77 (0.48)	1.19
	Excellent SRL	2.67 (0.52)	2.93 (0.48)	3.22 (0.43)	9.68***
P2	Moderate SRL	2.13 (0.48)	2.45 (0.60)	2.31 (0.55)	4.19*
	Dissonant SRL	2.13 (0.60)	2.14 (0.60)	2.55 (0.53)	5.60**
	Excellent SRL	2.15 (0.61)	2.38 (0.48)	2.79 (0.67)	8.49***
P3	Moderate SRL	3.11 (0.51)	3.40 (0.51)	3.44 (0.69)	5.41**
	Dissonant SRL	3.30 (0.58)	3.33 (0.57)	3.75 (0.65)	5.29**
	Excellent SRL	3.15 (0.68)	3.43 (0.66)	3.83 (0.65)	8.66***
P4	Moderate SRL	2.60 (0.57)	2.96 (0.56)	3.05 (0.64)	7.63**
	Dissonant SRL	2.76 (0.71)	2.99 (0.55)	3.14 (0.65)	2.36
	Excellent SRL	2.60 (0.65)	2.90 (0.62)	3.44 (0.65)	14.82***
P5	Moderate SRL	2.60 (0.46)	2.90 (0.49)	3.00 (0.58)	7.29**
	Dissonant SRL	2.47 (0.66)	2.91 (0.52)	3.28 (0.74)	12.07***
	Excellent SRL	2.60 (0.68)	2.94 (0.54)	3.43 (0.56)	16.47***

P1=Designing instruction
P2=Cooperation–teachers working with others
P3=Ethical commitments
P4=Diversity of pupils and preparing them for the future
P5=Teachers' own professional learning.

Table 4. Means and standard deviations of student teachers' achievement in professional competencies for SRL profile groups with different active learning experience.

Relationships between Active Learning, SRL and Professional Competences

A correlation analysis revealed that all active learning components correlated positively (.18–.50**) with the components of professional competences (see correlation matrix in the appendix). The active learning methods related to goal-oriented and intentional learning correlated more strongly than the other active learning components with the professional competences, especially with the core competence 'Designing instruction' and the competence 'Teacher's own professional learning'. In addition, all active learning components correlated most strongly with 'Teacher's own professional learning'.

In addition, the SRL components were positively related to professional competences (.03–.32**). Student teachers who were highly motivated (especially those who saw the task value of their studies), were able to manage their own learning and had better professional

competences required in their future careers. Student teachers accustomed to self-reflection and self-assessment scored higher on 'Ethical commitments' and 'Teacher's own professional learning'. Performance anxiety was weakly and negatively related to professional competences.

Active Learning and SRL Explaining the Achievement of Professional Competences

In order to examine how much the use of active learning methods in TE and student teachers' SRL could explain the achievement of professional competences, regression analyses were conducted. In all regression models, professional competences were entered one by one as a dependent variable whereas the active learning and SRL components were entered as independent variables. First, the two active learning components were the strongest explanatory variables in the regression models in general (Tab. 5). Second, as can be seen in the fifth model, active learning and SRL components explained most strongly the professional competency 'Teacher's own professional learning' ($R^2 = .326$). The active learning methods 'Goal-oriented and intentional learning' and 'Autonomous and responsible group work' with SRL components 'Help seeking and collaboration' and lack of 'Performance anxiety' together accounted for almost 33% of 'Teacher's own professional learning'.

The second strongest explanation was found in the third regression model, where the active learning method 'Goal-oriented and intentional learning' and SRL components 'Help seeking and collaboration' and 'Task value' explained 'Ethical commitment' significantly. The R^2 value for this model ($R^2 = .231$) shows a moderate magnitude (Cohen, 1992), the above-mentioned components explained 23% of 'Ethical commitment'. Additionally, for the fourth regression model, the R^2 value was moderate ($R^2 = .197$) in magnitude. The competency 'Diversity of pupils and preparing them for the future', the use of active learning methods 'Goal-oriented and intentional learning' and SRL component 'Task value' were the strongest predictors. Regression models 1 and 2 explained professional competences such as 'Designing instruction' and 'Cooperation—teachers working with others', which were also statistically significant with the former model explaining almost 18% and the latter explaining 12% of those competences.

Model	Dependent variable	Independent variable	B	S.E.	β	t
1	PC1	A1	.20	.04	.33	5.75***
	Designing instruction	F5 Performance anxiety	-.12	.04	-.16	-3.01**
		S2 Self-management	.08	.04	.12	2.11*
Model summary: $R^2 = .177$, $F(3, 281) = 20.14$, $p = .000$						
2	PC2	A1	.19	.04	.27	4.59***
	Cooperation–teachers working with others	F4 Task value of studies	.14	.05	.16	2.77**
Model summary: $R^2 = .118$, $F(2, 277) = 18.61$, $p = .001$						
3	PC3	A1	.28	.04	.35	6.42***
	Ethical commitment	S4 Help seeking and collaboration	.15	.04	.20	3.61***
		F4 Task value of studies	.13	.06	.13	2.36*
Model summary: $R^2 = .231$, $F(3, 278) = 27.80$, $p = .001$						
4	PC4	A1	.27	.05	.33	6,04***
	Diversity of pupils and preparing them for the future	F4 Task value of studies	.23	.05	.23	4.17***

Model summary: $R^2 = .197$, $F(2, 282) = 34.52$, $p = .000$

5	PC5	A1	.28	.05	.35	5.64***
	Teachers' own	A2	.20	.05	.23	3.68***
	professional learning	S4 Help seeking and				
		collaboration	.11	.04	.14	2.83**
		F5 Performance anxiety	-.13	.05	-.14	-2.72*

Model summary: $R^2 = .326$, $F(4, 273) = 33.05$, $p = .000$

A1=Goal oriented and intentional learning
A2=Autonomous and responsible group work.

Table 5. Summary of regression analyses, Professional competences, Active Learning and SRL among student teachers.

Discussion

This study investigated the relationships between student teachers' active learning experiences, SRL and achievement of professional competences. First, our core finding was that the use of active learning methods is important for developing student teachers' professional competences. This finding is in line with several previous studies (Felder et al., 2000; Kaasila & Lauriala, 2012; Kramarsky & Michalsky, 2009; Lynch et al., 2012; Niemi, 2012). Active learning methods, including goal-oriented and intentional learning tasks, autonomous and responsible group work, and shared problem solving, promoted especially the competences such as 'Teacher's own professional learning', 'Ethical commitments to the teaching profession' and 'Taking into account the diversity of pupils and preparing them for the future', but also other measured competences.

Second, the importance of student teachers' high learning motivation and capability for self-regulation became evident for the achievement of the best professional competences. Third, we found that the achievement of professional competences were explained most strongly by specific active learning methods, such as 'Goal-oriented and intentional learning' and SRL components, such as 'Task value of studies', 'Self-management' and 'Help seeking and collaboration'.

Finally, according to the best of our knowledge, this study was the first to investigate how student teachers with different SRL profiles profit from the use of active learning methods. We found three main SRL profiles for student teachers. *Excellent SRL*, which resembles the HE student profile *Excellent in SRL* that was found by Virtanen, Nevgi, and Niemi (2013), *Self-directed students* by Heikkilä et al. (2011) and *Effective self-regulators* by Vrugt and Oort (2008). Students with excellent SRL scored clearly higher in professional competences as their experiences of active learning increased. Another profile that we found, *Moderate SRL*, resembles the *Less-effective self-regulators*, which was identified by Vrugt and Oort (2008). These student teachers also scored higher on professional competences when experiencing more active learning. In addition, we identified the *Dissonant SRL* profile, which had not been identified in previous research. These student teachers were not able to profit from active learning methods to achieve professional competences as successfully as the students with other SRL profiles.

The goal oriented and intentional learning methods were the most effective active learning methods for achievement of professional competences. As to why this was so, we suggest, that when the student teachers used these active learning methods, it strengthened their teacher self-efficacy. These active learning methods specifically enhanced the student teachers' own responsibility and autonomy when developing their teaching skills. They had to aggressively self-regulate their learning and put what they had learned into practice. Autonomy support enhances professional competences and self-efficacy, which are essential

to teachers' successful academic performance (White & Bembenutty, 2013). We believe that regulating one's own development in a safe study group has a positive effect on a students' beliefs of his/her teacher efficacy. When efficacy beliefs improve, ones' professional skills are more likely to be rated higher.

Autonomous and responsible group work was found especially valuable for a teacher's own professional learning, which is very important competency for reflective lifelong learning and the developing one's own work community. Per De Neve, Devos, and Tuytens (2015), it is important to improve the professional learning of beginning teachers by providing opportunities to share knowledge and experiences with other teachers. Their research results confirmed that both autonomy and collaboration are important resources for novice teachers' professional learning. Working responsibly and autonomously in groups during TE may present student teachers' first experiences of functioning as professional educators; thus, these experiences are vital in the beginning phase of professional learning.

Our findings also show the importance of task value for the development of several professional competences. Student teachers should recognise the importance of learning to their future and development and value the course content. This motivational factor was useful particularly for the development of competence related to identification and taking into account the diversity of pupils and preparing them for the future. This competence may be challenging for young, inexperienced teachers, who may be more concerned about their own functioning as teachers than about their students. The self-regulation strategy 'Help seeking and collaboration', in addition to the use of active learning methods, emerged as important for the development of teachers' ethical commitment. This competence is highly valued in societies where teachers are seen as key promoters for equity and well-being in a society (Darling-Hammond, 2010; Niemi, 2002a).

Student teachers' abilities to transfer their active learning experiences into school contexts and further into their own work with their classes have been called into question. The Finnish TE aims to prepare students to evaluate and develop their teaching practices from the very beginning of their careers. In addition, many of the tasks in TE, such as planning and implementing large teaching projects are related to a teacher's wide professional role. The implementations are evaluated by the students, and they are encouraged to use these experiences as bases for their planning tasks as novice teachers. Finally, the general learner-oriented ideology in Finnish schools facilitates both the university-practice school partnership and the transfer of active learning methods into novice teachers' working practice.

Limitations of the Study

There were some limitations in this study. The length of the electronic survey lowered the response rate. Even so, when compared with the general response rates for web surveys, the achieved rate can be considered good, or at least satisfactory. Further, the data were collected from two different universities to improve the reliability of the study. Although the components of the active learning inventory used in this study correlated strongly with each other, the three-factor model's components for active learning were used to find out what kind of active learning methods were the most useful for the development of professional competences.

Another limitation is that the achievement of professional competences was evaluated only by the student teachers through the survey. More revealing results may have emerged if evaluation results from multiple sources had been used. It may be difficult for student teachers to identify the competences that they have acquired in certain contexts (e.g. in

practice schools or in TE institute). Because it may be challenging to activate the competences in contexts other than where they were acquired, it is worth considering how to best promote the activation of competences that are achieved in TE in student teachers' work as novice teachers.

It can be considered as a limitation for this study, that the findings on SRL were based on Western models of SRL only, even though researchers have raised concerns about the cross-cultural validity of these Western models (Rotgans & Schmidt, 2008). However, the ethnic background of the Finnish students composing the sample was homogenous. In addition, Rotgans and Schmidt (2008) found evidence showing that the Motivated Strategies for Learning Questionnaire (MSLQ), which we used is a valid and reliable instrument also in multicultural contexts.

Educational Implications and Future Research

The results of our study show that student teachers need SRL skills to benefit the active learning methods to achieve professional competences. It is important to consider how to support student teachers' autonomy if TE approaches are standards-based and regulated by authorities.

Our study showed the importance of the regular use of active learning methods for ensuring student teachers' professional development. In addition, the findings confirm that SRL is crucial for student teachers to engage in lifelong professional development and they should be encouraged and guided towards SRL to master the most demanding professional competences. As Kramarski and Kohen (2017) claim, only teachers who are themselves skilled in SRL are able to guide pupils towards SRL. Finnish teachers at schools have broad freedom, but also the responsibility for designing the learning processes and selecting tasks for students with different needs to best support their learning. Thus, it is important that student teachers themselves experience active learning and achieve competences to design learning settings utilising active learning and SRL supporting methods.

Our study results suggest that collaboration in TE is one of the keys to promote student teachers' active learning and encouraging SRL. These are in line with Niemi's (2012) and Kaasila and Laurila's (2021) findings, which showed how learning experiences that are related to a collaborative learning culture are the most effective. In addition, the results of this study suggest that when student teachers believe that TE studies are beneficial to their future, they will achieve better professional competences. Therefore, TE should highlight the connections between theoretical learning and future teachers' practical work. More importantly, TE should ensure that student teachers discover these connections themselves.

In most cases, student teachers who pass the Finnish entrance examination are highly motivated and have well-developed strategies for learning. However, among the participants, there were student teachers with dissonant SRLs who received few benefits from the active learning methods. Probably they would had profited fully with more teacher regulation. This finding supports the previous findings (e.g. Niemi et al., 2003; Virtanen et al., 2013) that higher education students with ineffective time management and lacking perseverance are those at risk. More attention should be paid to guide these students.

In our study, we examined the relationships between SRL, active learning and professional competencies by means of a survey wherein the results were based on student teachers' self-reporting. For future research, a follow-up study should be conducted in order to deepen the knowledge about the effects of active learning methods on student teachers' development of professional competences. Furthermore, a follow-up study is needed to examine whether the use of active learning methods develops student teachers' SRL.

We conclude that active learning methods and supporting students' SRL are not only pathways to career-long development, but they also create grounds to understand and implement the teacher's wide professional role. As SRL skills and preparedness to use active learning methods are constantly becoming more important in school learning, TE should continue to be developed towards these aims.

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Appendix

Sum scales	F1	F2	F3	F4	F5	S1	S2	S3	S4	S5	A1	A2	A3	P1	P2	P3	P4
F2	.78**																
F3	.50**	.54**															
F4	.40**	.33**	.34**														
F5	-.22**	-.31**	-.12*	-.07													
S1	.35**	.23**	.27**	.13**	-.16**												
S2	.39**	.28**	.40**	.25**	.06	.47**											
S3	.51**	.39**	.38**	.24**	-.23**	.64**	.41**										
S4	.02	-.05	.13**	.25**	.04	.05	.16**	.04									
S5	.33**	.38**	.62**	.30**	-.02	.15**	.40**	.22**	.27**								
A1	.27**	.28**	.30**	.23**	-.06	.14**	.28**	.15**	.09	.32**							
A2	.10	.13*	.10	.18**	.08	.01	.11*	-.05	.17**	.26**	.60**						
A3	.14*	.15**	.18**	.26**	.00	-.02	.18**	.03	.21**	.33**	.71**	.62**					
P1	.20**	.24**	.22**	.25**	-.13**	.17**	.19**	.20**	.03	.16**	.36**	.19**	.18**				
P2	.15**	.21**	.14**	.21**	-.09	.11*	.18**	.14**	.06	.13**	.28**	.25**	.21**	.54**			
P3	.20**	.19**	.21**	.31**	-.07	.14**	.22**	.17**	.24**	.25**	.37**	.30**	.34**	.61**	.52**		
P4	.15**	.17**	.21**	.32**	-.11*	.10*	.19**	.13**	.18**	.19**	.37**	.26**	.36**	.51**	.52**	.66**	
P5	.19**	.23**	.22**	.28**	-.09	.15**	.23**	.15**	.17**	.28**	.50**	.43**	.39**	.61**	.46**	.69**	.64**

Significance of correlation coefficient: * = 0.05 level (two-tailed), ** = 0.01 level (two-tailed)
F1=Expectation of success
F2=Self-efficacy
F3=Intrinsic interest of learning
F4=Task value of studies
F5=Performance anxiety
S1=Time management
S2=Self-management
S3=Persistency
S4=Help seeking and collaboration
S5=Self-assessment
A1=Goal oriented and intentional learning
A2=Autonomous and responsible group work
A3=Shared and collaborative problem solving
P1=Designing instruction
P2=Cooperation–teachers working with others
P3=Ethical commitments
P4=Diversity of pupils and preparing them for the future
P5=Teachers' own professional learning
Table 6. Pearson's correlation coefficients among SRL components and professional competences