Promoting self-regulated learning
in primary teacher education

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Voorwoord

Ruim vijf jaar geleden begon ik als externe promovenda bij het 'Ruud de Moor Centrum', inmiddels uitgegroeid tot 'Wetenschappelijk Centrum leraren Onderzoek' (*LOOK*). Dit in combinatie met mijn werk als lerarenopleider binnen Iselinge Hogeschool. Mijn onderzoek is een prototype van praktijkrelevant wetenschappelijk onderzoek. Het is ontstaan vanuit een vraag in de onderwijspraktijk van lerarenopleidingen waarop ik met kwantitatieve en kwalitatieve onderzoeksgegevens antwoord heb gegeven. Dit zogenaamde modus 2 onderzoek is precies waar LOOK voor staat en spreekt me bijzonder aan. Het is dan ook niet echt verrassend dat ik per 1 september van het afgelopen jaar ben gestart als Universitair Docent bij LOOK. Ik heb mijn plekje daar al helemaal gevonden en kan mijn onderzoek rondom zelfgestuurd leren vanuit LOOK verder voortzetten.

De onderzoeken die ik tijdens de promotiejaren uit heb mogen voeren zijn gebundeld in dit proefschrift. Het object van onderzoek, ondersteuning bieden bij het ontwikkelen van zelfgestuurd leren van leraren in opleiding, is ook van toepassing geweest op mijn eigen zelfsturend vermogen tijdens het opzetten, uitvoeren en rapporteren van dit promotieonderzoek. Het belang van studiemotivatie en metacognitieve vaardigheden voor succesvol leren is niet alleen zichtbaar gemaakt bij pabo studenten, maar ook bij mijn eigen onderzoekswerk.

Tijdens deze jaren, is een aantal mensen erg belangrijk voor me geweest. Hen wil ik dan ook graag via deze weg bedanken:

Theo, bedankt voor alle begeleiding en vooral voor je vertrouwen in mijn werk. Mijn breedsprakigheid in de door mij bij de start van het traject geschreven stukken moest al snel plaats maken voor een meer zakelijke schrijfstijl. Uiteindelijk heb ik ervaren dat jouw manier van begeleiden goed aansluit bij mijn wensen en te typeren is als: kritisch, efficiënt, to the point en competentie bevorderend.

Sjef, dank je wel voor alle feedback en commentaar. Je kritische blik en betrokkenheid hebben me steeds weer verder geholpen. Jij had altijd wel een goed boek of artikel in de kast staan waar ik dan weer mee verder kon. Jij en Theo vormen samen een goed team en vullen elkaar aan in de begeleiding van promovendi. Ik verheug me er dan ook op de komende jaren met jullie samen te blijven werken binnen LOOK en zal graag een beroep op jullie blijven doen bij de uitvoering van de nieuwe onderzoeksplannen.

Contents

Chapter 1
General introduction

In a society that requires lifelong learning, the ability to steer one's own learning is becoming more and more important to be successful in academic as well as in non-academic contexts (Kremer-Hayon & Tillema, 1999; Zimmerman, 2002). For that reason, contemporary curricula are increasingly grounded on social constructivist learning theories in which students' learning activities are more controlled by students themselves compared to more traditional curricula in which students are provided with direct instructional guidance on the concepts and procedures required by a particular discipline (Lunenberg & Korthagen, 2003).

One of the shared assumptions of social constructivist learning theories is the importance of self-regulated learning (SRL) as the key to successful learning in school and beyond (Boekaerts, 1999). In general, SRL can be defined as a goal-oriented process, proceeding from a forethought phase through self-monitoring and self-control to self-reflection (Pintrich, 2000, 2004). Many researchers (e.g., Simons, Van der Linden, & Duffy 2000; Zimmerman, 2002) stress the importance of SRL to foster students' deep and meaningful learning, resulting in significant gains in student achievement.

The focus of this thesis is on primary student teachers' (i.e., prospective primary teachers) SRL development in pre-service teacher education. Apart from the value of SRL for student teachers' academic success that is increasingly stressed from an international scientific angle, researchers and practitioners in teacher education are more and more confronted with the lack of transfer from theory to practice (Korthagen, 2010). In other words, student teachers are often not able to translate the provided knowledge and skills throughout their initial training in actual teaching practices in the schools (Korthagen, Klaassen, & Russell, 2000). The main reason for this gap between theory and practice is that most teacher education programs have traditionally been based on teaching subject knowledge and training teaching skills (Kremer-Hayon & Tillema, 1999).

In response to both the scientific and practise-based pressure, primary teacher educators (i.e., teachers of prospective primary teachers) are increasingly urged by policy makers to increase students' SRL opportunities throughout their initial training (Lunenberg & Korthagen, 2003). Teacher educators must facilitate, support, monitor and evaluate student teachers' interaction with the subject matter and focus less on merely transmitting subject matter knowledge. Moreover, teacher educators must become coaches in student teachers' development as learners, preparing their students for lifelong learning (Oosterheert, 2001).

Although primary teacher educators support the importance of the idea of SRL, they often find it difficult to actually foster it in educational pre-service programs (Korthagen et al., 2000). Many practising teacher educators have not been prepared for this changing role during their own education and are often worried about their decreasing role as knowledge providers (Kremer-Hayon & Tillema, 1999). So, the

professional development of teacher educators deserves more attention to implement SRL in educational pre-service programs.

Furthermore, disputes about the effectiveness of specific instructional practices derived from social constructivist learning theories have been ongoing for at least the past half-century (Kirschner, Sweller, & Clark, 2006). Although the increase of students' SRL opportunities is recommended by several researchers (e.g., Simons et al., 2000; Zimmerman, 2002), proper preparation of student teachers is necessary to achieve a situation where SRL opportunities might lead to successful academic achievement (e.g., Eshel & Kohavi, 2003; Stijnen, 2003).

To contribute to the discussion how to best implement SRL in pre-service teacher education and find a good balance between student- and teacher-directed learning, the research projects reported in this dissertation measure the effects of primary student teachers' increased SRL opportunities on their use of metacognitive learning strategies and motivation for learning, both important for their academic success. To our knowledge, these research intentions have not yet been objects of study in the specific context of primary teacher education.

The focus of this thesis is not only on student teachers' metacognitive and motivational development, but also on the professionalization of teacher educators that has become a vital concern of our department, the Scientific Centre for Teacher Research (LOOK), an expertise centre within the Open Universiteit in the Netherlands. Through practise-based research in close collaboration (so called co-creation) with teachers and schools, the centre stimulates professional development of teachers and contributes to the quality of teachers in the Netherlands. Our assumption is that deeper understanding of SRL in the context of primary teacher education is necessary in order to design powerful teacher education programs. From this perspective, this dissertation studies in detail how primary teacher educators can be supported in the SRL implementation process.

This chapter continues with a general description of the research questions of the studies presented in this thesis and the way they are connected. Then, based on the research questions, an overview of the dissertation is provided.

1.1   Research questions

To gain more insight into SRL, a systematic literature study is conducted first, resulting in a conceptual framework in the form of an SRL model. This model comprises seven SRL design principles for primary teacher education and is the starting point for the empirical part of this PhD research.

To support teacher educators' professional development in the area of SRL, an instrument is needed that assesses student teachers' SRL opportunities in pre-service teacher programs. Such an instrument does not exist for primary teacher

education. Therefore, the SRL model is elaborated towards the 'SRL Opportunities Questionnaire' that can be applied by primary teacher educators as a diagnostic instrument for classroom settings.

To be sure of the usefulness of the SRL model and according questionnaire for primary teacher educators in educational practise, an empirical pilot study is performed. In the pilot study (3 teacher educators and 136 student teachers of 2 primary teacher education institutes), the SRL model and according questionnaire are applied to train teacher educators in assessing student teachers' SRL opportunities in classroom practise. The pilot study provides indications of the added value of the training interventions for teacher educators' expertise development.

In this pilot study, student teachers' metacognitive and motivational development is measured as well, because of their relevancy in determining student teachers' academic success. Several researchers demonstrate that metacognition (e.g., Pintrich & De Groot, 1990; Vermunt & Verloop, 1999; Zimmerman & Pons, 1988) and motivation (e.g., Bruinsma, 2004; Pintrich, 2000, 2004) are positively related to academic achievement. Regarding the correspondence between metacognitive and motivational variables, many researchers also report that these variables are positively related (e.g., Bruinsma 2004; Pintrich 2000, 2004; Pintrich & De Groot 1990). To be able to search for the consequences of the professionalization trajectory on student teachers' metacognitive and motivational development, the 'Motivation and Metacognition Questionnaire' (MMQ; see Appendix 4.A) is developed in this PhD research. The 'Motivated Strategies for learning Questionnaire' (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991) is used as a starting point for developing the MMQ.

As expected, significant positive relationships are found between SRL, metacognition and motivation. These findings justify more elaborate research in the main study that empirically investigates the mentioned relationships on a larger scale (11 teacher educators and 257 student teachers of 5 institutes). In line with the results of the pilot study, the main study demonstrates that teacher educators play a major role in developing student teachers' use of metacognitive learning strategies by increasing student teachers' SRL opportunities in teacher education programs and also enhance student teachers' motivation for learning.

In the empirical studies, multiple quantitative (correlation analyses, independent-samples t-tests, paired-samples t-tests and regression analyses) and qualitative (semi-structured interviews, tutorial conversations) methods are applied.

In sum, the following general research questions are answered in this dissertation:

1. Which SRL principles for primary teacher education are distinguished in the literature?
2. Which tool can assess primary student teachers' SRL opportunities in educational pre-service programs?

3. To what extent do student teachers' use of metacognitive learning strategies and motivation for learning change in a learning environment with increased SRL opportunities?

Based on the research findings of the main study, it becomes obvious that teacher educators require more informal learning trajectories to further implement SRL opportunities in their learning programs. The elaboration of the SRL design principles in online learning networks can support teacher educators' search for a sufficient balance between teacher- and student-centred learning, because online learning networks are not limited by geography, space, or time. Rather, they can provide experiences for extending learning beyond the classroom walls that can be applied in classroom practice. This insight results in a closer investigation of the value of online learning networks for further support of SRL implementation in primary teacher education, resulting in a final fourth research question of this PhD research:

4. What is the value of online learning networks to support SRL implementation in primary teacher education?

1.2 Overview of the dissertation

In this dissertation, five studies are presented in Chapters 2 to 6, respectively. These studies investigate the previous mentioned research questions, often divided in sub questions and hypotheses. The chapters are written as independent articles; as a consequence, there is some overlap between them.

1.2.1 The 'Self-Regulated Learning Model for primary teacher education' (Chapter 2)

Regarding the first research question of this dissertation, the second Chapter describes seven SRL design principles for primary teacher education, summarized in an SRL model (see Figure 2.1). These design principles are important to consider while increasing student teachers' SRL opportunities in educational pre-service programs.

The recommendations of the SRL model point out the importance: (1) to create a sufficient knowledge base for student teachers in the domain (subject area); (2) to facilitate this knowledge building by integrating the necessary metacognitive skills and content matter during teaching; (3) to model these metacognitive skills by using four regulatory skill levels, namely observation, emulation, self-control and self-regulation; (4) to gradually develop from teacher control to student control over learning processes (scaffolding); (5) to be aware of the conditional factors that can hinder or foster SRL development; (6) to engage student teachers in collaborative learning environments; and (7) to pay attention to the relevant SRL aspects of the learning task (goal setting, prior knowledge activation, metacognitive knowledge

activation, metacognitive awareness and monitoring of cognition, judgments, attributions, task value activation and time management).

The second Chapter provides the theoretical foundation for the empirical studies of this dissertation.

1.2.2 The 'Self-Regulated Learning Opportunities Questionnaire': A diagnostic instrument (Chapter 3)

An innovative design like SRL needs to be explicit about the teaching behaviours expected from the teachers (Könings, Brand-Gruwel, & Van Merriënboer, 2007). Therefore, in response to research question 2, the SRL model of the second Chapter is further elaborated towards a diagnostic instrument for primary teacher education: the 'SRL Opportunities Questionnaire' (SRLOQ). This instrumental development is presented in Chapter 3. In addition, a single case study is described that illustrates the usefulness of the SRLOQ in classroom practice.

The SRLOQ categorizes items into 5 different SRL scales (planning, monitoring of the learning process, zone of proximal development, coaching/judging, collaboration) and assesses the level of student teachers' SRL opportunities in educational pre-service programs. The results of the empirical studies (Chapters 4 and 5) show that, combined with training, teacher educators are able to assess student teachers' SRL opportunities in classroom practice on the five scales.

1.2.3 Self-regulated learning, metacognitive and motivational development (Chapters 4 and 5)

Chapter 4 reports the development of the 'Metacognition and Motivation Questionnaire' (MMQ) and the application of both the MMQ and the SRLOQ in a first empirical intervention study. This pilot study investigates dynamics of student teachers' use of metacognitive learning strategies and motivation for learning in learning environments with increased SRL opportunities (research question 3). Based on the preliminary results of the pilot study, the main study in Chapter 5 also elaborates research question 3 by exploring the mentioned relationships on a larger scale.

Both empirical studies are conducted in educational theory courses containing lectures, lessons and moments of guidance. A mixed methods pre- and post-test design is applied in authentic primary teacher education class settings. In total, 14 teacher educators and 393 first- and second-year student teachers of 7 primary teacher education institutes in the Netherlands participated. During data collection, teacher educators participated in training courses and tutorial conversations aimed at increasing student teachers' SRL opportunities in the learning program. At the

end of the research period, all teacher educators and a sample of student teachers are interviewed in depth.

The findings of the empirical studies indicate that student teachers' use of meta-cognitive learning strategies increases significantly in learning environments with increased SRL opportunities. In opposite to these findings, no significant difference is shown between student teachers' motivation for learning before and after the research period. However, student teachers' expectancy, a component within the motivational construct, does increase significantly in the research period. Finally, minor significant positive correlations are found between the metacognitive and motivational constructs measured.

1.2.4 Promoting self-regulated learning in online learning networks (Chapter 6)

One of the outcomes of the empirical studies of this PhD research is primary teacher educators' need for informal SRL trajectories such as online learning networks for successful implementation of an innovative design like SRL. Therefore, the benefits of SRL learning networks for teacher educators' professional development are explored in Chapter 6 (research question 4). It first describes the importance of online SRL learning networks to provide experiences for extending learning beyond the classroom walls, followed by three important topics that can be practised in such learning networks: (1) modelling of metacognitive skills to student teachers by using the four modelling phases of Schunk and Zimmerman's (2007) model (observation, emulation, self-control and self-regulation); (2) improving student teachers' learning tasks by applying the 'Four Component Instructional Design' (4C-ID) model of Van Merriënboer and Kirschner (2007); and (3) creating a gradual SRL increase ('scaffolding') within educational pre-service learning programs by applying the SRLOQ (see Appendix 3.A) as a diagnostic tool.

Finally, Chapter 7 encompasses general conclusions of the studies presented in this dissertation and discusses these conclusions in terms of practical and theoretical implications. In general, the results show that, after training, the SRL model (see Figure 2.1) and according assessment instrument (see Appendix 3.A) are useful tools for primary teacher educators to assess student teachers' SRL opportunities in educational learning settings. Besides this, the present PhD research reveals that the level of SRL opportunities in pre-service teacher learning environments is a moderate predictor of primary student teachers' use of metacognitive learning strategies and motivation for learning, both important constructs for their academic career. In the case of metacognition, the enhancement of student teachers' use of metacognitive skills is only achieved by explicit strategy promotion to support student teachers' learning (see Figure 2.1, design principles 2 and 4). When it comes to motivation, it is important for teacher educators to provide an adequate knowledge base for student teachers and gradually increase their SRL opportunities in educational

programs (see Figure 2.1, design principles 1 and 3). Only then, primary student teachers can successfully develop their SRL skills.

Chapter 2

The 'Self-Regulated Learning Model for primary teacher education'

Abstract

Many recent studies have stressed the importance of students' self-regulated learning (SRL) skills for successful learning. Consequently, primary teacher educators have been encouraged by policy makers to increase their students' SRL opportunities in educational pre-service programs. However, primary teacher educators often find it difficult to implement these innovations in their teaching. In this chapter, a literature search concerning SRL was conducted. Based on this search, seven process-oriented design principles were formulated, resulting in an SRL model for primary teacher education. This SRL model provides more insight into relevant SRL aspects and can support SRL implementation in pre-service teacher education.

2.1   Introduction

This chapter describes the findings of a literature search concerning self-regulated learning (SRL) and aims at formulating design principles for primary teacher education. It critically discusses relevant and constraining factors that should be taken into account during the implementation of SRL in pre-service teacher education. The resulting recommendations can provide more insight for primary teacher educators (i.e., teachers of prospective primary teachers) into the SRL implementation process.

2.1.1   Importance of SRL

Several researchers (e.g., Hmelo-Silver, Duncan, & Chinn, 2007; Simons, Van der Linden, & Duffy, 2000; Zimmerman, 2002) stress the importance of students' SRL skills for successful learning. In general, SRL is defined as a goal-oriented process, proceeding from a forethought phase through self-monitoring and self-control to self-reflection (Pintrich, 2000, 2004). SRL can foster deep and meaningful learning as well as significant gains in student achievement.

As a result, in educational practice, new developments aimed at promoting students' SRL are increasingly being initiated by policy makers. In the context of teacher education, student teachers (i.e., prospective primary teachers) are required to demonstrate a high degree of SRL by writing personal development plans, documenting their progress in a portfolio, monitoring their learning process and evaluating their results (Lunenberg & Korthagen, 2003). In such learning environments, teacher educators must be able to structure the learning process in such a way that it allows and motivates student teachers to regulate their own learning.

The fundamental idea behind this growing attention to SRL is epistemological in nature. In the field of cognitive psychology, social constructivist learning theories can be regarded as the leading paradigm in recent years (Loyens, 2007). These theories emphasize that learners should construct their own understanding. One of the shared assumptions of social constructivist learning theories is the importance of SRL as the key component for successful learning in school and beyond (Boekaerts, 1999; Zimmerman, 2001). SRL is regarded as an interaction of personal, behavioural and environmental factors (Pintrich, 2000; Zimmerman, 2000). SRL includes not only behavioural skills in self-managing environmental factors, but also the knowledge and the sense of personal agency to enact these skills in relevant contexts. Such monitoring leads to changes in learners' strategies, cognitions, affects and behaviour (Schunk & Ertmer, 2000).

In line with this increasing epistemological attention for social constructivist views, the promotion of SRL is also influenced by societal developments (Bronneman-Helmers, 2007). Individuals increasingly strive to realize their own

choices. Due to this individualization process, there is more focus on individual students with their own talents (Bronneman-Helmers, 2007). Consequently, educational settings must enable students to develop their individual talents and needs. In such classrooms, SRL opportunities can be very useful.

Furthermore, from an economical perspective, students have to be prepared for lifelong learning and working in a knowledge society (Kremer-Hayon & Tillema, 1999; Zimmerman, 2002). Students are expected to master lifelong learning skills to be able to regulate their own learning once they are working in their fields of expertise (Van Eekelen, Boshuizen, & Vermunt, 2005).

Altogether, this focus on the construction of learners own understanding, combined with the rapid technological developments needed to support this knowledge construction (Bronneman-Helmers, 2007), have increased the interest in SRL in educational practice.

2.1.2 Primary teacher education and SRL

Teacher education is a field that has traditionally focused on teaching subject knowledge and training teaching skills (Kremer-Hayon & Tillema, 1999). In recent years, however, researchers and practitioners in teacher education have been confronted with the problem of the lack of transfer from theory to practice. In other words, student teachers are often not able to apply the knowledge and skills they have ostensibly learned in their teacher education programs in real classroom contexts (Korthagen, Klaassen, & Russell, 2000).

In response to this problem, teacher educators are now striving to increase student teachers' SRL opportunities throughout their initial training (Kremer-Hayon & Tillema, 1999). Research shows that students who are more cognizant of themselves as learners and who can better regulate their own intellectual activity are more successful in learning, problem solving, and transfer, and function better in an overall academic capacity (Nota, Soresi, & Zimmerman, 2004; Sundre & Kitsantas, 2004; Valle et al., 2003; VanderStoep, Pintrich, & Fagerlin, 1996). This may also be the case with students in teacher education. Furthermore, in the context of student teacher learning, teaching SRL is doubly beneficial as student teachers can adopt this self regulation approach when they become teachers (Kremer-Hayon & Tillema, 1999).

To achieve this goal of the self reflective learner and teacher, student teachers must learn to develop an attitude of reflective inquiry, and to experiment with ideas and teaching skills to enable lifelong learning (Kremer-Hayon & Tillema, 1999).

2.1.3 Problem definition

Although teacher educators support the importance of the idea of SRL (Kremer-Hayon & Tillema, 1999), they often find it difficult to actually foster it in educational pre-service programs (Lunenberg & Korthagen, 2005; Van Petegem, Donche, & Vanhoof, 2005). Many practising teacher educators have not been prepared for this changing role during their own education (Korthagen et al., 2000) and are often worried about their decreasing role of knowledge providers (Kremer-Hayon & Tillema, 1999). As a result, the professional development of teacher educators deserves more attention if we are to increase student teachers' SRL opportunities in educational pre-service programs (Könings, Brand-Gruwel, & Van Merriënboer, 2007).

To be able to provide more insight for primary teacher educators into relevant SRL aspects during teaching, the research question of this study (see Section 1.1, research question 1) was as follows: Which SRL principles for primary teacher education are distinguished in the literature? The present chapter represents an SRL search aimed at describing a specific set of design principles for primary teacher education.

This chapter begins with a description of the literature search. Then, the findings from the literature search are outlined in the form of process-oriented design principles for primary teacher education. These principles are summarized in an SRL model for primary teacher education. Finally, the findings are discussed and indications for future research are formulated.

2.2 Review of the literature

To answer the research question, a literature review was carried out in four phases. In line with Cooper (1998), this method section reports the channels used, a rationale for the choices of sources, the years they cover and the key words that guide the search.

The literature search started with searching in the databases of ERIC, PICARTA, GOOGLE SCHOLAR, DARE-net, ISED, Web of Science, Academic Search Complete, British Education Index, PsychINFO and the Social Sciences Citation index. These databases are well known and considered adequate for research in social studies. The following key words, all related to the research question, were used: self-regulated learning, self-regulation, self-directed learning, higher education, primary teacher education and pre-vocational teacher education. All key words were indexed in both singular and plural forms. Only contemporary studies conducted between 1990 and 2010 were selected. Furthermore, only journals that are registered by the Social Science Citation Index (SSCI) or by the Interuniversity Centre for Educa-

tional Research (ICO) were selected, because these are considered to be proper outlets for the articles.

During the second phase of the search process, the abstract, summary and references of all selected sources were studied. Six new key words turned out to be relevant: scaffolding, process-oriented learning, student-centred learning, academic performance, academic achievement and teacher training. All databases of phase one were searched again for these terms, repeating the first and second phase of the search process. In total, a number of 125 articles, 24 book chapters, 8 books, 8 dissertations and 4 reports were selected.

Next, all selected sources were read in depth. During this content analysis, the properties of the textual information were systematically identified by the frequencies of most used key words in the text. All selected sources had to be related to two large groups of key words namely (1) SRL/self-regulation/self-directed learning/student-centred learning/process-oriented learning, and (2) secondary education/ higher education/pre-vocational teacher education.

In the final phase, the selected sources were categorized by: (1) authors names and year of publication; (2) type of document; (3) location of the university of the first author; (4) type of research (conceptual versus empirical); (5) type of education; and (6) the main findings of the theoretical search (see Appendix 2.A). Subsequently, the main findings were grouped into eight covering main themes: (1) importance of SRL; (2) knowledge building; (3) integration of content matter and metacognitive skills; (4) modelling of metacognitive skills; (5) scaffolding; (6) conditions; (7) collaboration; and (8) learning task. These main themes were also incorporated in Appendix 2.A. The first represented a general theme that was used in section 2.1 of the present chapter. The remaining seven themes provided the conceptual framework for section 2.3 of this chapter, leading to the process-oriented design principles.

2.3   Findings from the literature

2.3.1   Introduction

In this section, theoretical findings concerning SRL are outlined, resulting in seven process-oriented design principles for primary teacher education. Process-oriented teaching represents a way of teaching that facilitates students' use of SRL skills (Vermunt & Verloop, 1999). The first set of six principles represents design principles that are necessary for successful implementation of SRL in primary teacher education. These principles are described in the first part of this section. The seventh principle concerns an exploration of SRL with regard to the learning task (i.e., assignments student teachers have to accomplish) and is formulated in the second

part of this section. At the end of the second part, all design principles are summa-rized and visualized in an SRL model for primary teacher education (Figure 2.1).
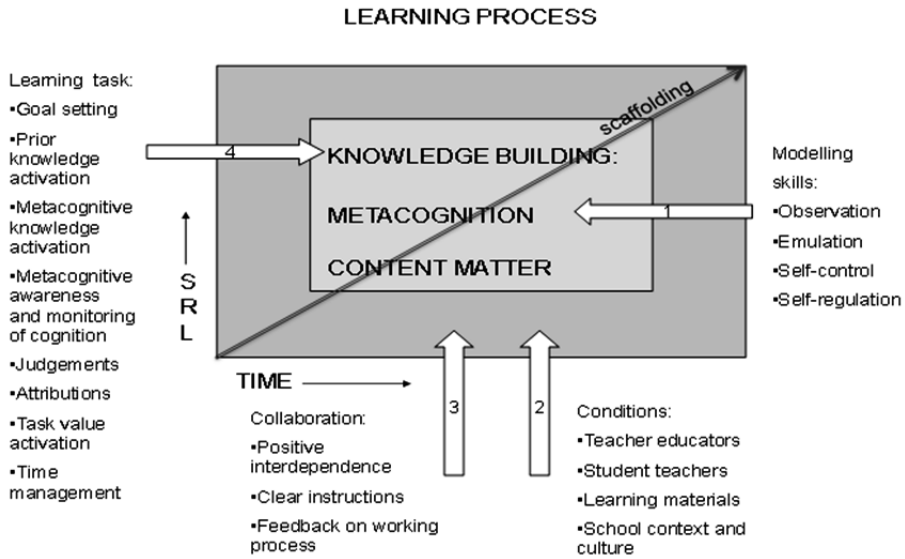
Figure 2.1. SRL model for primary teacher education

2.3.2 Findings concerning a successful SRL implementation

2.3.2.1 Knowledge building

Although the increase of students' SRL opportunities is recommended by several researchers (e.g., Simons et al., 2000; Zimmerman, 2002), disputes about the effec-tiveness of specific instructional practices derived from constructivism have been ongoing for at least the past half-century (Kirschner, Sweller, & Clark, 2006). Eshel and Kohavi (2003) state that proper organization of the class is necessary to estab-lish a situation where SRL opportunities might lead to good academic performance. Teachers have to exert enough control on students' learning processes to enable them to achieve good academic results. Further, a lack of metacognitive skills or knowledge might threaten the exploration of new insights during learning (Stijnen, 2003).

Teachers cannot expect their students to regulate their learning all by them-selves. Teachers are experts in the relevant subject-matter domain, and it is their task to make this domain more accessible to students (Bolhuis & Voeten, 2001). This conclusion leads to the following principle when it comes to pre-service teacher learning: focus on knowledge building in the domain (subject area).

2.3.2.2 Metacognition and content matter

When learning is conceived as self-regulated knowledge construction, the role of the teacher changes in the direction of supporting and guiding students' SRL (Vermunt & Verloop, 1999). The aim of this process-oriented instruction is to integrate teaching of domain-specific knowledge on the one hand and learning and thinking strategies on the other (Vermunt & Vermetten, 2004; Vermunt & Verschaffel, 2000). Process-oriented instruction focuses on the processes of knowledge construction and utilization by the learners themselves.

In sum, process-oriented teaching should focus on increasing both primary student teachers' content matter and metacognitive skills. Therefore, the following design principle is important: integrate content matter and metacognitive skills during knowledge building.

2.3.2.3 Modelling skills

Teaching metacognitive skills demands overt and explicit demonstration of often hidden learning and thinking activities (Zimmerman, 2000). However, teacher educators often find it difficult to serve as a role model (Lunenberg, Korthagen, & Swennen, 2007). Schunk and Zimmerman (2007) describe a four phase social cognitive model of the development of SRL. Their research (Schunk, 1999; Zimmerman, 2000; Zimmerman & Kitsantas, 2002) shows that the development of SRL can be positively mediated using four regulatory skill levels during modelling, also among college students.

At the first level (observation), learners can induce the major features of the skill from watching someone model learning or performing. At the second level (emulation), the learner, with assistance from the group, imitates the model's performance. At the third level (self-control), the learner independently performs under structured conditions. At the final level (self-regulation), the learner shows an adaptive use of skills across changing personal and environmental conditions. By using this modelling, teacher educators can make their teaching more explicit and can improve the transfer between theory and educational practice (Lunenberg et al., 2007).

To conclude, it is recommended for primary teacher educators to model necessary metacognitive skills to their student teachers. During this process, the following phases are important: observation, emulation, self-control and self-regulation.

2.3.2.4 Scaffolding

To ensure successful knowledge building, Hmelo-Silver et al. (2007) stress the important role of teachers in providing guidance to students. Kirschner et al. (2006) emphasize the importance for students to possess sufficient prior knowledge to be

able to internally guide themselves. Only then can the guidance of the teacher decrease.

These findings indicate the importance of striking a balance between teacher-centred and student-centred learning in the curriculum, gradually moving from teacher to student regulation of the learning process. This step-by-step approach is often called 'scaffolding' and was first introduced by Wood and Middleton (1975) and Wood, Bruner, and Ross (1976). The metaphor of scaffolding is originally based on Vygotsky's 'zone of proximal development', referring to 'the notion that developing mental functions must be fostered and assessed through collaborative activities in which learners participate in constructive tasks of problem solving with the assistance of more knowledgeable others' (Windschill, 2002, 141).

To recapitulate, the following design principle can be put forward for primary teacher education: move gradually from teacher control to student control over learning processes (scaffolding).

2.3.2.5 Conditions

Prospective teachers are increasingly being required to regulate their own learning without receiving explicit instructions on how to learn and without sufficient coaching and supervision (Taks, 2003). One well known problem in implementing curricula aimed at encouraging SRL, is the risk that educational designers develop a design for a powerful learning environment while teachers are subsequently not able to implement it in their teaching (Könings et al., 2007).

Vermunt and Verschaffel (2000) distinguish four factors that can hinder the implementation of process-oriented teaching in schools and universities, namely teacher characteristics, student characteristics, characteristics of learning materials and characteristics of the school context and culture.

Van Hout-Wolters, Simons, and Volet (2000) argue that adequately preparing teachers is necessary for a successful implementation of SRL in classrooms. The effective integration of SRL in educational programs requires teachers who understand and are convinced of the educational value of SRL (Windschill, 2002). Teacher educators may also lack the necessary knowledge and skills to implement SRL (Lunenberg & Korthagen, 2005; Putnam & Borko, 2000).

Student teachers too may have ideas about and preferences for learning and teaching that are contrary to appreciating process-oriented learning (Van Petegem et al., 2005). Furthermore, learners are not always motivated to invest much time and energy in developing adequate learning skills (Van Hout-Wolters et al., 2000).

Many learning materials are not suitable for SRL based learning environments. For example, smooth implementation can be threatened by classrooms that do not allow for individual or group work (Könings et al., 2007; Vermunt & Verschaffel, 2000).

The school context and culture may also be obstacles to implementing an innovative design, like process-oriented learning (Könings et al., 2007; Van Hout-Wolters et al., 2000; Vermunt & Verschaffel, 2000). Fluent implementation can be impeded by a lack of time, large group sizes, applying a school evaluation system that neglects process-oriented variables, etc.

In conclusion, the following design principle can be noted for primary teacher education: be aware of the conditional factors that influence the implementation of SRL in the curriculum. Pay attention to an adequate preparation of teacher educators, the comprehension of the significance of SRL by student teachers, the use of adequate learning materials and an appropriate school context and culture.

2.3.2.6 Collaboration

Student collaboration plays a facilitative role in developing SRL (Wigfield, Hoa, & Klauda, 2007). When students have collaborative projects to complete, they make special effort to ensure that they make a helpful contribution to the group. Also, encouraging students to consult with peers can lead to making the most of their classmates as knowledge resources. For that reason, learning processes and results should be regarded as social phenomena (Bolhuis & Voeten, 2001). To facilitate student teachers' reasoning and to sustain their interest and engagement, teacher educators have to guide peer interactions (Norton & Hathaway, 2010) by insuring positive interdependence in the group, giving clear instructions on how to co-operate and providing adequate feedback on the co-operating process (Bolhuis & Voeten, 2001).

In short, the sixth design principle is as follows: engage student teachers in collaborative learning environments. Pay attention to positive interdependence, clear instructions and feedback on the working process.

2.3.3 Findings concerning the learning task

2.3.3.1 Goal setting

Academic goals are regarded as important variables in current motivational research because they serve as self-defining reference points that determine the further processes of SRL, such as planning, executing and monitoring (Schunk & Ertmer, 2000; Zimmerman, 1999). Goals are cognitive representations of the various aims that students can adopt in different achievement situations (Valle et al., 2003).

Summarizing the findings of several researchers (e.g., Dembo & Eaton, 2000; Eccles & Wigfield, 2002; Schunk & Ertmer, 2000; Zimmerman 2007), the following goal categories need to be taken into account to create more successful SRL: (1) goals concerning learning processes; (2) personal learning goals; (3) short- and long-

term goals; (4) conscious goals; (5) specific goals; (6) proximal goals; (7) challenging goals.

2.3.3.2 Prior knowledge activation

Prior knowledge activation enables individuals to understand the task and its goals, to recognize the required knowledge for performing it and to distinguish the several characteristics and their prediction of performance (Eilam & Aharon, 2003). In this way, prior knowledge facilitates individuals to monitor, behave accordingly, judge results in relation to goals and construct more appropriate conditional knowledge for better performance in the future (Butler & Winne, 1995).

2.3.3.3 Metacognitive knowledge activation

The activation of metacognitive knowledge in the SRL forethought phase (Pintrich, 2000, 2004) includes the activation of knowledge about cognitive tasks and cognitive strategies. Butler and Cartier (2004) distinguish three interrelated characteristics within tasks: task purpose (goals), task structures and task components. To be successful, students must have productive metacognitive knowledge about tasks concerning each of these components.

2.3.3.4 Metacognitive awareness and monitoring of cognition

As part of the knowledge that they construct, students develop metacognitive knowledge, which influences their approaches to academic tasks (Butler & Cartier, 2004). Metacognitive regulation activities are those thinking activities that students use to decide on learning contexts, to exert control over their processing and affective activities and to steer the course and outcomes of their learning (Vermunt & Verloop, 1999). Metacognitive monitoring skills are a core component within information processing models of self-regulation (Butler, 2002; Nietfeld, Cao, & Osborne, 2006).

Effective self-regulated learners generate internal feedback as they monitor their engagement with learning activities and tasks and assess progress towards goals (Butler & Winne, 1995). During this self-evaluation, students compare self-observed performance to an absolute standard or prior performance (Zimmerman, 2002).

Effective self-regulated learners also actively interpret external feedback, for example, from teachers and other students, in relation to their internal goals. External feedback has shown to be a critical educational intervention for developing students' SRL (Nicol & Macfarlane-Dick, 2006). According to Hattie and Timperly (2007), effective external feedback needs to be clear, purposeful, meaningful, and compatible with students' prior knowledge to provide logical connections. Furthermore, it needs to encourage students' active information processing, have low task

complexity, relate to specific and clear goals, and provide little threat to students' feelings of self-efficacy.

2.3.3.5 Judgements

In the SRL self-reflection phase, Pintrich (2000, 2004) distinguishes two key processes. The first process involves learners' judgements and evaluations of their performance of the task. One of the principles within this process is to help students clarify what good performance is, using task requirements (Butler, 2002; Butler & Cartier, 2004; Nicol & Macfarlane-Dick, 2006). Another principle is to facilitate the development of self-assessment. Students need to learn to make judgements about the way their work relates to the criteria (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006).

2.3.3.6 Attribution

The second process of the SRL self-reflection phase concerns students' attributions for performance. Attributions are beliefs concerning the causes of outcomes (Butler, 2002; Schunk, 2007). Such beliefs influence students' motivation for SRL. If students use adaptive attributions, they believe that poor performance is caused by low effort or poor strategy use and not by lack of general ability. These beliefs can result in deeper cognitive processing and better learning and achievement (Pintrich, 2000). Educators can facilitate effective self-regulation by providing attributional feedback to students, which stresses factors students can control, such as effort and strategy use (Schunk, 2007).

2.3.3.7 Task value activation

Task value beliefs include perceptions of the relevance, utility and importance of the task (Pintrich, 2000). Eccles and Wigfield (2002) outline four components of task value: attainment value, intrinsic value, utility value and cost. They define attainment value as the personal importance of doing well on the task. Intrinsic value is the enjoyment the individual gets from performing the activity or the subjective interest the individual has in the subject. Utility value is determined by how well a task relates to current and future goals, such as career goals. Finally, cost is conceptualized in terms of the negative aspects of engaging in the task, such as performance anxiety and fear of both failure and success, as well as the amount of effort needed to succeed, and the lost opportunities that result from making one choice rather than another.

2.3.3.8 Time management

Time management involves making schedules for studying and allocating time for different activities (Pintrich, 2000) and is an important component of SRL (Dembo &

Eaton, 2000). The key factor of time management is prioritizing activities each day. Students make decisions and form intentions about how they will allocate their effort and the intensity of their work.

2.3.4   Construction of the SRL model

In this section, the findings from the literature are discussed, with the goal of formulating relevant SRL recommendations for primary teacher education. Seven process-oriented design principles are distinguished. All design principles are theoretically underpinned in this chapter and outlined in the SRL model for primary teacher education (Figure 2.1).

In this SRL model, the learning process of student teachers is visualized. As can be seen in the centre of the SRL model (knowledge building), the literature search revealed the importance for teacher educators to create a sufficient knowledge base for student teachers in the domain (subject area). Teacher educators have to play a key role in facilitating this knowledge building by integrating the necessary metacognitive skills and content matter during teaching. The importance of modelling these metacognitive skills is shown by arrow 1 (pointing at the metacognitive concept), representing four regulatory skill levels, namely: observation, emulation, self-control and self-regulation. Furthermore, to ensure successful knowledge building, a gradual development from teacher control to student control over learning processes (scaffolding) is stressed. This gradual increase in SRL is displayed in Figure 2.1 by the diagonal arrow.

Besides the importance of successful knowledge building, awareness of the conditional factors that can hinder or foster SRL development is necessary. Arrow 2 shows the influence of these conditions on the learning process. It is emphasized to prepare teacher educators adequately for their job, to ensure the comprehension of significance by student teachers, to use suitable learning materials for SRL and to create an appropriate school context and culture.

Also, the engagement of student teachers in collaborative learning environments was discussed. Arrow 3 indicates the influence of collaboration on the learning process. Three pieces of advice for teacher educators were explained: ensure positive interdependence in the group, provide clear instructions to student teachers and provide adequate feedback on their working process.

In the end, the relevant SRL aspects of the learning task were explored. This is visualised by arrow 4 (pointing at the knowledge building concept). These SRL aspects concern goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgements, attributions, task value activation and time management.

2.4   Discussion

Primary teacher educators are confronted with the necessity of facilitating through instruction and demonstration the adaption by student teachers of SRL principles. This literature review provides a range of sources through which to explore SRL and opens up some key debates, including how best to facilitate SRL and likely constraining factors.

The large majority of the elements incorporated in the present study address issues or areas that have received significant research attention over a long time span. By presenting them in a clarifying SRL model including seven process-oriented design principles, more insight into relevant SRL aspects is provided. The design principles can be considered in designing programs for primary teacher education. In this way, the SRL model supports SRL implementation within educational pre-service programs.

Some critical remarks about this study can be made. The design principles are based solely on a literature review. Despite the systematic inquiry method of the literature search, the validity of conclusions cannot be taken for granted (Cooper, 1998). Combining separate SRL studies into a new design for primary teacher education involves inferences as central to the validity of knowledge.

An innovative design like SRL needs to be explicit about the teaching behaviours expected from the teachers (Könings et al., 2007). Therefore, in a follow up study (see Chapter 3), the SRL model is used for the development of a diagnostic instrument for primary teacher education. Such an instrument can support primary teacher educators during diagnosing student teachers' SRL opportunities in educational pre-service programs. In this way, a better balance between student-centred and teacher-centred approaches in primary teacher education can be achieved.

Appendix 2.A. Studies included in the analysis

Author (Year)	Type of document	Location	Empirical/ Conceptual	General/ Secondary/ Higher/ Teach. Ed.	Main findings	Main themes
Boekaerts (1999)	Journal article	NL	C	HE	Internal, external, shared regulation Development of metacognitive skills Self-chosen goals	Scaffolding Modelling Learning task
Bolhuis & Voeten (2001)	Journal article	NL	E	SE	Learning process-es as social phe-nomena	Collaboration
Bronneman-Helmers (2007)	Report	NL	C	SE	Educational reform in the Netherlands	Importance
Butler (2002)	Journal article	US	C	SE/HE	Instructional SRL model Productive, un-productive attrib-ution	Content/ metacognition Learning task
Butler & Cartier (2004)	Journal article	US	C	SE/HE	Effective task interpretation	Learning task
Butler & Winne (1995)	Journal article	US	C	SE/HE	SRL Model includ-ing feedback	Learning task
Dembo & Eaton (2000)	Journal article	US	C	SE	Academic achievement Time manage-ment/ Learning and performance goals	Importance Learning task
Eccles & Wig-field (2002)	Journal article	US	E	G	Specific, proximal, challenging goals/ Task-involved and performance goals	Learning task
Eilam & Aharon (2003)	Journal article	ISR	C	SE	Academic achievement Prior knowledge	Importance Learning task
Eshel & Kohavi (2003)	Journal article	ISR	E	SE	Classroom control, achievement Student and teacher control	Importance Knowledge building
Hattie &Timperly (2007)	Journal article	NZ	C	G	Feedback model	Learning task

Author (Year)	Type of document	Location	Empirical/ Conceptual	General/ Secondary/ Higher/ Teach. Ed.	Main findings	Main themes
Hmelo-Silver et al. (2007)	Journal article	U	C	G	Academic achievement Innovative approaches	Importance Scaffolding
Kirschner et al. (2006)	Journal article	NL	C	G	Student guidance	Knowledge building
Könings et al. (2007)	Journal article	NL	E	SE	Teachers' professional development	Conditions
Korthagen et al. (2000)	Book chapter	NL	C	TE	Changing role of teachers	Importance
Kramarski & Michalsky (2009)	Journal article	ISR	E	TE	Instruction by teachers	Modelling
Kremer-Hayon & Tillema (1999)	Journal article	ISR	E	TE	Demands on organization and curricula	Importance
Loyens (2007)	Dissertation	NL	E	HE	Students' conceptions	Importance
Lunenberg & Korthagen (2003)	Journal article	NL	E	TE	Teachers' professional development	Conditions
Lunenberg & Korthagen (2005)	Journal article	NL	E	TE	Teachers' professional development	Conditions
Lunenberg et al. (2007)	Journal article	NL	E	TE	Teachers' professional development	Modelling
Nicol & Macfarlane-Dick (2006)	Journal article	UK	C	HE	Feedback principles	Learning task
Nietfeld et al. (2006)	Journal article	US	E	HE	Metacognition, academic achievement	Learning task
Norton & Hathaway (2010)	Book chapter	US	E	TE	Teachers' guidance	Collaboration
Nota et al. (2004)	Journal article	US	E	HE	Academic achievement	Importance
Pintrich (2000)	Book chapter	US	C	HE	SRL Framework	Importance
Pintrich (2004)	Journal article	US	C	HE	SRL Framework	Importance

Author (Year)	Type of document	Location	Empirical/ Conceptual	General/ Secondary/ Higher/ Teach. Ed.	Main findings	Main themes
Putnam & Borko (2000)	Journal article	US	C	TE	Teachers' professional development	Conditions
Schunk (1999)	Journal article	US	C	G	Four levels	Modelling
Schunk (2007)	Book chapter	US	C	G	Attributions, motivation, achievement	Learning task
Schunk & Ertmer (2000)	Book chapter	US	C	HE	Specific, proximal, challenging goals	Learning task
Schunk & Zimmerman (2007)	Journal article	US	E	G	Four levels	Modelling
Simons et al. (2000)	Book chapter	NL	C	HE	Guided, action, experimental learning Importance	Scaffolding Modelling
Stijnen (2003)	Book	NL	C	G	Criticism SRL implementation	Importance
Sundre & Kitsantas (2004)	Journal article	US	E	HE	Academic achievement	Importance
Taks (2003)	Dissertation	NL	E	TE	New roles of teachers and students	Conditions
Valle et al. (2003)	Journal article	SP	E	HE	Academic achievement Learning goals, performance goals	Importance Learning task
VanderStoep et al. (1996)	Journal article	US	E	HE	Academic achievement	Importance
Van Eekelen et al. (2005)	Journal article	NL	E	HE	Teachers' SRL	Conditions
Van Hout-Wolters et al. (2000)	Book chapter	NL	C	G	Difficulties SRL implementation	Conditions
Van Petegem et al. (2005)	Journal article	BE	E	TE	Students' preferences	Conditions
Vermunt & Verloop (1999)	Journal article	NL	C	HE	Strong, shared, loose teacher control Importance	Scaffolding Modelling

Author (Year)	Type of document	Location	Empirical/ Conceptual	General/ Secondary/ Higher/ Teach. Ed.	Main findings	Main themes
Vermunt & Vermetten (2004)	Journal article	NL	C	HE	Process-oriented instruction Gradual increase of student control	Content/ metacognition Scaffolding
Vermunt & Verschaffel (2000)	Book chapter	NL	C	HE	Process-oriented instruction Gradual increase of student control Epistemological perspective Components	Content/ metacognition Scaffolding Importance Conditions
Wigfield et al. (2007)	Book chapter	US	C	G	Facilitative role	Collaboration
Windschill (2002)	Journal article	US	C	G	SRL Framework	Importance
Wood et al. (1976)	Journal article	UK	E	G	Gradual increase of student control	Scaffolding
Wood & Mid-dleton (1975)	Journal article	UK	E	G	Gradual increase of student control	Scaffolding
Zimmerman (1999)	Journal article	US	C	G	SRL Model	Importance
Zimmerman (2000)	Book chapter	US	C	G	SRL Model Four levels	Importance Modelling
Zimmerman (2001)	Book chapter	US	C	G	Theoretical SRL perspectives	Importance
Zimmerman (2002)	Journal article	US	C	G	SRL Model	Importance
Zimmerman (2007)	Book chapter	US	C	G	Advantageous properties of goals	Learning task
Zimmerman & Kitsantas (2002)	Journal article	US	E	HE	Academic achievement	Modelling

Chapter 3

The 'Self-Regulated Learning Opportunities Questionnaire': A diagnostic instrument

Abstract

Many recent studies have stressed the importance of students' self-regulated learning (SRL) skills for successful learning. Although primary teacher educators are aware of the importance of SRL for their students, they often find it difficult to implement SRL opportunities in their teaching. To support teacher professional development, an SRL model (see Figure 2.1) was described in a previous theoretical study (see Chapter 2). In the present chapter, this SRL model is elaborated towards the 'SRL Opportunities Questionnaire' (SRLOQ) that can be applied by primary teacher educators as a diagnostic instrument for classroom settings. A four-phase research design is applied consisting of scale development, score validation, further validation of the SRLOQ in primary teacher education, and a confirmatory factor analysis. Finally, a single case study is described that illustrates the usefulness of the SRLOQ in classroom practice.

3.1 Introduction

This chapter describes the elaboration of a theoretical self-regulated learning (SRL) model (see Figure 2.1) towards a diagnostic questionnaire – the 'SRL Opportunities Questionnaire' (SRLOQ) - for primary teacher educators (i.e., teachers of prospective primary teachers). The chapter also demonstrates the usefulness of the SRLOQ for primary teacher educators to assess student teachers' (i.e., prospective primary teachers) SRL opportunities in pre-service teacher education.

3.1.1 Primary teacher education and SRL

Teacher education is a field that has traditionally focused on teaching subject knowledge and training teaching skills (Kremer-Hayon & Tillema, 1999). However, researchers and practitioners in teacher education are increasingly confronted with the lack of transfer from theory to practice (Korthagen, Klaassen, & Russell, 2000). In other words, primary student teachers are often not able to apply the knowledge and skills they have learned in their teacher education programs in real classroom contexts.

In response to this problem, many teacher educators are now striving to increase student teachers' SRL opportunities throughout their initial training (Lunenberg & Korthagen, 2003), because SRL has shown to foster students' deep and meaningful learning, resulting in significant gains in learning, problem solving, transfer and academic achievement in general (Nota, Soresi, & Zimmerman, 2004; Sundre & Kitsantas, 2004; Valle et al., 2003; VanderStoep, Pintrich, & Fagerlin, 1996). In such educational settings, teacher educators attempt to adjust their instructional behaviour, aimed at enhancing students' self-regulation of learning.

In general, SRL is defined as a goal-oriented process, proceeding from a forethought phase through self-monitoring and self-control to self-reflection (Pintrich, 2000, 2004). The most important aspect of SRL is that students can monitor, control and regulate their own cognitive actions (Pintrich, 2000; Veenman, Van Hout-Wolters, & Afflerbach, 2006; Zimmerman, 2001), which often is referred to as metacognition. By using such metacognitive skills, student teachers can become aware of and monitor their progress towards their goals. In this way, they can improve their learning and comprehension. As a result, students can realize any adaptive changes in their learning (Vermunt & Verloop, 1999).

3.1.2 SRL design principles

Although primary teacher educators support the importance of the idea of SRL, they often find it difficult to actually foster it in educational pre-service programs (Korthagen et al., 2000). Many practising teacher educators have not been prepared

for this changing role during their own education and are often worried about their decreasing role as knowledge providers (Kremer-Hayon & Tillema, 1999). To provide more insight into relevant SRL aspects during teaching, Chapter 2 formulated seven SRL design principles for primary teacher education, combined in an SRL model (see Figure 2.1). These design principles are important to consider while increasing student teachers' SRL opportunities in educational pre-service programs.

In the SRL model, the learning process of student teachers is visualized. As can be seen in the centre of the SRL model ('knowledge building'), teacher educators are advised to create a sufficient knowledge base for student teachers in the domain (first SRL design principle). Teacher educators cannot expect their students to regulate their learning all by themselves from scratch. As experts in the relevant subject-matter domain, it is the teachers' task to make this domain more accessible to student teachers (Bolhuis & Voeten, 2001).

Teacher educators can play a key role in facilitating this knowledge building by integrating the necessary metacognitive skills and content matter during teaching (second SRL design principle). The importance of modelling these metacognitive skills (third SRL design principle) is drawn by arrow 1 (pointing at 'metacognition'), representing four regulatory skill levels (Schunk & Zimmerman, 2007). At the first level (observation), learners can induce the major features of the skill from watching someone model learning or performing. At the second level (emulation), the learner, with assistance from the group, imitates the model's performance. At the third level (self-control), the learner independently performs under structured conditions. At the final level (self-regulation), the learner shows an adaptive use of skills across changing personal and environmental conditions.

Furthermore, in line with the first 'knowledge building' principle, a gradual development from teacher control to student control over learning processes ('scaffolding') is stressed (fourth SRL design principle). To ensure successful knowledge building, it is important for teacher educators to provide considerable guidance to students (Kirschner et al., 2006). In this way, student teachers gain sufficient prior knowledge to be able to internally guide them. Only then the guidance of the teacher educator can decrease. This gradual increase in SRL is displayed in Figure 2.1 by the diagonal arrow.

Besides the importance of successful knowledge building, awareness of the conditional factors that can hinder or foster SRL development is necessary (fifth SRL design principle). Arrow 2 shows the influence of these conditions on the learning process. It is emphasized to prepare teacher educators adequately for their job, to ensure the comprehension of the significance of SRL by student teachers, to use suitable learning materials for SRL and to create an appropriate school context and culture.

Also, the engagement of student teachers in collaborative learning environments is visualized in the model (sixth SRL design principle). Student collaboration

plays a facilitative role in developing SRL (Wigfield, Hoa, & Klauda, 2007). When students have collaborative projects to complete, they make special effort to ensure that they make a helpful contribution to the group. Also, encouraging students to consult with peers can lead to making the most of their classmates as knowledge resources. Arrow 3 indicates the influence of collaboration on the learning process. Three pieces of advice for teacher educators are described: ensure positive interdependence in the group, provide clear instructions to student teachers and provide adequate feedback on their working process.

Finally, the seventh SRL design principle explores the relevant SRL aspects of the learning task. This is visualized by arrow 4 (pointing at 'knowledge building'). The first SRL aspect concerns 'goal setting'. Academic goals are regarded as important variables for student teachers because goals can serve as self-defining reference points that determine the further processes of SRL, such as planning, executing and monitoring (Schunk & Ertmer, 2000). Second, 'prior knowledge activation' enables student teachers to understand the task and its goals, to recognize the required knowledge for performing it and to distinguish the several characteristics and their prediction of performance (Eilam & Aharon, 2003). Third, 'metacognitive knowledge activation' includes the activation of knowledge about cognitive tasks and cognitive strategies in the SRL forethought phase (Pintrich, 2000, 2004).

The fourth SRL aspect of the learning task, 'metacognitive awareness and monitoring of cognition', is a core component within information processing models of self-regulation (e.g., Nietfeld, Cao, & Osborne, 2006). It is important for student teachers to develop thinking activities to decide on learning contexts, to exert control over their processing and affective activities and to steer the course and outcomes of their learning (Vermunt & Verloop, 1999).

In the SRL self-reflection phase, Pintrich (2000, 2004) distinguishes two cognitive key processes. The first process involves learners' 'judgements' and evaluations of their performance of the task (fifth SRL aspect of the learning task). Students can learn to make judgments about the way their work relates to the criteria. The second process of the SRL self-reflection phase concerns students' 'attributions' for performance (sixth SRL aspect of the learning task). Attributions are beliefs concerning the causes of outcomes (Butler, 2002). Teacher educators can facilitate effective self-regulation by providing attribution feedback to students that stresses the factors students can control, such as effort and strategy use (Schunk, 2007).

The seventh SRL aspect of the learning task, 'task value activation', includes perceptions of the relevance, utility and importance of the task (Pintrich, 2000). Finally, 'time management' (eighth SRL aspect of the learning task) is an important component of SRL as well (Dembo & Eaton, 2000). This aspect involves making schedules for studying and allocating time for different activities.

3.1.3   Problem definition

Although the SRL model provides more insight for primary teacher educators during SRL implementation in educational pre-service programs, an innovative design like SRL needs to be more explicit about the teaching behaviours expected from the teachers to really support teachers' professional development (Könings, Brand-Gruwel, & Van Merriënboer, 2007). Teacher educators play a crucial role in the interpretation of the SRL design and its translation to educational practice. It is a general concern of innovations such as SRL that educational developers create a powerful learning design and teacher educators subsequently are not able to fully implement it in their teaching (Könings et al., 2007). Therefore, the SRL model must be further operationalized towards a tool that enables primary teacher educators to implement SRL opportunities in their teaching, gradually moving from teacher to student regulation of the learning process (see Section 2.3.2.4).

As a consequence, the present study further elaborates the principles of the SRL model to answer the following research question (see Section 1.1, research question 2): Which tool can assess primary student teachers' SRL opportunities in educational pre-service programs? The chapter continues with a description of the incorporation and validation of the SRL design principles in a diagnostic instrument for classroom settings. Then, the usefulness of the instrument for primary teacher education is outlined and illustrated in the form of a single case study. Finally, the findings are discussed and indications for future research are formulated.

3.2   Development of the 'SRL Opportunities Questionnaire' as a diagnostic instrument

3.2.1   Introduction

In this section, the SRL principles are made objectives of instruction for teacher educators in the form of a diagnostic instrument for classroom practice: the SRLOQ. This study followed a four-phase research design, consisting of scale development, score validation, further validation of the instrument in a pilot study, and a confirmatory factor analysis (CFA) after a main study. The method and results of each phase are outlined.

3.2.2   Scale development

In the scale development phase of the SRLOQ we first determined which principles of the SRL model needed further elaboration towards a diagnostic instrument for classroom practice. The principles concerning collaboration (sixth SRL design principle) and the learning task (seventh SRL design principle) were selected for two rea-

sons: these recommendations are directly related to instructional designs for classroom practice; and incorporating these recommendations in the SRLOQ also puts in practice the remaining set of 5 more generic SRL recommendations (knowledge building, integration of content matter and metacognitive skills, modelling skills, scaffolding, and conditions) in an indirect matter while applying the SRLOQ. For example, by modelling student teachers to judge their own work (fifth SRL aspect of the learning task), the importance of explicitly teaching metacognitive skills (second and third SRL design principles) is stressed as well. This is further explained hereafter.

When the SRL aspects of the learning task (principle 7) are taken as a starting point, the first 4 SRL principles concerning knowledge building are incorporated as elementary rules. As a consequence to be able to perform the learning task in a self-regulating manner (e.g. Appendix 3.A, item 1.1.1 'Students describe personal learning goals for my course'), student teachers must possess sufficient knowledge (principle 1) about the course, containing both content matter as well as metacognitive skills (principle 2). In the case of metacognition, a more skilled tutor, such as the teacher, can be asked to model the necessary skills (principle 3). Similarly, sufficient knowledge building of student teachers in learning tasks can only be ensured by a gradual increase of their SRL opportunities (principle 4). Besides knowledge building also learning conditions (principle 5) have to be regarded as a basic assumption to ensure smooth performance of the learning task. If, for example, student teachers are not aware of the importance of describing their own goals, this can impede a fluent performance of the learning task.

In the second phase of the scale development, the recommendations concerning collaboration and the learning task were operationalized in potentially relevant items of the questionnaire. Based on the literature review of Chapter 2 that aimed at formulating SRL design principles for primary teacher education, all selected sources of the literature review concerning collaboration and the learning task were analysed for the operationalization of the SRLOQ. This screening led to the first selection of items that were included in the SRLOQ in analogous versions for student teachers and teacher educators. Table 3.1 presents an example of the items of the student teachers' (third column) and of teacher educators' (fourth column) versions for each SRL recommendation (second column). The teachers' and students' ratings for each SRLOQ subscale were expected to correlate.

Table 3.1. SRLOQ scales

Scale SRLOQ	Recommendation SRL model	Scale example version student teachers	Scale example version teacher educators	Number of items	Cronbach's α version student teachers	Cronbach's α version teacher educators
Planning	Goal setting	The teacher expects me to describe personal learning goals	Students describe personal learning goals for my course	17	α = 0.84/0.86	α = 0.85
	Metacognitive knowledge activation	The teacher expects me to divide big assignments into smaller parts	Students divide big assignments into smaller parts for my course			
	Task value activation	The teacher expects me to describe the value of my learning goals towards classroom practice	Students describe the value of their learning goals for my course towards classroom practice			
	Time management	The teacher expects me to make a time plan to master my learning goals	Students make a time plan to master the learning goals for my course			
Monitoring learning process	Metacognitive awareness and monitoring of cognition	The teacher expects me to point out in which areas I need feedback	Students point out in which areas they need feedback for my course	6	α = 0.81/0.85	α = 0.74
Zone of proximal development	Prior knowledge activation	The manual describes in what way I can prepare myself for the lessons	The manual describes the way students can prepare themselves for the lessons of my course	12	α = 0.84/0.78	α = 0.77
	Perceptions of task difficulty	The teacher expects me to describe why my learning activities are challenging	Students describe why their learning activities for my course are challenging			

Scale SRLOQ	Recommendation SRL model	Scale example version student teachers	Scale example version teacher educators	Number of items	Cronbach's α version student teachers	Cronbach's α version teacher educators
Coaching and Judging	Metacognitive awareness and monitoring of cognition	The teacher provides feedback on my learning progress	I provide feedback to students' learning progress for my course	16	α = 0.86/0.91	α = 0.81
	Judgments	The grading of the assignments by the teacher is based on previously formulated judging criteria	I grade the assignments based on previously formulated judging criteria			
	Attributions	The teacher demonstrates that making mistakes is part of the learning process	I demonstrate that making mistakes is part of the learning progress			
Collaboration	Collaboration	During collaboration, the teacher pays attention to specific collaboration skills such as dividing tasks and reporting to each other	During collaboration, I pay attention to specific collaboration skills such as dividing tasks and reporting to each other	5	α = 0.61/0.73	α = 0.74

In the final phase of the scale development, the selected items were grouped into potentially relevant scales of the SRLOQ. The SRL recommendations concerning collaboration and the learning task (goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgments, attributions, task value activation and time management) were incorporated in five scales of the SRLOQ. This can be seen in the first and second columns of Table 3.1. The SRLOQ distinguishes the following super ordinate scales: (1) planning (including goal setting, metacognitive knowledge activation, task value activation, and time management), (2) monitoring of the learning process (including metacognitive awareness and monitoring of cognition), (3) zone of proximal development (including prior knowledge activation, and perceptions of task difficulty), (4) coaching/judging (including metacognitive awareness and monitoring of cognition, judgments, and attributions), and (5) collaboration. Because the recommendation concerning 'metacognitive awareness and monitoring of cognition' includes both internal and external feedback, this recommendation was incorporated in two dif-

ferent super ordinate scales, namely 'monitoring of the learning process' (internal feedback) and 'coaching and judging' (external feedback). Also, the importance of challenging goals (part of the 'goal setting' recommendation) was embedded in the super ordinate 'zone of proximal development' scale as 'perceptions of task difficulty'.

3.2.3 Score validation

3.2.3.1 Qualitative analyses

To be able to empirically test the SRLOQ, depth interviews with 5 primary student teachers and 4 primary teacher educators were conducted first. Based on qualitative analyses of the interviews, the SRLOQ was adjusted. Besides minor textual adjustments to improve the readability of the questionnaire, analyses of the interviews resulted in two major changes in the questionnaire:

1. The 2 items concerning 'successful experiences' ('The assignments of my course can result in successful experiences' and 'Students describe why their learning activities for my course resulted in successful experiences') were too difficult to understand for student teachers and therefore removed from the questionnaire.

2. Most educational programs in primary teacher education only apply the portfolio as a tool to assess student teachers' development in their working place and not to assess student teachers' theoretical an practical development in general. Therefore, the words 'in the portfolio' were removed from all concerning items in the questionnaire.

Then, 62 primary student teachers and 29 primary teacher educators of one primary teacher education institute in the Netherlands completed the SRLOQ. Besides minor textual adjustments, qualitative analyses (based on the remarks of the respondents) resulted in five major changes in the questionnaire:

1. In the introduction text was clarified that the aim of questionnaire is not to judge the teacher educator, but to assess student teachers' SRL opportunities in educational pre-service programs.

2. In most primary teacher education institutes, teacher educators perform different roles. They teach a subject course, but often also provide personal guidance to student teachers' academic development. Because the questionnaire aims at the assessment of student teachers' SRL opportunities in classroom practice, the word 'teacher' was changed into 'teacher of a course'.

3. Although several teacher educators do not make use of planned moments for appointments with student teachers, students often can meet the teacher whenever they have questions. As a result, the concerning item was reformulated ('I make use of planned moments for students on which they can

meet me to ask questions about their progress or students can always meet me when they have questions about their progress').

4. In the introduction section of the student teachers version of the questionnaire was explained that the word 'expect' (e.g., 'The teacher expects me to describe personal learning goals') means that the SRL activities are not only stimulated by teacher educators during the lessons, but really have to be accomplished by student teachers.

5. In the introduction section of the teacher educators version of the questionnaire was clarified that the aim of the questionnaire is not to provide teachers' opinion on SRL opportunities, but to describe the teaching situation as actually occurring.

3.2.3.2 Quantitative analyses

The data of the score validation phase were quantitatively analysed by performing reliability analyses at the level of the scales of the instrument first. Based on these analyses, the item concerning peer feedback ('Students provide peer feedback to other students for my course') was removed from the 'monitoring' construct and added to the 'coaching/judging' construct. Table 3.1 outlines the number of items (fifth column) and Cronbach's Alpha's for the scales for the student teachers (first value of column 6) and teacher educators (column 7) version of the SRLOQ. Cronbach's Alpha's for the student teachers version were 0.84 (planning), 0.81 (monitoring of the learning process), 0.84 (zone of proximal development), 0.86 (coaching/judging) and 0.61 (collaboration). Cronbach's Alpha's for the teacher educator version were 0.85 (planning), 0.74 (monitoring of the learning process), 0.77 (zone of proximal development), 0.81 (coaching/judging) and 0.74 (collaboration). In general, these values imply reasonable reliability and homogeneity of items within the scales of the questionnaire.

Second, correlation analyses were performed at the level of the items within the scales of the questionnaire. In illustration of the results, the correlation matrix in Table 3.2 shows the correlations between the items of the 'goal setting' recommendation, which is part of the super ordinate scale 'planning'. The findings confirmed the results of the scale analyses. In addition, it was noticed that the items concerning the manual (e.g., 'The electronic learning environment/manual describes the learning goals for my course') scarcely correlate with other SRL items in the questionnaire. Table 3.2 illustrates this as well: the last two manual related items (Appendix 3.A, items 1.1.8 and 1.1.9) poorly correlate to the other 'goal setting' items. This indicated that most teacher educators do not apply the manual as a real tool in the guidance of student teachers' SRL. However, the manual is an important tool in the SRL implementation process and the concerning items were therefore maintained.

Table 3.2. Correlation matrix 'goal setting'

Goal setting	Item 1.1.1	Item 1.1.2	Item 1.1.3	Item 1.1.4	Item 1.1.5	Item 1.1.6	Item 1.1.7	Item 1.1.8	Item 1.1.9
Item 1.1.1	1.00	0.66*	0.73*	0.43*	0.35*	0.54*	0.54*	0.14	0.14
Item 1.1.2	0.66*	1.00	0.89*	0.67*	0.43*	0.54*	0.64*	0.23	0.03
Item 1.1.3	0.73*	0.89*	1.00	0.70*	0.42*	0.55*	0.60*	0.22	0.15
Item 1.1.4	0.43*	0.67*	0.70*	1.00	0.30**	0.58*	0.47*	0.29**	0.10
Item 1.1.5	0.35*	0.43*	0.42*	0.30**	1.00	0.60*	0.49*	-0.03	0.10
Item 1.1.6	0.54*	0.54*	0.55*	0.58*	0.60*	1.00	0.59*	0.25	0.13
Item 1.1.7	0.54*	0.64*	0.60*	0.47*	0.49*	0.59*	1.00	0.31**	0.26
Item 1.1.8	0.14	0.23	0.22	0.29**	-0.03	0.25	0.31**	1.00	-0.02
Item 1.1.9	0.14	0.03	0.15	0.10	0.10	0.13	0.26	-0.02	1.00

* significance: $p < 0.01$, two-tailed
** significance: $p < 0.05$, two-tailed

3.2.4   Further validation of the SRLOQ in classroom practice

3.2.4.1 Introduction

The present section describes the further validation of the SRLOQ in classroom practice. In chronological order the procedure and findings are outlined, also including a general discussion of the data and their implications for the field of educational psychology.

3.2.4.2 Procedure

In the next final validation phase, the scores for the 5 scales found in the former phase were cross-validated with a second set of student participant responses. From September 2009 until January 2010, the SRLOQ was applied in an empirical pilot study with 3 teacher educators and 136 first-year student teachers in 2 primary teacher education colleges in the Netherlands (see Chapter 4). The research was conducted in courses about educational theory containing lectures, lessons and moments of guidance. Table 3.3 visualizes the research design of the intervention study. Student teachers' SRL opportunities were quantitatively measured by the SRLOQ. Teacher educators and student teachers were qualitatively tracked by training courses (teacher educators), tutorial conversations (teacher educators) and retrospective interviews (teacher educators and student teachers).

Table 3.3. Research design intervention study

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lessons	x	x		x		x	x			x		x				x	x	X
SRLOQ (TEs and STs)				x						x								X
Course (TEs)					x													
Conversations (TEs)						x					x							
Interviews (TEs and STs)																		X

The pre-test (completing the SRLOQ) was performed at the end of the third lesson (week 4). At that time, teacher educators and student teachers were expected to be unaware of the treatments in the intervention-period. Both student teachers' judgments of a teachers' instruction behaviour and teacher ratings of their own SRL instruction were compared to obtain better interpretable data. After the pre-test, two kinds of treatments were undertaken with teacher educators aimed at increasing student teachers' SRL opportunities in educational programs: (1) training courses after lesson 3 (week 5) and (2) individual tutorial conversations after lesson 4 (week 6). The content of the training courses and tutorial conversations is explained in Section 3.3.3.

The intermediate-test (completing the SRLOQ) was performed at the end of the sixth lesson (week 10). Based on analyses of the intermediate-test, tutorial conversations were conducted again after lesson 6 (week 11) aimed at a further increase of student teachers' SRL opportunities.

At the end of the last lesson (week 18), the post-test (completing the SRLOQ) was conducted. Within five days after the post-test (end of week 18), all teacher educators and a sample of student teachers (two students per teacher educator) were interviewed retrospectively.

3.2.4.3 Findings

Reliability of the SRLOQ was assessed via estimates of the internal consistency of scores for each scale of the SRLOQ. The values of Cronbach's Alpha's of the student teachers version of the SRLOQ are reported in Table 3.1 (sixth column, second value). Cronbach's Alpha's were 0.86 (planning), 0.85 (monitoring of the learning process), 0.78 (zone of proximal development), 0.91 (coaching/judging) and 0.73 (collaboration). These results again provide evidence that the scores on the 5 scales are consistent.

The final version of the SRLOQ is a self-report instrument designed to assess student teachers' SRL opportunities in educational programs. It contains 56 items, divided in 5 final sales: planning (17 items), monitoring of the learning process (6 items), zone of proximal development (12 items), coaching/judging (16 items) and collaboration (5 items). Except for the items concerning the manual that ask for a yes or no reply, the items are scored on a five-point Likert scale. The instrument is

designed for classroom practice and takes approximately 20 minutes to administer. In Appendix 3.A, all items of the teacher educator's version of the SRLOQ are presented.

Qualitative analyses indicated that teacher educators could distinguish and became more conscious of the five SRL scales in their teaching by using the SRLOQ. This instrument enabled them to assess student teachers' SRL opportunities in classroom practice on the five scales. However, effective appliance of the SRLOQ requires training. To be successful in the SRL implementation process, teacher educators are advised to attend training courses that explain the design principles of the SRL model and individual tutorial conversations, based on the measured degree of SRL opportunities with the SRLOQ. In this way, in answer to the research question of the present study, the SRLOQ is a suitable diagnostic instrument for teacher educators to assess student teachers' SRL opportunities in primary teacher education.

In general, it was found that the educational programs of the participating primary teacher educators displayed a gap concerning SRL opportunities between the second and third year. In the first two years, the major phase, educational programs are mainly teacher-centred. Then, from the start of the third year, student teachers are expected to self-regulate their' learning by applying all they learned in, for example, self-chosen specializations. By learning to use the SRLOQ, the instrument cannot only be applied as a diagnostic tool for individual teacher educators, but also for educational pre-service programs in general.

3.2.5   Confirmatory Factor Analysis

In the final validation phase, the dimensional structure of the SRLOQ was tested with a CFA using the data of a main study (see Chapter 5). This main study was performed from January 2010 until June 2010 with 11 teacher educators and 257 second-year student teachers in 5 primary teacher education colleges in the Netherlands. Since the items concerning the manual correlated rather poor with the other items in the questionnaire, a CFA was applied on the SRLOQ as well as on the SRLOQ without the items related to the manual. The sample size was 485 since the data from the pre-test and the post-test of the main study were used for the CFA.

In addition to the chi-square (χ^2) statistic, which is an 'exact fit index', the overall fit of both versions of the SRLOQ was evaluated by examining three other types of fit indices as suggested by Hu and Bentler (1998). The Root Mean Square Error of Approximation (RMSEA) represents the 'approximate fit indices'. The Tucker-Lewis Index (TLI) and the Comparative Fit Index (CFI) represent the 'incremental fit indices', and the Standardized Root Mean Square Residual (SRMR) represents the 'residual based fit indices'. The results are outlined in Table 3.4.

Table 3.4. Model fit indices

Model	χ^2	df	RMSEA	TLI	CFI	SRMR
SRLOQ	4878.49[*]	1474	0.070	0.95	0.95	0.072
SRLOQ without items related to the manual	3571.57[*]	892	0.080	0.95	0.96	0.073

[*] significance: p < 0.01

Because the chi-square (χ^2) test is highly susceptible to the impact of the sample size (Russell, 2002), the χ^2 ratio to its degrees of freedom (df) was evaluated instead. Values below 5 for the χ^2/df (Kline, 2005) and values below 0.08 for RMSEA indicate an acceptable fit (Marsh, Hau, & Wen, 2004). Values for the TLI and CFI above 0.90 indicate a good fit (Russell, 2002), while a SRMR below 0.10 indicate a good fit (Kline, 2005).

The results for the SRLOQ were χ^2/df = 3.31, RMSEA = 0.070, TLI = 0.95, CFI = 0.95, and SRMR = 0.072, which indicates at least an acceptable fit. The results for the SRLOQ without the items related to the manual were χ^2/df = 4.00, RMSEA = 0.080, TLI = 0.95, CFI = 0.96, and SRMR = 0.073, which indicates an acceptable fit as well, but slightly inferior to the results for the SRLOQ. In general, the results of the CFA confirmed the five dimensional structure of the SRLOQ to be acceptable.

3.3 The usefulness of the 'SRL Opportunities Questionnaire' in classroom practice: A case study

3.3.1 Introduction

To illustrate the usefulness of the SRLOQ for classroom practice, a single case study (one of the 11 participating teacher educators of the main study) is outlined in this chapter. First, the context of the study is explored, followed by a description of the design and the findings of the case study. Finally, recommendations for smooth SRL implementation are outlined.

3.3.2 Context

This preservice case study was conducted in a college of primary teacher education, which predominantly serves schools in a rural area in the east of the Netherlands. This is an independent, relatively small institution totalling approximately 500 students per academic year. Most students enter its program after graduating from the middle level of general secondary education and the highest level of secondary vocational education.

The female teacher educator that is described in the case study (Anne) taught 10 lessons to 4 separate groups of fulltime second-year regular student teachers in

the research period. She volunteered to cooperate. At the time of measurement, she had 8 years of working experience.

3.3.3 Design

The research design of the main study was similar to the pilot study that is described in Section 3.2.4.2. Two treatments were accomplished in the research period: training courses and individual consulting conversations.

The aims of the training courses were to increase teacher educators' SRL knowledge and skills, to focus on the consulting conversations, and to make a first planning on increasing student teachers' SRL opportunities in the learning program. After getting acquainted, teacher educators were firstly trained in applying the first set of five design principles of the SRL model (knowledge building, integration of content matter and metacognitive skills, modelling skills, scaffolding, and conditions). For example, the four phases of modelling metacognitive skills (observation, emulation, self-control, self-regulation) were practiced. Then, the elaboration of the sixth (collaboration) and the seventh (learning task) design principles towards the SRLOQ was explained and practiced. Finally, teacher educators were asked to make a planning for their individual classrooms in which at least 3 of the 5 SRLOQ scales were implemented.

The two cycles of tutorial conversations were based on both teacher educators' SRL planning and analyses of respectively the pre-, and intermediate-test. The SRLOQ scales were the leading themes of the conversations. The intentions of the teacher educators and analyses of the measured SRL degree as viewed by teacher educators and student teachers, were compared. In the end, this comparison resulted in an adjusted planning for SRL implementation in classroom practice, aiming at a further increase of student teachers' SRL opportunities in the learning program.

Finally, teacher educators and student teachers were questioned in semi-structured interviews about their experiences with student teachers' increased SRL opportunities in educational programs. The scales of the SRLOQ were used as starting points for the topics of the interviews.

3.3.4 Findings

In general, Anne wished to diminish the consuming role of student teachers that she frequently observed in her lessons. To achieve this shift, Anne planned to work on four super ordinate scales of the SRLOQ: 'planning', 'zone of proximal development', 'coaching/judging' and 'collaboration'. In the case of 'planning', she aimed at the sub scale 'goal setting', more specifically item 1.1.5 (Appendix 3.A: 'Students determine which learning activities they attend to master the learning goals for my course.'). At the end of lesson 2, Anne divided the theory of her course in 8 subjects

and provided opportunities for her students to select one of the topics that interested them. Then, the students worked on their subjects during the lessons 3 till 6. Anne also provided criteria for the students concerning the presentations of the subjects that were incorporated in the lessons 7 till 9. In the final 10th lesson, students had opportunities to ask questions about uncertainties in the topics.

In this way, Anne also aimed at improving the 'prior knowledge activation' aspect of the 'zone of proximal development' scale, representing items 3.1.4, 3.1.5, and 3.1.6 (Appendix 3.A: 'My assignments connect well to students' prior knowledge', 'My lessons appeal to students' prior knowledge', 'The content of my lessons connects well to students' prior knowledge').

In the presentation lessons, student teachers were asked to provide feedback to their peers, based on the criteria as provided by Anne (Appendix 3.A, item 4.1.1 'Students provide peer feedback to other students for my course'). In this way, Anne worked on the aspect 'metacognitive awareness and monitoring of cognition' within the super ordinate scale 'coaching/judging' as well.

The final scale that Anne worked on was the 'collaboration' scale (Appendix 3.A, item 5.1.1 'Students collaborate with peers for my course', item 5.1.2 'Students describe the way they collaborate with peers for my course', 5.1.4 'During collaboration, I pay attention to specific collaboration skills such as dividing tasks and reporting to each other').

> It is much more fun for me to work like this, because students are active in stead of consumptive and my role is more guiding instead of directing. I now am really looking forward to the lessons.

Student teachers were in favour of their active role during the course. Nevertheless, they also stressed the importance for teacher educators to provide an adequate knowledge base to avoid uncertainty. Student teachers stressed the importance for Anne to add the necessary information to the student-presentations. Student teachers also appreciated the final lesson in which Anne provided opportunities to elaborate on the content of her course to better prepare student teachers for the test.

> It is very pleasant to be activated and work like this; however we must know for sure that we possess all the required knowledge for the test.

Furthermore, it appeared difficult for student teachers to provide peer feedback in a suitable manner. This indicates student teachers' need for explicit metacognitive strategy instruction. Although Anne provided criteria for feedback, the modelling of peer feedback was not practiced in the classroom.

Student teachers appreciated the collaborative tasks. By discussion, argumentation, and reflection upon the task at hand, deeper processing of the information and

richer and more meaningful learning was achieved. Nevertheless, student teachers also stressed the importance for all individual members of the group to actively cooperate. When this was not the case, the advantages of the joined effort were decreased and student teachers gave privilege to working alone.

> *Less active students see their peers working: explaining the theory and thinking of ways to illustrate the theory during the presentation; by working in groups, all members are forced to actively cooperate.*

In general, Anne observed many possibilities to further enhance student teachers' SRL opportunities in her lessons on the longer term. She stressed the need to improve the learning task by utilizing real-life problems that require the integrated use of knowledge, skills, and attitudes. She also observed that the electronic learning environment was an undervalued aspect of the learning program. It was not applied as a real tool in the guidance of the self-regulation of primary student teachers. However, to make such an innovation a successful one, the implementation of SRL opportunities must not be an individual journey, but a joined enterprise of teacher educators, student teachers, and a supportive school context and culture.

Finally, Anne remarked that the five SRL scales are closely connected. Although Anne planned to increase SRL opportunities on a selected number of SRL constructs, student teachers' general SRL opportunities increased significantly during the research period.

> *By becoming more conscious of the 5 SRL scales, the instrument helps me to observe my course, the manual, the electronic learning environment, and so on, from a different perspective.*

In sum, Anne managed to distinguish the five SRL scales in her teaching and was also able to increase student teachers' SRL opportunities on the separate scales and in general. Through working with the SRLOQ, her consciousness of the SRL scales was trained, resulting in SRL ideas to implement in classroom practice on the short, but also on the longer term. In addition, Anne not only noticed the advantages of SRL for student teachers' academic success, but also became aware of the importance to 'scaffold' SRL opportunities in pre-service teacher education to avoid disadvantages such as student teachers' uncertainty.

3.3.5   *Recommendations for successful SRL implementation*

As can be learned from the case of Anne, primary teacher educators are advised to focus on knowledge building in the domain by creating a gradual transfer from teacher control to student control ('scaffolding'). Teachers are experts in the rele-

vant subject-matter domain, and it is their task to make this domain more accessible to students.

To enable SRL, this knowledge construction not only includes content knowledge, but also metacognitive knowledge. To develop and enhance student teachers' metacognitive learning skills, primary teacher educators are obliged to explicitly link that skill development to the way they teach. This means that the teaching procedures challenge students' thinking and their thinking about thinking. To achieve this goal, the four phases of Zimmerman's model (observation, emulation, self-control and self-regulation) can be incorporated in primary student teachers' education and training.

To facilitate student teachers' reasoning and sustain their interest and engagement in collaborative projects, teacher educators have to guide peer interactions by insuring positive interdependence in the group, giving clear instructions on how to co-operate and providing adequate feedback on the co-operating process (Bolhuis & Voeten, 2001). In addition, the transaction costs (communication and coordination within the group) should be kept to a minimum to ensure positive interdependence (Kirschner, Paas, & Kirschner, 2009). When viewed as a metacognitive skill, student teachers need practice and guidance in performing adequate collaborative skills.

To increase student teachers' SRL opportunities in learning tasks, the 'Four Component Instructional Design' (4C-ID) model (Van Merriënboer & Kirschner, 2007) can be applied. In the 4C-ID model, student teachers start with relative simple but realistic situations that contain all essential aspects of the complex task, and then gradually receive more complex authentic assignments characteristic for their professional situation. This improves the transfer between theory and practice. The SRL recommendations concerning the learning task (see Figure 2.1) can be embedded in the 4C-ID model.

Finally, successful SRL implementation involves a joined venture of all participants within primary teacher education. Primary teacher educators that perceived their schools as being more supportive were more motivated and persistent towards SRL implementation.

3.4   Discussion

Because of the promising results of SRL for students' academic success, teacher educators are increasingly confronted with the necessity of increasing student teachers' SRL principles in their learning programs. Although teacher educators support the idea of SRL, they often find it difficult to implement SRL opportunities for student teachers in their teaching. Therefore, a theoretical SRL model was developed in a former study as described in Chapter 2.

However, implementation of SRL in curricula asks for more explicit instructions about the teaching behaviours expected from teacher educators. Many researchers (e.g., Elwood & Klenowski, 2002) indicate formative assessment (i.e., assessment whose purpose it is to enable students, through effective feedback, to fully understand their own learning and the goals they are aiming for) as a promising element to improve learning and the quality of teaching. For that reason, to further support teacher educators' professionalism, the SRL model was further elaborated in the present study towards an assessment instrument for classroom settings: the 'SRL Opportunities Questionnaire' (SRLOQ). The SRLOQ was shown to provide a good grip for primary teacher educators in the SRL implementation process as it can support primary teacher educators in assessing student teachers' SRL opportunities in educational pre-service programs. Combined with teacher training, the instrument is not only applicable in individual classroom settings, but also to assess educational programs in general.

A major misunderstanding about SRL concerns the idea that student teachers can work more independent, and teacher educators are allowed to invest less time in the guidance of student teachers. This is a false assumption. Student teachers' SRL development demands adequate guidance by teacher educators. SRL implementation asks for a thorough preparation. Teacher educators have to think about ways to provoke goal setting, planning, monitoring, control and reflection by student teachers themselves.

Teacher educators also have to pay attention to individual differences between student teachers. Every student needs specific guidance and feedback. So, SRL implementation asks for flexible teacher educators who share the control with their student teachers. Prior knowledge activation, for example, can be realized by active involvement of student teachers in the preparation of the lessons. What do student teachers want to learn and what do they already know?

Maybe, the increase of student teachers' SRL opportunities in the learning program even demands more effort and attention of teacher educators than the regular approach. However, if SRL implementation is done right, it probably results in more academic success for student teachers. By applying the SRL model in teacher training courses and the SRLOQ as a diagnostic tool for teacher educators and program developers, a better awareness of important instructional SRL principles for primary teacher education can be achieved.

Future research would benefit from developing a shorter version of the SRLOQ that takes less than 20 minutes to administer. Furthermore, the SRLOQ can be calibrated in a representative sample to provide norms for the SRLOQ. Finally, developing on-line measurement methods to obtain behavioural SRL measures during task performance can enrich appliance of the SRLOQ as a self-assessment instrument.

Appendix 3.A. SRLOQ, version teacher educators

Scales SRLOQ	Recommendation SRL model	Scale items of the original SRLOQ
1. planning	**1.1 goal setting**	1.1.1 Students describe personal learning goals for my course.
		1.1.2 Students describe SMART (specific, measurable, acceptable, realistic and time processing) learning goals for my course.
		1.1.3 Students describe short-term learning goals to master their long-term personal learning goals for my course.
		1.1.4 Students describe how their personal learning goals and the learning goals of my course are harmonized.
		1.1.5 Students determine which learning activities they attend to master the learning goals for my course.
		1.1.6 Students describe how their learning activities contribute to mastering the learning goals for my course.
		1.1.7 Students describe SMART (specific, measurable, acceptable, realistic and time processing) learning activities for my course.
		1.1.8 The electronic learning environment/manual describes how my course can support students in their development towards primary teachers.
		1.1.9 The electronic learning environment/manual describes the learning goals for my course.
	1.2 metacognitive knowledge activation	1.2.1 Students divide big assignments into smaller parts for my course.
		1.2.2 The electronic learning environment/manual describes how students can divide big assignments into smaller parts for my course.
	1.3 task value activation	1.3.1 Students describe the value of their learning goals for my course towards classroom practice.
		1.3.2 The electronic learning environment/manual describes the importance of the learning goals for my course towards classroom practice.
	1.4 time management	1.4.1 Students make a time plan to master the learning goals for my course.
		1.4.2 The electronic learning environment/manual describes when the assignments for my course have to be finished.
		1.4.3 The electronic learning environment/manual describes how much time students need in general to accomplish the assignments for my course.
		1.4.4 The electronic learning environment/manual describes the subject matter that has to be studied for my course.
2. monitoring of the learning process	**2.1 metacognitive awareness and monitoring of cognition**	2.1.1 Students describe their progress for my course.
		2.1.2 Students describe their progress for my course based on obvious criteria.
		2.1.3 Students point out in which areas they need feedback for my course.
		2.1.4 Students describe the adjustments of their work after getting feedback for my course.

		2.1.5 Students describe the adjustments of their working routine based on their success and failure experiences for my course.
		2.1.6 The electronic learning environment/manual describes how students can describe their progress for my course.
3. zone of proximal development	**3.1 prior knowledge activation**	3.1.1 Students describe their prior knowledge for my course.
		3.1.2 Students describe how their thinking and acting have changed due to the obtained new knowledge and skills for my course.
		3.1.3 Students can point out which subjects should be part of the lessons for my course.
		3.1.4 My assignments connect well to students' prior knowledge.
		3.1.5 My lessons appeal to students' prior knowledge.
		3.1.6 The content of my lessons connects well to students' prior knowledge.
		3.1.7 A few days before the lessons start, students have access to relevant documents for my course (e.g., through the electronic learning environment).
		3.1.8 The program of my course provides opportunities for making choices in the subject matter.
		3.1.9 The electronic learning environment/manual describes students' opportunities for making choices in the subject matter of my course.
		3.1.10 The electronic learning environment/manual describes the way students can prepare themselves for the lessons of my course.
	3.2 perceptions of task difficulty	3.2.1 Students describe why their learning activities for my course are challenging.
		3.2.2 The assignments of my course challenge students.
4. coaching/ judging	**4.1 metacognitive awareness and monitoring of cognition**	4.1.1 Students provide peer feedback to other students for my course.
		4.1.2 I provide feedback to students' learning progress for my course.
		4.1.3 I provide feedback to students' assignments and tests for my course.
		4.1.4 My feedback is based on previously formulated criteria.
		4.1.5 I provide feedback to short-term products.
		4.1.6 I provide opportunities for handing over the assignments after adjustments.
		4.1.7 I provide feedback in the electronic learning environment.
		4.1.8 I make use of planned moments for students on which they can meet me to ask questions about their progress or students can always meet me when they have questions about their progress.
	4.2 judgments	4.2.1 Students describe judging criteria to grade their progress for my course.
		4.2.2 Students describe judging criteria to grade their work for my course.

		4.2.3 Students describe strong and weak points in their work for my course based on judging criteria.
		4.2.4 I grade the assignments based on previously formulated judging criteria.
		4.2.5 The electronic learning environment/manual describes how students can grade their progress for my course.
		4.2.6 The electronic learning environment/manual describes the judging criteria of the assignments for my course.
	4.3 attributions	4.3.1 I stress students' strong qualities.
		4.3.2 I demonstrate that making mistakes is part of the learning process.
5. collaboration	**5.1 Collaboration**	5.1.1 Students collaborate with peers for my course.
		5.1.2 Students describe the way they collaborate with peers for my course.
		5.1.3 Students describe the way they collaborate with peers in the electronic learning environment for my course.
		5.1.4 During collaboration, I pay attention to specific collaboration skills such as dividing tasks and reporting to each other.
		5.1.5 During collaboration, I pay attention to general social and communicative skills such as good listening and respecting other opinions.

Chapter 4

Self-regulated learning, motivation for learning and the use of metacognitive skills: The pilot study

Abstract

This intervention study focused on the relationships between primary student teachers' self-regulated learning (SRL) opportunities, their motivation for learning and their use of metacognitive learning strategies. The participants were 3 teacher educators and 136 first-year student teachers. During one semester, teacher educators and student teachers were monitored by questionnaires measuring opportunities for SRL offered by the program. Questionnaires were also administered monitoring student teachers' motivation and metacognition. During data collection, teacher educators participated in training courses and tutorial conversations aimed at increasing student teachers' SRL opportunities in the curriculum. At the end of the research period, all teacher educators and a sample of student teachers were interviewed. Results indicate that student teachers' use of metacognitive skills increased significantly in learning environments with increased SRL opportunities. Student teachers' motivation for learning was also enhanced, although to a lesser degree. Finally, significant correlations were found between the metacognitive study process construct and the motivational constructs measured.

4.1   Introduction

The motivation for this intervention study of self-regulated learning (SRL) in the context of primary teacher education emerged from the importance attributed to SRL for student teachers' academic success (e.g., Boekaerts, 1999). The study is aimed at examining relationships between primary student teachers' (i.e., prospective primary teachers) SRL opportunities, their motivation for learning and their use of metacognitive skills. Metacognition and motivation and were analysed because of their relevancy in determining student teachers' academic success. In the case of motivation, several researchers (e.g. Pintrich, 2000, 2004) demonstrate that higher motivation results in higher academic achievement. When it comes to metacognition, many studies (e.g. Vermunt & Verloop, 1999) that student teachers' use of metacognitive skills can improve their learning and comprehension, finally resulting in better academic performance. As for the relatedness between student' motivation and use of metacognitive learning strategies, these components must be conceived as interacting constructs in research regarding SRL (e.g., Eccles & Wigfield, 2002).

4.1.1   Self-regulated learning and primary teacher education

In a society that requires lifelong learning, the ability to steer one's own learning is becoming more and more important to be successful in academic as well as in non-academic contexts (e.g., Kremer-Hayon & Tillema, 1999; Zimmerman, 2002). For that reason, contemporary curricula are increasingly based on social constructivist learning theories in which students' learning activities are more controlled by students themselves compared to more traditional curricula in which students are provided with direct instructional guidance on the concepts and procedures required by a particular discipline (Kremer-Hayon & Tillema, 1999; Lunenberg & Korthagen, 2003).

One of the shared assumptions of social constructivist learning theories is the importance of SRL as the key to successful learning in school and beyond (Boekaerts, 1999). In general, SRL is defined as a goal-oriented process, proceeding from a forethought phase through self-monitoring and self-control to self-reflection (Pintrich, 2000, 2004). Many researchers (e.g., Simons, Van der Linden, & Duffy, 2000; Zimmerman, 2002) stress the importance of SRL to foster students' deep and meaningful learning, resulting in significant gains in student achievement. Self-regulating students in higher education are more successful in learning, problem solving, transfer and academic achievement in general (e.g., Nota, Soresi, & Zimmerman, 2004; Sundre & Kitsantas, 2004). This may also be the case with students in teacher education. As a consequence, primary teacher educators (i.e., teachers of prospective primary teachers) are increasingly urged to renew their teaching concepts to en-

courage student teachers to demonstrate a high degree of SRL by learning as professionals, constructing their practical knowledge, developing an attitude of reflective inquiry and experimenting with ideas and teaching skills (Kremer-Hayon & Tillema, 1999).

4.1.2 The SRL model for primary teacher education

Although primary teacher educators support the importance of the idea of SRL, they often find it difficult to actually foster it in educational pre-service programs (Korthagen, Klaassen, & Russell, 2000). Many practising teacher educators have not been prepared for this changing role during their own education and are often worried about their decreasing role as knowledge providers (Kremer-Hayon & Tillema, 1999). To provide more insight for primary teacher educators into relevant SRL aspects during teaching, Chapter 2 described seven process-oriented design principles, summarized in an SRL model for primary teacher education (see Figure 2.1).

   The first principle of the SRL model suggests that teacher educators should create a sufficient knowledge base for their students. To do this, teacher educators should integrate the necessary metacognitive skills and content matter into their teaching, comprising the second design principle. As part of the third principle, this integration should be modelled upon the following four regulatory skill levels: observation, emulation, self-control and self-regulation. In the fourth principle, control of the learning processes should gradually transfer from teacher to student ('scaffolding'). The fifth principle moves past successful knowledge building to encompass knowledge of the conditional factors that can foster or hinder successful implementation. The sixth principle stresses the engagement of student teachers in collaborative learning environments. Finally, the seventh SRL design principle explores the relevant aspects of the learning task (goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgments, attributions, task value activation and time management). Based on the recommendations of the SRL model, the operationalization of the theory towards a diagnostic instrument is elaborated in Section 3.2. This instrument ('SRL Opportunities Questionnaire'- SRLOQ) enables primary teacher educators to assess SRL opportunities in their teaching and is further described in Section 4.2.2.1.

4.1.3 Problem definition

Although primary student teachers are increasingly required to self-regulate their' learning, the consequences of the increased SRL opportunities for student teachers' academic success have not been measured so far. Therefore, in the present study, dynamics of primary student teachers' motivation for learning and use of metacognitive learning strategies were measured in learning environments with increased

SRL opportunities. These two concepts were chosen because of their relevancy in determining student teachers' academic success and are discussed hereafter.

Several researchers (e.g., Bruinsma, 2004; Pintrich, 2000, 2004) demonstrate that higher motivation results in higher academic achievement. Motivation can be seen as either a product or a process (Wolters, 2003). When viewed as a product, students have a level of motivation that they experience and that influences their choice, effort and persistence regarding a particular activity. When viewed as a process, motivation refers not just to an end state but also to the means through which that state is determined. In other words, motivational tendencies change during learning in classroom practice (Järvelä, Järvenoja, & Veermans, 2008) and students can learn to regulate their motivational state (Wolters, 2003).

At the same time, self-regulated learners are able to apply a large arsenal of cognitive learning strategies in academic tasks. Pintrich (2000, 2004), for example, distinguishes rehearsal, organization, and elaboration as cognitive learning strategies to understand the material in the course. Moreover, when it comes to the meta-cognitive concept that can be viewed as a subordinate component to SRL (Muis & Franco, 2010; Veenman, Van Hout-Wolters, & Afflerbach, 2006), its role is generally acknowledged as critical in constructivist views of learning (e.g., Butler, 2002; Ef-klides, 2006). Metacognition can be defined as the knowledge about and the regula-tion of one's cognitive activities in learning processes (Veenman et al., 2006) and is positively related to students' academic performances (e.g., Pintrich & De Groot, 1990; Vermunt & Verloop, 1999). It represents "the awareness learners have about their general academic strengths and weaknesses, cognitive resources they can apply to meet the demands of particular tasks, and their knowledge about how to regulate engagements in tasks to optimize learning processes and outcomes" (Win-ne & Perry, 2000, p. 533).

Many researchers report that metacognitive and motivational variables, these variables are positively related (e.g., Bruinsma, 2004; Pintrich, 2000, 2004). In other words, more motivated students are more likely to use a variety of cognitive and metacognitive strategies and are more effective in their effort regulation. Berger and Karabenick (2011) also found evidence for the relatedness between student' motivation and use of learning strategies. More specifically, their research shows no reciprocal, but unidirectional effects between the two constructs: motivation pre-dicts the use of learning strategies, but the use of learning strategies does not pre-dict motivation.

In the present study, the motivational and metacognitive concepts were inves-tigated because of the relevancy for student teachers' academic achievement. Learning environments were created in which teacher educators were expected increase student teachers' SRL opportunities. In these learning conditions, the fol-lowing research questions (see Section 1.1, research question 3) were studied:

- To what extent can teacher educators increase student teachers' SRL opportunities in learning programs?
- In what way does student teachers' use of metacognitive learning strategies change in a learning environment with increased SRL opportunities?
- In what way does student teachers' motivation for learning change in a learning environment with increased SRL opportunities?
- What relationship exists between student teachers' motivation for learning and use of metacognitive learning strategies in a learning environment with increased SRL opportunities?

This chapter continues with a description of the methods used, containing an explanation of the participants, the research instruments, the procedure, data-collection and -analysis. Then, the results of the study are outlined and conclusions for primary teacher education are discussed. Finally, the limitations of the study and indications for future research are formulated.

4.2   Method

4.2.1   Participants

From September 2009 until January 2010, the exploration of the effects of student teachers' increased SRL opportunities on student teachers' motivation for learning and use of metacognitive learning strategies was conducted with 3 teacher educators and 136 first-year (mainly 17-19 year old; average age 17.84 year) student teachers in 2 primary teacher education colleges in the Netherlands. The research was carried out in educational theory courses containing lectures, lessons and moments of guidance. Only teacher educators with a minimum of 10 meetings in the research period and teaching fulltime regular student teachers were allowed to participate. All participating teacher educators volunteered to cooperate.

4.2.2   Instruments

Two instruments were applied in this study: (1) the SRLOQ that enables teacher educators to assess the degree of SRL opportunities they provide to student teachers and (2) the 'Motivation and Metacognition Questionnaire' (MMQ) that measures the level of student teachers' motivation for learning and their use of metacognitive learning strategies. Both instruments are explained hereafter.

4.2.2.1 The 'SRL Opportunities Questionnaire'

Student teachers' SRL opportunities were measured by the SRLOQ (see Appendix 3.A). In the scale development phase of the SRLOQ was first determined which prin-

ciples of the SRL model (see Section 4.1.2) needed further elaboration towards a diagnostic instrument for classroom practice. The principles concerning collaboration (sixth SRL design principle) and the learning task (seventh SRL design principle) were selected for two reasons: (1) these recommendations are directly related to instructional designs for classroom practice, and (2) by incorporating these recommendations in the SRLOQ, the remaining set of 5 more generic SRL recommendations (knowledge building, integration of content matter and metacognitive skills, modelling skills, scaffolding, and conditions) are also put in practice by teacher educators in an indirect matter while applying the SRLOQ.

In the second phase of the scale development, the recommendations concerning collaboration and the learning task were operationalized in potentially relevant items of the questionnaire. Based on a literature review (see Chapter 2) that aimed at formulating SRL design principles for primary teacher education, all selected sources of the review concerning collaboration and the learning task were analysed for the operationalization of the SRLOQ. This screening led to the first selection of items that were included in the SRLOQ in analogous versions for student teachers and teacher educators.

In the final phase of the scale development, the selected items were grouped into 5 potentially relevant scales of the SRLOQ: planning, monitoring of the learning process, zone of proximal development, coaching/judging and collaboration.

In de score validation phase, depth interviews with 5 primary student teachers and 4 primary teacher educators were conducted first. Based on qualitative analyses of the interviews, the SRLOQ was adjusted. Then, 62 primary student teachers and 29 primary teacher educators of one primary teacher education institute in the Netherlands completed the SRLOQ. The data of the score validation phase were quantitatively analysed by performing reliability analyses at the level of the scales of the instrument and correlation analyses at the level of the items within the scales of the questionnaire. The analyses confirmed the five scales of the scale development phase. The final SRLOQ consists of 56 items scored on a five-point Likert scale. Student teachers and teacher educators have to indicate to what extent each item is true for them. In Table 1, an example is given for each SRL scale. Table 1 also outlines the number of items and Cronbach's Alpha's for the different scales for the student teacher's ($\alpha = 0.61\text{-}0.86$) and the teacher educator's version ($\alpha = 0.74\text{-}0.85$) of the questionnaire. In general, these values imply sufficient reliability and homogeneity of items within the scales of the questionnaire.

Table 4.1. SRLOQ scales

Scale	Scale example	Number of items	Cronbach's α Version STs	Cronbach's α Version TEs
Planning	The teacher expects me to make a time plan for working on my learning goals	17	α = 0.84	α = 0.85
Monitoring learning process	The teacher expects me to point out in which areas I need feedback	6	α = 0.81	α = 0.74
Zone of proximal development	The manual describes in what way I can prepare myself for the lessons	12	α = 0.84	α = 0.77
Coaching and Judging	The grading of the assignments by the teacher is based on previously formulated criteria	16	α = 0.86	α = 0.81
Collaboration	During collaboration, the teacher pays attention to specific collaboration skills such as dividing tasks and reporting to each other	5	α = 0.61	α = 0.74

4.2.2.2 The 'Motivation and Metacognition Questionnaire'

Student teachers' motivation for learning and use of metacognitive learning strategies were measured by the MMQ, developed for the present study. The 'Motivated Strategies for Learning Questionnaire' (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991) was applied as a starting point for developing the MMQ for three reasons: (1) the MSLQ distinguishes a metacognition and a motivation part; (2) the MSLQ focuses on the course level of college students (Duncan & McKeachie, 2005); (3) the MSLQ has been applied and validated at different educational levels, including higher education (Montalvo & Torres, 2004). The MSLQ was translated into Dutch and validated by Blom and Severiens (2008) in Dutch schools of general secondary higher education and pre-university education.

In the present study, the translated MSLQ by Blom and Severiens and the original MSLQ by Pintrich were screened for differences. In the metacognition part (the items regarding 'metacognitive self-regulation'), the original MSLQ includes 12 items. In the revised MSLQ, however, only 7 items remained. Because these items do not cover all relevant aspects of metacognition for primary teacher education in depth, 3 items of the original MSLQ were re-added to the MMQ. Furthermore, it was noticed that both versions of the MSLQ only measure for the study process. As a consequence, the distinction between study process, study results and study content, as described in the 'Inventory of Learning Styles' (ILS, Vermunt & Van Rijswijk, 1987), was retained in the MMQ to complete the metacognitive scale. Finally, scale

analysis led to combining study process and study results into one final study process scale with sufficient values of Cronbach's Alpha (0.76).

It was also noted that the motivation part of the original and translated MSLQ does not distinguish between approach and avoidance goals orientation, but only represents a mastery approach orientation (intrinsic goal orientation) and a performance approach orientation (extrinsic goal orientation). As a result, the mastery-avoidance and performance-avoidance items, as proposed and tested by Elliot and Mc Gregor (2001), were analysed. Their 2x2 achievement goal framework was tested in 3 studies, supporting the independence of the 4 achievement goals constructs. Consequently, the mastery-avoidance and performance-avoidance items of the framework were added to the MMQ to complete the motivation scale.

The final MMQ consists of nine scales. For the metacognition part, two scales were distinguished: study process and study content. The motivation section comprises seven scales: intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy, and test anxiety. The final MMQ was completed by 67 student teachers and contains 51 items scored on a five-point Likert scale. Student teachers have to indicate to what extent each item is true for them. In Table 4.2, an example is given for each scale. Table 4.2 also shows the number of items and Cronbach's Alpha's of the different scales (α = 0.72-0.90). These values imply sufficient reliability and homogeneity of items within the scales of the questionnaire. In Appendix 4.A, all items of the MMQ are presented.

Table 4.2. MMQ scales

Scale	Scale example	Number of items	Cronbach's Alpha
Metacognitive learning strategies			
Study process	When studying for this course, I reflect on questions to keep my mind on the job	14	α = 0.76
Study content	Besides the content of the examination, I also study extra literature related to the course	4	α = 0.82
Motivation			
Intrinsic goal orientation	During this course, I prefer challenging subject material so I can learn new things	3	α = 0.73
Extrinsic goal orientation	I want to do better than the average student	7	α = 0.77
Intrinsic goal avoidance	I worry about not getting the full benefit out of this course	3	α = 0.81
Extrinsic goal avoidance	I only want to avoid doing poorly for this course	3	α = 0.72
Task value	I believe I can apply the subject material of this course in practice	4	α = 0.74
Expectancy	I think that I will get good grades for this course	8	α = 0.90
Test anxiety	I suffer from nerves when I take an exam	5	α = 0.89

4.2.3 Procedure

In order to answer the research questions of the study, intervention research was conducted using a mixed methods pre- and post-test design. No control groups were applied because of the difficulty for teacher educators to differentiate in the level of provided SRL opportunities between their student groups. Table 4.3 displays the research design of the intervention study. Student teachers' SRL opportunities, motivation for learning and use of metacognitive learning strategies were measured by respectively the SRLOQ and the MMQ. Teacher educators and student teachers were qualitatively tracked by tutorial conversations (teacher educators) and semi-structured interviews (teacher educators and student teachers). These interventions are further explained in Section 4.2.4.

In this one-group pre- and post-test design, the pre-test (completing both questionnaires) was performed at the end of the third lesson (week 4). At that time, teacher educators and student teachers were expected to be unaware of the increased SRL opportunities that would be applied in the intervention-period and student teachers were expected to be able to indicate their starting level of SRL opportunities. To avoid socially desirable answers, the questionnaires were administered anonymously. By monitoring both teacher educators and student teachers on SRL opportunities rather than teacher educators alone, the statements of both groups could be compared to obtain better interpretable data. After the pre-test, two kinds of treatments were carried out with teacher educators aimed at increasing student teachers' SRL opportunities: (1) training courses after lesson 3 (week 5) and (2) individual tutorial conversations after lesson 4 (week 6). The tutorial conversations were based on analyses of the pre-test.

The intermediate-test (completing the SRLOQ) was performed at the end of the sixth lesson (week 10). Based on analyses of the intermediate-test, tutorial conversations were carried out again after lesson 6 (week 11) aimed at a further increase of student teachers' SRL opportunities. At the end of the last lesson (week 18), the post-test (completing both questionnaires) was conducted. Within five days after the post-test (end of week 18), all teacher educators and a sample of student teachers (3 per teacher educator) were interviewed in depth.

Table 4.3. Research design intervention study

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lessons	x	x		x		x	x			x		x				x	x	X
SRLOQ (TEs and STs)				x						x								X
MMQ (STs)				x						x								X
Course (TEs)					x													
Conversations (TEs)						x					x							
Interviews (TEs and STs)																		X

4.2.4 Data collection and analysis

Student teachers' motivation for learning and their use of metacognitive skills were assessed using quantitative and qualitative methods. Quantitative analyses (correlation analyses, independent-samples t-tests and regression analyses) were based on the data of the pre- and the post-test for all participating teacher educators. The data of the intermediate-test (completing the SRLOQ) were not used for the quantitative analyses because the research period only lasted 10 weeks at that time, a too short period to find preliminary results. However, the gathered data of the intermediate-test did provide the necessary input for the second cycle of tutorial conversations with primary teacher educators. However, the data of the intermediate-test provided the necessary input for the second cycle of tutorial conversations with primary teacher educators.

Qualitative analyses were based on the data of the tutorial conversations and the semi-structured interviews. The first cycle of tutorial conversations with teacher educators was grounded on both teacher educators' SRL planning (a result from the training course) and analyses of the pre-test. The SRLOQ scales (planning, monitoring, zone of proximal development, coaching/judging, collaboration) were the leading themes of the conversations. The concept planning of the teacher educators and analyses of the measured SRL degree as viewed by teacher educators and student teachers, were compared. This comparison resulted in adjusted planning for SRL implementation in classroom practice by teacher educators.

Based on analyses of the intermediate-test, the second cycle of tutorial conversations resulted in adjusted SRL planning for teacher educators. The SRL scales and subscales that could further be improved, as assessed by the SRLOQ, were incorporated in this adjusted planning. In general, the planning aimed at a further increase of student teachers' SRL opportunities in the learning program. In the post-test, all teacher educators and a sample of student teachers (2 per teacher educator) were questioned in semi-structured interviews. The interviews with the student teachers were focused on the way student teachers had experienced the increased SRL opportunities and how these changed learning conditions influenced their motivation for learning and use of metacognitive learning strategies during the research period. The interviews with the teacher educators were based on both teacher educators' SRL planning and analyses of the post-test. The SRL planning of the teacher educators and analyses of the measured SRL degree as viewed by teacher educators and student teachers were compared. The interviews took approximately 45 minutes.

The collected data from questionnaires, tutorial conversations and semi-structured interviews, were analysed and related by triangulation to enhance the internal validity of the results. First, all quantitative and qualitative findings were structured in a matrix containing the scales of the SRLOQ (planning, monitoring of the learning process, zone of proximal development, coaching/judging, collaboration) and the MMQ (metacognition: study process, study content and motivation:

intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy and test anxiety) and, per scale, all different sources of data collection (analyses pre-, intermediate- and post-test as viewed by teacher educators and student teachers). Second, the content of each category was examined and described for each teacher educator separately. Third, similarities and differences in teacher educators' and student teachers' view of SRL opportunities and the consequences for motivation and metacognition were analysed. For this purpose, patterns in teacher educators' and student teachers' knowledge and beliefs were identified and described. These 'patterns' refer to groups of associated statements that give insight into the similarities and differences in the knowledge and beliefs of the teacher educators and student teachers. Finally, the results of the analysis of the data provided by the different instruments were synthesized in order to gain a deeper level of insight into teacher educators' and student teachers' practical knowledge.

4.3   Results

In this section, the four research questions are addressed separately. For each research question, the qualitative and qualitative findings are presented.

To what extent can teacher educators increase student teachers' SRL opportunities in learning programs?

Table 4.4 represents student teachers' SRL opportunities, their use of metacognitive skills and their motivation for learning before (pre-test) and after (post-test) the research period for the three participating teacher educators. Because the questionnaires were administered anonymously, paired-samples t-tests could not be applied to compare the average scores between the pre- and post-test. For that reason, the dynamics in student teachers' SRL opportunities, their use of metacognitive skills and their motivation for learning were analysed by independent-samples t-tests. Since the pre- and post-test samples of the present study are not independent, the independent-samples t-tests were only applied to estimate the significance of the increase of student teachers' SRL, metacognition and motivation. Independent-samples t-tests assume the covariance between the two samples to be zero, which is not the case between our pre- and post-test samples. As a consequence, the estimated significance of the SRL increase is too low and therefore presents minimum values. The degrees of freedom in the independent-samples t-tests varied because the participating student teachers were allowed to skip questions of the questionnaire.

Table 4.4. Results of the independent-samples t-tests for SRL and metacognition/motivation

Table 4.4a (TE 1)

Scale	Points in time	M	SD	t	df	p
SRL opportunities	Pre test	111.48	30.74	3.648	35	0.001[*]
	Post test	145.50	25.92			
Planning	Pre test	26.87	9.88	4.442	49	0.000[*]
	Post test	38.00	6.53			
Monitoring of the learning process	Pre test	11.06	5.76	2.864	54	0.006[*]
	Post test	15.14	4.18			
Zone of proximal development	Pre test	32.35	5.89	1.354	39	0.183
	Post test	34.81	6.74			
Coaching/judging	Pre test	28.88	11.21	4.432	44	0.000[*]
	Post test	41.60	8.24			
Collaboration	Pre test	13.44	3.71	3.264	45	0.002[*]
	Post test	16.73	3.72			
Metacognition	Pre test	47.47	7.50	2.566	35	0.015[**]
	Post test	55.00	10.55			
Motivation	Pre test	103.15	11.73	1.380	25	0.180
	Post test	108.89	10.96			
Expectancy	Pre test	21.84	4.31	2.077	40	0.044[**]
	Post test	24.87	5.14			

[*] significance: p < 0.01
[**] significance: p < 0.05

Table 4.4b (TE 2)

Scale	Points in time	M	SD	t	df	p
SRL opportunities	Pre test	123.93	28.23	3.497	107	0.001*
	Post test	141.17	24.80			
Planning	Pre test	31.18	8.62	1.808	136	0.073
	Post test	33.64	7.53			
Monitoring of the learning process	Pre test	11.66	4.48	3.587	140	0.000*
	Post test	14.29	4.51			
Zone of proximal development	Pre test	30.12	6.14	4.799	140	0.000*
	Post test	34.62	5.13			
Coaching/judging	Pre test	33.00	10.99	4.743	134	0.000*
	Post test	41.31	8.78			
Collaboration	Pre test	15.21	3.49	5.094	152	0.000*
	Post test	17.88	3.08			
Metacognition	Pre test	48.80	9.69	1.266	134	0.208
	Post test	50.99	11.41			
Motivation	Pre test	107.24	9.90	1.334	112	0.185
	Post test	109.64	10.68			
Expectancy	Pre test	24.45	4.32	2.041	149	0.043**
	Post test	25.83	4.03			

[*] significance: p < 0.01
[**] significance: p < 0.05

Table 4.4c (TE 3)

Scale	Points in time	M	SD	t	df	P
SRL opportunities	Pre test	143.22	34.77	4.128	63	0.000[*]
	Post test	172.10	16.05			
Planning	Pre test	33.73	11.21	4.262	70	0.000[*]
	Post test	42.74	4.07			
Monitoring of the learning process	Pre test	15.20	5.19	3.228	75	0.002[*]
	Post test	18.55	3.35			
Zone of proximal development	Pre test	35.14	6.76	2.365	73	0.021[**]
	Post test	38.39	4.60			
Coaching/judging	Pre test	41.77	12.37	3.824	67	0.000[*]
	Post test	51.10	5.72			
Collaboration	Pre test	17.34	3.58	3.868	78	0.000[*]
	Post test	20.15	2.56			
Metacognition	Pre test	54.17	10.18	2.596	57	0.012[**]
	Post test	60.55	10.62			
Motivation	Pre test	108.66	9.86	0.319	54	0.751
	Post test	109.47	11.56			
Expectancy	Pre test	26.30	3.52	1.354	49	0.182
	Post test	27.68	4.94			

[*]significance: $p < 0.01$
[**] significance: $p < 0.05$

Qualitative analyses indicated that teacher educators could distinguish and became more conscious of the five SRL scales. The results of t-tests and qualitative analyses also showed the close connection between the five SRL scales. Although teacher educators often planned to increase SRL opportunities on a selected number of SRL constructs, student teachers' general SRL opportunities increased significantly at the 0.01 significance level for teacher educator 1 (t = 3.648), teacher educator 2 (t = 3.497) and teacher educator 3 (t = 4.128). Similarly, all sub-scales within SRL-opportunities increased significantly at the 0.01 level as well. The first exception was the 'Zone of proximal development' scale that increased significantly at the 0.05 significance level (t = 2.365) for teacher educator 3 and demonstrated no significant increase for teacher educator 1 (t = 1.354). Similarly, the 'Planning' scale of teacher educator 2 did not increase significantly (t = 1.808). In short, after being trained, teacher educators are able to increase student teachers' SRL opportunities in pre-service educational learning programs.

In what way does student teachers' use of metacognitive learning strategies change in a learning environment with increased SRL opportunities?

The relationships between SRL opportunities, the use of metacognitive skills and motivation for learning were first studied by means of correlational analysis, based on the data of all participating teacher educators (Table 4.5). Student teachers' SRL opportunities were positively correlated to the use of metacognitive skills at the 0.01 significance level to a strong extent (r = 0.937). The same was true for all separate constructs within SRL opportunities (r varied between 0.837 and 0.959). In addition, qualitative analyses indicated that student teachers were often not aware of their use of metacognitive skills. Moreover, student teachers' need for more explicit metacognitive strategy instruction was identified.

Table 4.5. Pearson correlation coefficient between SRL and metacognition/motivation

Scale	Metacognition	Motivation	Expectancy
SRL opportunities	0.937[*]	0.771[**]	0.881[*]
Planning	0.913[*]	0.759[**]	
Monitoring of the learning process	0.959[*]	0.756[**]	
Zone of proximal development	0.870[*]	0.624	
Coaching/judging	0.933[*]	0.808[*]	
Collaboration	0.837[*]	0.693[**]	
Metacognition		0.663	
Study process		0.717[**]	
Study content		0.535	

* significance: p < 0.01
** significance: p < 0.05

Second, independent-samples t-tests were applied to show the statistical significance of metacognitive differences between the pre- and the post-test (Table 4.4). Student teachers' use of metacognitive learning strategies increased significantly for teacher educator 1 (t = 2.556) and teacher educator 3 (t = 2.596) at the 0.05 significance level. There was no significant increase of student teachers' use of metacognitive learning strategies for teacher educator 2 between the pre- and post-test (t = 1.266). In short, student teachers' use of metacognitive skills was raised to a higher level for two of the three teacher educators after increasing the SRL opportunities in educational pre-service programs.

Finally, regression analyses were performed to investigate whether student teachers' level of SRL opportunities predicted their use of metacognitive learning strategies. Table 4.6 displays the results of regression analyses with SRL opportunities as the independent variable and the use of metacognitive skills as the dependent variable. The results indicate that the degree of SRL opportunities is a significant positive predictor of the metacognition score at the 0.01 significance level (B = 0.201). Hence, student teachers that receive more SRL opportunities apply more metacognitive learning strategies.

Table 4.6. Regression analyses with SRL as the independent variable and metacognition/motivation as the dependent variables

	T	P	B
SRL opportunities			
(Constant)	5.878	0.001	23.964
Metacognition [a]	7.127	0.000*	0.201
SRL opportunities			
(Constant)	19.987	0.000	93.430
Motivation [b]	3.200	0.015**	0.103

[*] significance: $p < 0.01$
[**] significance: $p < 0.05$

> *In what way does student teachers' motivation for learning change in a learning environment with increased SRL opportunities?*

The relationship between SRL opportunities and motivation was firstly studied by means of correlational analyses, based on the data of all participating teacher educators (Table 4.5). The relationship between SRL opportunities and motivation was shown to be significantly positive at the 0.05 significance level to a strong extent (r = 0.771). The separate constructs within SRL opportunities also correlated significantly positive to a strong extent with motivation at the 0.01 significance level for coaching/judging (r = 0.808) and at the 0.05 significance level for planning (r = 0.759), monitoring (r = 0.756) and collaboration (r = 0.693). The only exception was the 'zone of proximal development' that showed no significant correlations with motivation (r = 0.624).

Secondly, independent-samples t-tests showed no statistical significance of the differences between the degree of student teachers' motivation for learning before (pre-test) and after (post-test) increasing student teachers' SRL opportunities in the curriculum (Table 4.4). By contrast, the expectancy component within the motivation scale did increase significantly at the 0.05 significance level for teacher educator 1 (t = 2.007) and teacher educator 2 (t = 2.041) after the SRL treatments. For that reason, the correlation between SRL opportunities and expectancy was analysed (Table 4.5) and proved to be positively significant at the 0.01 significance level (r = 0.881). Qualitative analyses also indicated that student teachers appreciated the SRL increase and felt more confident towards the transfer from theory to their own practise, the assignments and the final test. Nevertheless, in line with the findings of the literature review (see Chapter 2), student teachers also stressed the important role of the teacher in providing a sufficient knowledge base to avoid uncertainty.

Finally, Table 4.6 indicates the results of regression analyses with SRL opportunities as the independent variable and motivation for learning as the dependent variable. The results indicate that the amount of SRL opportunities was a significant positive predictor of the motivation score at the 0.05 significance level (*B* = 0.103*).*

To recapitulate, student teachers that receive more SRL opportunities in educational programs are more motivated towards learning.

> *What relationship exists between student teachers' motivation for learning and use of metacognitive learning strategies in a learning environment with increased SRL opportunities?*

The relationship between the use of metacognitive skills and motivation for learning was studied by means of correlational analysis (Table 4.5). The results showed no significant correlation (r = 0.663) between metacognition and motivation. So, contrary to the theoretical findings, no relationships were shown between student teachers' motivation for learning and their use of metacognitive learning strategies. The same goes for the relationship between study content (the second sub scale within metacognition) and motivation for learning that displayed no significant correlation (r = 0.535). However, the relationship between study process (the first sub scale within metacognition) and motivation for learning showed significant correlations at the 0.05 significance level (r = 0.717).

To summarize, student teachers' use of metacognitive learning strategies increased significantly in learning environments with increased SRL opportunities for teacher educator 1 and 3. In addition, qualitative analyses identified student teachers' need for more explicit metacognitive strategy instruction. Although the amount of SRL opportunities was shown to be a significant predictor of motivation, student teachers' motivation for learning did not increase significantly in the research period. Student teachers' expectancy did however show a significant increase during the research period. Similarly, qualitative analyses revealed that student teachers appreciated the SRL increase and felt more confident towards the transfer from theory to their own classroom practice, the assignments and the final test: "Because we cooperated actively, we were forced to think about the subject matter of teaching, resulting in better remembrance and more confidence". The relationship between student teachers' motivation for learning and their use of metacognitive learning strategies appeared significant between the metacognitive study process part and motivation for learning.

4.4   Conclusions and discussion

The present study measured dynamics of student teachers' use of metacognitive learning skills and motivation for learning in learning environments with increased SRL opportunities. With training, teacher educators were able to increase student teachers' SRL opportunities in primary teacher education. The results show that student teachers' use of metacognitive skills increased significantly in learning environments with increased SRL opportunities for 2 of the 3 participating teacher edu-

cators. This may indicate that teacher educators can influence student teachers' use of metacognitive learning strategies in a short period (one semester), but more evidence is required. Subsequently, qualitative analyses indicated student teachers' need for more explicit metacognitive strategy instruction. These findings correspond with the recommendations of Veenman et al. (2006) and the literature review of the present thesis (see Chapter 2) that indicate the necessity for primary teacher educators to explicitly model metacognitive learning strategies to their student teachers. By modelling metacognitive skills, teacher educators can make their teaching more explicit and improve the transfer between theory and educational practice. This means that the teaching procedures challenge students' thinking and their thinking about thinking. During modelling, the four steps as distinguished by Schunk and Zimmerman (2007) can be used: (1) observation: learners can induce the major features of the skill from watching a model learn or perform; (2) emulation: the learner imitates performances of a model's skill with social assistance; (3) self-control: the learner independently shows a model's skill under structured conditions; and (4) self-regulation: the learner shows an adaptive use of skills across changing personal and environmental conditions.

Student teachers' motivation for learning was also enhanced in learning environments with increased SRL opportunities, but this relationship was less strong than the relationship between SRL opportunities and the use of metacognitive skills. One reason for the absence of motivation effects may be that the temporal interval in the present study was too brief for the effects to be detected. However, the increase of student teachers' expectancy, a component within the motivation scale, was shown to be significant. Student teachers appreciated the increased SRL opportunities in the curriculum. They felt more confident in using the provided knowledge and skills in their own classrooms and towards the assignments and the final test. Nevertheless, they also stressed the importance for teacher educators to provide an adequate knowledge base to avoid uncertainty. For example, student teachers like to know the criteria for judging their work in advance. Therefore, teacher educators are advised to focus on knowledge building in the domain, including both metacognitive skills and content matter (see Sections 2.3.2.1 and 2.3.2.2). Hence, it is important for teacher educators to strike a balance between teacher-centred and student-centred learning in the curriculum, gradually moving from teacher to student regulation of the learning process.

In line with earlier research (e.g., Eccles & Wigfield, 2002; Pintrich, 2000, 2004), the present study confirmed the assumed positive relationships between the use of metacognitive learning skills (in our study only the metacognitive study process part) and motivation for learning. These interacting components influence students' involvement with their learning and, consequently, academic performance.

In conclusion, this study revealed that teacher educators were able to increase student teachers' SRL opportunities in the curriculum after being trained. Moreover,

it was demonstrated that SRL opportunities in learning environments are strongly related to student teachers' use of metacognitive skills and also enhance student teachers' motivation for learning, both important constructs for their academic career. However, if student teachers have ideas about and preferences for learning and teaching that are contrary to appreciating process-oriented learning, it is not likely they will engage in SRL activities (Loyens, 2007). Also, learners are not always motivated to invest much time and energy in developing adequate learning skills (Van Hout-Wolters, Simons, & Volet, 2000). Qualitative analyses of the present study indicated that, although important for learning, SRL imposes a substantial burden on student teachers and asks for a high responsibility of learners. Therefore, increasing primary student teachers' SLR opportunities does not automatically result in a different attitude towards learning and more use of metacognitive learning strategies by student teachers. To achieve such a positive attitude, it is important to consider the process-oriented design principles (see Figure 2.1). In this way, student teachers' conceptions can turn in favour of SRL, resulting in more successful learning in school and beyond.

A first limitation of the present study is that no control group was assessed. The point of reference used was the starting situation of student teachers' SRL opportunities. Other experiences by teacher educators and student teachers between the pre- and post-test might have influenced the results of the study. Furthermore, all participating teacher educators volunteered to cooperate and can therefore not be regarded as a fully representative sample of the population. Third, although all selected teacher educators taught the same course for first-year fulltime student teachers, the subjects within the courses differed. This might have influenced the effects on student teachers' motivation and metacognition. Finally, the small sample of participating teacher educators might have limited the generalizability of the results. Therefore, in a follow-up study, the number of teacher educators is increased up to 11 teacher educators in 5 primary teacher education colleges. This main study is described in Chapter 5.

Appendix 4.A. Motivation and Metacognition Questionnaire

Scales MMQ	Sub-scales	Scale items of the MMQ
Metacognition	**1.1 Study process**	1.1.1 When studying for this course, I reflect on questions to keep my mind on the job.
		1.1.2 Before I study new course material thoroughly, I often skim it to see how it is organized.
		1.1.3 I try to change the way I study in order to fit the course requirements.
		1.1.4 I try to think through a topic and decide what I am supposed to learn from it rather than just reading it oven when studying for this course.
		1.1.5 When studying for this course, I try to determine which concepts I don't understand well.
		1.1.6 When studying for this course, I set goals for myself in order to direct my activities in each study period.
		1.1.7 If I get confused taking notes in this class, I make sure I sort it out afterwards.
		1.1.8 When I become confused about something I'm reading or this class, I go back and try to figure it out.
		1.1.9 If course readings are difficult to understand, I change the way I read the material.
		1.1.10 I ask myself questions to make sure I understand the material I have been studying in this class.
		1.1.11 When studying for this course, I also focus on my own learning goals.
		1.1.12 To test my learning progress after studying the whole course, I try to summarize the subject matter in my own words.
		1.1.13 To test whether I manage the course material, I try to think of other examples and problems than provided by the course material or the teacher.
		1.1.14 To test my learning progress after studying a part of the course, I summarize the subject matter in my own words.
	1.2 Study content	1.2.1 Besides the content of the examination, I also study extra literature related to the course.
		1.2.2 I do more than required in the course.
		1.2.3 I add other sources to the learning material of the course.
		1.2.4 when I study a text hat I do not understand, I search for other literature on the subject matter.
2. Motivation	**2.1 Intrinsic goal orientation**	2.1.1 In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.
		2.1.2 The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
		2.1.3 During this course, I prefer challenging subject material so I can learn new things.
	2.2 Extrinsic goal orientation	2.2.1 I want to do better than the average student.

		2.2.2 I dislike bad grades on my tests and want to do better next time.
		2.2.3 Getting a good grade in this class is the most satisfying thing for me right now.
		2.2.4 My main concern in this class is getting a good grade.
		2.2.5 I like it when the test results of this course are shown on the bulletin board so I can see how well I've done.
		2.2.6 I always learn for a good grade, whether I like the course material or not.
		2.2.7 I want to do well in this class because it is important for me to show my abilities to others.
	2.3 Intrinsic goal avoidance	2.3.1 I worry about not getting the full benefit out of this course.
		2.3.2 Sometimes I'm afraid that I may not understand the content of this class, as thoroughly as I'd like.
		2.3.3 I am often concerned that I may not learn all that there is to learn in this class.
	2.4 Extrinsic goal avoidance	2.4.1 I just want to avoid doing poorly for this course.
		2.4.2 My goal in this class is to avoid performing poorly.
		2.4.3 My fear of performing poorly in this class is often what motivates me.
	2.5 Task value	2.5.1 I am very interested in the content area of this course.
		2.5.2 I like the subject matter of this course.
		2.5.3 It is important for me to understand the course material in this class.
		2.5.4 I believe I can apply the subject material of this course in practice.
	2.6 Expectancy	2.6.1 I think that I will get good grades for this course.
		2.6.2 I'm certain I can understand the most difficult material presented in this course.
		2.6.3 I'm confident I can learn the basic concepts taught in this course.
		2.6.4 I'm confident I can understand the most complex learning material presented by the teacher of this course.
		2.6.5 I'm confident I can do an excellent job on the assignments and tests in this course.
		2.6.6 I expect to do well in this class.
		2.6.7 I'm certain I can master the skills being taught in this class.
		2.6.8 Considering the requirements of this course, the teacher, and my skills, I think I can do well in this class.
	2.7 Test anxiety	2.7.1. When I take a test, I think about how poorly I'm doing compared with other students.
		2.7.2 When I take a test I think about items on other parts of the test I can't answer.
		2.7.3 When I take a test I think of the consequences of failing.
		2.7.4 I have an uneasy, upset feeling when I take an exam.
		2.7.5 I suffer from nerves when I take an exam.

Chapter 5

Self-regulated learning, metacognitive and motivational development: The main study

Abstract

This intervention study focused on the relationships between student teachers' self-regulated learning (SRL) opportunities, their use of metacognitive learning strategies and their motivation for learning. Results indicate that student teachers' use of metacognitive learning strategies increases significantly in learning environments with increased SRL opportunities. In opposite to these findings, no significant difference was shown between student teachers' motivation for learning before and after the research period. However, student teachers' expectancy, a component within the motivational construct, did increase significantly in the research period. Finally, minor significant positive correlations were found between the metacognitive and motivational constructs measured. In general, the level of SRL opportunities turns out to be a moderate predictor of student teachers' use of metacognitive learning strategies and motivation for learning, both important constructs for their academic career.

5.1   Introduction

This chapter describes an intervention study that focused on the relationships be-tween primary student teachers' (i.e., prospective primary teachers) self-regulated learning (SRL) opportunities, their use of metacognitive learning strategies and their motivation for learning, both important constructs for student teachers' academic success.

5.1.1   Primary teacher education and SRL

Most teacher education programs have traditionally been based on teaching subject knowledge and training teaching skills (Kremer-Hayon & Tillema, 1999). However, researchers and practitioners in teacher education are increasingly confronted with the lack of transfer from theory to practice. In other words, primary student teach-ers are often not able to translate the provided knowledge and skills throughout their initial training in actual teaching practices in the schools (Korthagen, Klaassen, & Russell, 2000).

In response to this problem, primary teacher educators (i.e., teachers of pro-spective primary teachers) nowadays are striving to increase student teachers' SRL opportunities in educational pre-service programs (Lunenberg & Korthagen, 2003). In a society that requires lifelong learning, the ability to steer one's own learning is becoming more and more important to be successful in academic as well as in non-academic contexts (Kremer-Hayon & Tillema, 1999). In general, SRL is defined as 'an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognitions, motivation, and behav-iour, guided and constrained by their goals and the contextual features in the envi-ronment (Pintrich, 2000, p. 453). Students in higher education who can better regu-late their academic functioning are more successful in learning, problem solving, transfer and academic achievement in general (Nota, Soresi, & Zimmerman, 2004; Sundre & Kitsantas, 2004; Valle et al., 2003; VanderStoep, Pintrich, & Fagerlin, 1996). This may also be the case with students in teacher education.

As a consequence, primary teacher educators are increasingly urged to renew their teaching concepts to encourage student teachers to demonstrate a high de-gree of SRL by learning as professionals, constructing their practical knowledge, developing an attitude of reflective inquiry and experimenting with ideas and teach-ing skills (Kremer-Hayon & Tillema, 1999). To support teacher educators in this SRL implementation process, seven process-oriented design principles were formulated in the present thesis (see Section 2.3), summarized in an SRL model for primary teacher education (see Figure 2.1). The recommendations of this SRL model point out the importance: (1) to create a sufficient knowledge base for student teachers in the domain (subject area); (2) to facilitate this knowledge building by integrating

the necessary metacognitive skills and content matter during teaching; (3) to model these metacognitive skills by using four regulatory skill levels, namely observation, emulation, self-control and self-regulation; (4) to gradually develop from teacher control to student control over learning processes (scaffolding); (5) to be aware of the conditional factors that can hinder or foster SRL development; (6) to engage student teachers in collaborative learning environments; and (7) to pay attention to the relevant SRL aspects of the learning task (goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgments, attributions, task value activation and time management). The model was applied in primary teacher education and first findings demonstrate that the model provides more insight for teacher educators into relevant SRL aspects (see Chapter 4).

5.1.2 *Relevant SRL concepts for student teachers' academic success*

Recent models of SRL include motivational beliefs or attitudes together with cognitive and metacognitive learning strategies (Wolters, 2003). Pintrich (2000, 2004), for example, demonstrates motivation as a key factor of SRL that is infused throughout all four phases: (1) forethought, planning, and activation, (2) monitoring, (3) control, (4) reaction and reflection. Motivational variables interact with cognitive, behavioural, and contextual factors to affect SRL and conceptual change. For example, self-regulated learners show more self-efficacy for learning than students with poorer SRL skills; the former believe that they can use their SRL skills to help them learn (Zimmerman, 2000). In such socio-cognitive approaches of SRL, the cognitions, motivations and learning of individuals cannot be comprehended unless social and cultural context, such as support from teachers and feedback from peers, are taken into consideration (Järvelä, Järvenoja, & Veermans, 2008).

Motivation can be seen as either a product or a process (Wolters, 2003). When viewed as a product, students have a level of motivation that they experience and that influences their choice, effort and persistence regarding a particular activity. When viewed as a process, motivation refers not just to an end state but also the means through which that state is determined. In other words, motivational tendencies change during learning in classroom practice (Järvelä et al., 2008) and students can learn to regulate their motivational state (Wolters, 2003).

For example, academic goals are regarded as important variables in current motivational research because goals serve as self-defining reference points that determine the further processes of SRL, such as planning, executing and monitoring (Schunk & Ertmer, 2000; Zimmerman, 1999). Goals are cognitive representations of the various aims that students can adopt in different achievement situations (Valle et al., 2003).

In the literature on goal orientations, a general distinction is drawn between mastery and performance goals (Elliot & Mc Gregor, 2001; Schunk, 2005). Mastery goals reflect a focus on the acquisition of knowledge, skill, and competence relative to one's prior performance; performance goals involve a striving to demonstrate competence by outperforming peers. In line with Pintrich (2000), Elliot and Mc Gregor (2001) adopted a multiple goals perspective on motivation by crossing this mastery-performance dimension with an approach-avoid dimension according to whether students were attempting to approach or avoid the goals. Mastery-approach goals concern working on tasks to develop skills. Mastery-avoid goals might involve avoiding the possibility of not meeting high standards. Performance-approach goals include a focus on outperforming others. Performance-avoid goals entail a concern with avoiding the demonstration of low ability. Research has identified self-regulatory benefits of mastery-approach goals (Schunk, 2005) such as better cognitive monitoring and use of learning strategies while engaged in academic learning.

In general, students who display more adaptive SRL strategies demonstrate better learning and higher motivation for learning (Schunk, 2005), finally resulting in higher academic achievement (e.g., Bruinsma, 2004; Pintrich, 2000, 2004). When it comes to primary teacher education, the findings of the pilot study of the present dissertation (see Section 4.3) also showed significant positive relations between SRL opportunities and motivation for learning to a strong extent. Although the level of SRL opportunities was a significant positive predictor of the motivational score, student teachers' level of motivation did not increase significantly in the research period (one semester). By contrast was shown that the expectancy component within the motivational scale did increase significantly for 2 of the 3 teacher educators after the SRL treatments. The expectancy scale includes control belief and self-efficacy for learning and performance, e.g., 'I think that I will get good grades for this course'.

At the same time, self-regulated learners are able to apply a large arsenal of cognitive learning strategies in academic tasks. Pintrich (2000, 2004), for example, distinguishes rehearsal, organization, and elaboration as cognitive learning strategies in his SRL model. Moreover, when it comes to the metacognitive concept in SRL, its role is generally acknowledged as critical in constructivist views of learning (e.g., Butler, 2002; Efklides, 2006; Zimmerman & Schunk, 2001). In the context of primary teacher education, the findings of the pilot study of the present thesis (see Section 4.3) also demonstrated that student teachers' use of metacognitive skills increased significantly for 2 of the 3 participating teacher educators in learning environments with increased SRL opportunities. Some theorists view SRL as a subordinate component of metacognition whereas others regard SRL as a superordinate to metacognition (Veenman, Van Hout-Wolters, & Afflerbach, 2006). In line with Muis and Franco (2010), the present study explores metacogniton from a regulation of cognition perspective, situated as a subordinate to SRL.

Metacognition can be defined as the knowledge about and the regulation of one's cognitive activities in learning processes (Veenman et al., 2006). It represents 'the awareness learners have about their general academic strengths and weaknesses, cognitive resources they can apply to meet the demands of particular tasks, and their knowledge about how to regulate engagements in tasks to optimize learning processes and outcomes' (Winne & Perry, 2000, p. 533). Such active and self-regulated strategy use is found positively related to achievement (e.g., Pintrich & De Groot, 1990; Zimmerman & Pons, 1988). The use of metacognitive skills enables students to become aware of and monitor their progress towards their goals. In this way, they can improve their learning and comprehension. As a result, students can realize any adaptive changes in their learning (Vermunt & Verloop, 1999).

Many researchers indicate that student motivation and use of learning strategies are related (Bruinsma, 2004; Eccles & Wigfield, 2002; Pintrich, 2000, 2004; Pintrich & De Groot, 1990). In the case of primary teacher education, the pilot study of the present thesis (see Section 4.3) also found significant positive relations between student teachers' study process (one of the two sub scales within metacognition) and motivation for learning. In other words, more motivated students are more likely to use more cognitive and metacognitive strategies and are more effective in their effort regulation. Berger and Karabenick (2011) also found evidence for the relatedness between student' motivation and use of learning strategies. More specific, their research shows no reciprocal, but unidirectional effects between the two constructs: motivation predicts the use of learning strategies, but the use of learning strategies does not predict motivation.

5.1.3   Problem definition

Although primary student teachers are increasingly required to self-regulate their' learning, the consequences of these increased SRL opportunities for student teachers' academic success have not been measured on a large scale so far. Therefore, the present study explored dynamics of primary student teachers' use of metacognitive learning strategies and motivation for learning in learning environments with increased SRL opportunities. As stated earlier, these two concepts are relevant in determining academic performance.

The socio-cognitive models of SRL, as described in Section 5.1.2, were the starting points to focus on in the present study. Both the individual and the social context were targets for data collection and analyses. The measurement of SRL, motivation and metacognition was considered from a process-oriented approach (Järvelä et al., 2008) and therefore observed as an integral part of the overall process during the course of all learning activities.

Based on theory and the results of the intervention pilot study (see Section 4.3), the following hypotheses (see Section 1.1, research question 3) were investigated in the present study:

1. Student teachers' use of metacognitive learning strategies increases significantly during one semester in learning environments with increased SRL opportunities.
2. Student teachers' motivation for learning increases significantly during one semester in learning environments with increased SRL opportunities.
3. Student teachers' motivation for learning is significantly related to student teachers' use of metacognitive learning strategies.

This chapter continues with a description of the methods used, containing an explanation of the participants, the research instruments, the procedure, data collection and analysis. Then, the results of the study are outlined and conclusions for primary teacher education are discussed. Finally, the limitations of the study and indications for future research are formulated.

5.2 Method

5.2.1 Participants

From January 2010 until June 2010, the exploration of the effects of student teachers' increased SRL opportunities on student teachers' use of metacognitive learning strategies and their motivation for learning was conducted with 11 teacher educators and 257 (36 Males and 221 females) second-year (mainly 18-20 year old; mean age 18.94 year) student teachers of 17 student groups in 5 primary teacher education colleges in the Netherlands. Two of the 5 participating teacher education institutes were independent institutes. The other 3 institutes were part of larger higher education institutes. All institutes were located in the eastern, southern and western parts of the Netherlands.

The research was carried out in educational theory courses containing lectures, lessons and moments of guidance. Only teacher educators with a minimum of 10 lessons in the research period and teaching fulltime regular student teachers were allowed to participate. All participating teacher educators volunteered to cooperate. The 17 groups of student teachers were relatively similar in terms of their age, gender and level of education. Student teachers' former level of education comprised lower general, followed by senior secondary education (low level, N = 32), higher general secondary education (middle level, N = 219), and pre-university education (high level, N = 6).

5.2.2 Instruments

In Chapters 2 and 3 of this dissertation, the development of two instruments for primary teacher education was described: (1) the 'SRL Opportunities Questionnaire' (SRLOQ) that enables teacher educators to measure the degree of SRL opportunities they provide to student teachers (see Appendix 3.A), and (2) the 'Motivation and Metacognition Questionnaire' (MMQ) that measures the level of student teachers' motivation for learning as well as their use of metacognitive learning strategies (see Appendix 4.A).

The development of the SRLOQ was based on a theoretical review study (see Chapter 2) that resulted in seven process-oriented design principles, representing relevant SRL categories for primary teacher education (see Figure 2.1). In Section 3.2, these categories were divided into specific aspects and operationalized in potentially relevant items of the questionnaire. Then, these items were screened for their relevance in primary teacher education and their possible overlap and gaps with other items, leading to a final selection of items, in analogous versions for student teachers and teacher educators.

The SRLOQ was completed by 62 first- and second-year student teachers and 29 teacher educators and categorizes items into 5 different SRL scales: planning (Cronbach's α = 0.84; sample item: 'The teacher expects me to make a time plan for working on my learning goals'), monitoring of the learning process (Cronbach's α = 0.81; sample item: 'The teacher expects me to point out in which areas I need feedback'), zone of proximal development (Cronbach's α = 0.84; sample item: 'The manual describes in what way I can prepare myself for the lessons'), coaching/judging (Cronbach's α = 0.86; sample item: 'The grading of the assignments by the teacher is based on previously formulated criteria') and collaboration (Cronbach's α = 0.61; sample item: 'During collaboration, the teacher pays attention to specific collaboration skills such as dividing tasks and reporting to each other'). The SRLOQ consists of 56 items scored on a five-point Likert scale. Student teachers have to indicate to what extent each item is true for them.

For the development of the MMQ, the 'Motivated Strategies for learning Questionnaire' (MSLQ, Pintrich et al., 1991) was used as a starting point for three reasons: (1) it distinguishes a motivational and a metacognitive part; (2) it focuses on the course level of college students; and (3) it has been applied and validated at different educational levels, including higher education. The MSLQ was translated into Dutch and validated by Blom and Severiens (Blom & Severiens, 2008; Blom, Severiens, Broekkamp & Hoek, 2005) in Dutch schools of general secondary higher education and pre-university education.

In the pilot study (see Section 4.2.2.2), the translated MSLQ by Blom and Severiens and the original MSLQ by Pintrich et al. were analysed on differences. In the metacognition part (the items regarding 'metacognitive self-regulation'), it was noticed that both versions of the MSLQ only measure for the study process. As a

consequence, the distinction between study process, study results and study content, as described in the 'Inventory of Learning Styles' (ILS, Vermunt & Van Rijswijk, 1987), was retained in the MMQ to complete the metacognitive construct. Finally, scale analysis led to combining study process and study results into one final study process construct with sufficient value of Cronbach's Alpha (0,76).

Furthermore, in the motivation part of the original and translated MSLQ was noted that the MSLQ does not distinguish between approach and avoidance goals orientation, but only represents a mastery approach orientation (intrinsic goal orientation) and a performance approach orientation (extrinsic goal orientations). As a result, the mastery-avoidance and performance-avoidance items, as proposed and tested by Elliot and Mc Gregor (2001), were analysed. Their 2 x 2 achievement goal framework was tested in 3 studies, supporting the independence of the 4 achievement goal constructs. As a result, the mastery-avoidance and performance-avoidance items of the framework were added to the MMQ to complete and improve the motivational construct.

For the metacognition part, two scales were distinguished: study process (Cronbach's α = 0.76; sample item: 'When I study for this course, I reflect on questions to keep my mind on the job') and study content (Cronbach's α = 0.82; sample item: 'Besides the content of the examination, I also study extra literature related to the course'). The motivation section comprises seven scales: intrinsic goal orientation (Cronbach's α = 0.73; sample item: 'During this course, I prefer challenging subject material so I can learn new things'), extrinsic goal orientation (Cronbach's α = 0.77; sample item: 'I want to do better than the average student'), intrinsic goal avoidance (Cronbach's α = 0.81; sample item: 'I worry about not getting the full benefit out of this course'), extrinsic goal avoidance (Cronbach's α = 0.72; sample item: 'I only want to avoid doing poorly for this course', task value (Cronbach's α = 0.74; sample item: 'I think the course material in this class is useful for me to learn'), expectancy (Cronbach's α = 0.90; sample item: 'I think that I will get good grades for this course ') and test anxiety (Cronbach's α = 0.89; sample item: 'I suffer from nerves when I take an exam'). The MMQ was completed by 67 student teachers and contains 51 items scored on a five-point Likert scale. Student teachers have to indicate to what extent each item is true for them.

In general, the values of Cronbach's Alpha's for the different scales of both questionnaires imply reasonable reliability and homogeneity of items within the scales. Consequently, both instruments were used in the present study.

5.2.3 Procedure

In order to answer the research questions of the present study, an intervention study was conducted using a mixed methods pre- and post-test design. No control groups were used because of the difficulty for teacher educators to differentiate in

the level of provided SRL opportunities between their student groups. Table 5.1 visualizes the research design of the intervention study. Student teachers' SRL opportunities, motivation for learning and use of metacognitive learning strategies were measured with respectively the SRLOQ and the MMQ. Teacher educators and student teachers were qualitatively tracked by tutorial conversations (teacher educators) and semi-structured interviews (teacher educators and student teachers).

Table 5.1. Research design intervention study

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Lessons	x	x		x		x	x			x		x				x	x	x
SRLOQ (TEs and STs)				x						x								x
MMQ (STs)				x														x
Course (TEs)					x													
Conversations (TEs)						x					x							
Interviews (TEs and STs)																		x

In this one-group pre- and post-test design, the pre-test (completing both questionnaires) was performed at the end of the third lesson (week 4). At that time, teacher educators and student teachers were expected to be unaware of the increased SRL opportunities that would be applied in the intervention-period and student teachers were expected to be able to indicate their starting level of SRL opportunities. By monitoring both teacher educators and student teachers on SRL opportunities rather than teacher educators alone, the statements of both groups could be compared to obtain better interpretable data. After the pre-test, two kinds of treatments were carried out with teacher educators aimed at increasing student teachers' SRL opportunities: (1) training courses after lesson 3 (week 5) and (2) individual tutorial conversations after lesson 4 (week 6). The tutorial conversations were based on analyses of the pre-test.

The intermediate-test (completing the SRLOQ) was performed at the end of the sixth lesson (week 10). Based on analyses of the intermediate-test, tutorial conversations were carried out again after lesson 6 (week 11) aimed at a further increase of student teachers' SRL opportunities.

At the end of the last lesson (week 18), the post-test (completing both questionnaires) was conducted. Within five days after the post-test (end of week 18), all teacher educators and a sample of student teachers were interviewed in depth.

5.2.4   Data collection and analysis

Student teachers' motivation for learning and their use of metacognitive skills were assessed using both quantitative and qualitative methods. Quantitative analyses (correlation analyses, independent-samples t-tests, paired-samples t-tests and re-

gression analyses) were based on the data of the pre- and the post-test for all participating teacher educators. The data of the intermediate-test (completing the SRLOQ) were not used for the quantitative analyses because the research period only lasted 10 weeks at that time, a too short period to find preliminary results. However, the gathered data of the intermediate-test did provide the necessary input for the second cycle of consulting conversations with primary teacher educators.

The degrees of freedom in the independent-samples t-tests varied because the participating student teachers were allowed to skip questions of the questionnaires. No analyses of variance could be applied to show influences of age, gender or level of former education on student teachers' use of metacognitive learning strategies and motivation for learning mainly because of the small samples of male student teachers (N = 36), student teachers with a low (N = 32) or high level of education (N = 6) and the small age variation (18-20 years).

Qualitative analyses were based on the data of semi-structured interviews. The first cycle of the tutorial conversations with teacher educators was grounded on both teacher educators' SRL planning and analyses of the pre-test. The SRLOQ scales were the leading themes of the conversations. The concept planning of the teacher educators (a result from the SRL course) and analyses of the measured SRL degree as viewed by teacher educators and student teachers, were compared. This comparison resulted in an adjusted planning for SRL implementation in classroom practice for teacher educators.

Based on analyses of the intermediate-test, the second cycle of tutorial conversations resulted in an adjusted SRL planning for teacher educators, aiming at a further increase of student teachers' SRL opportunities in the learning program.

In the post-test, all teacher educators and a sample of student teachers (2 per teacher educator) were questioned in semi-structured interviews about their experiences with and perceptions of student teachers' increased SRL opportunities in educational programs. Semi-structured interviews were considered to be most suitable since developments with respect to SRL in primary teacher education are rather new and complex and not suitable to be asked about in questionnaires only. The scales of the SRLOQ and the MMQ were used as starting points for the topics of the interviews. The interviews took approximately 45 minutes.

The semi-structured interviews with the student teachers (see Appendix 5.A) were focused on the way student teachers had experienced the increased SRL opportunities and how these changed learning conditions influenced their motivation for learning and use of metacognitive learning strategies during the research period. Student teachers were asked what stroke them during the research period concerning teacher educators' teaching behaviour and how they reacted on this changed behaviour. For each example of teacher educators' behaviour, student teachers were asked to explain how this teaching behaviour influenced their motivation for

learning and their use of metacognitive learning strategies. In the end, student teachers were asked to provide compliments and advices for their teachers.

The semi-structured interviews with the teacher educators (see Appendix 5.A) were based on both teacher educators' SRL planning and analyses of the post-test. The SRL planning of the teacher educators and analyses of the measured SRL degree as viewed by teacher educators and student teachers were compared. Teacher educators were asked for the reason of the choices concerning the provided SRL opportunities, if they would make the same choices if they had the chance to repeat the intervention trajectory, what changes were observed in student teachers' motivation for learning and their use of metacognitive learning strategies and to provide examples of these changes in student teachers' behaviour.

In line with Miles and Huberman (1994), the collected data and the used instruments (questionnaires, tutorial conversations, semi-structured interviews) were analysed and related to each other by triangulation to enhance the internal validity of the results. First, all quantitative and qualitative findings were structured in a matrix containing the scales of the SRLOQ (planning, monitoring of the learning process, zone of proximal development, coaching/judging, collaboration) and the MMQ (metacognition: study process, study content and motivation: intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy and test anxiety) and, per scale, all different sources of data collection (analyses pre-, intermediate- and post-test as viewed by teacher educators and student teachers, consulting conversations, semi-structured interviews). Second, the content of each category was examined and described for each teacher educator separately. Third, similarities and differences in teacher educators' and student teachers' view of SRL opportunities and the consequences for motivation and metacognition were analysed. For this purpose, patterns in teacher educators' and student teachers' knowledge and beliefs were identified and described. These "patterns" refer to groups of associated statements that give insight into the similarities and differences in the knowledge and beliefs of the teacher educators and student teachers. Finally, the results of the analysis of the data provided by the different instruments were synthesized in order to gain a deeper level of insight into teacher educators' and student teachers' practical knowledge.

5.3   Results

In this section, the three hypotheses of the study are addressed separately. First, the results of quantitative analyses are presented, followed by the qualitative findings.

Student teachers' use of metacognitive learning strategies increases significantly during one semester in learning environments with increased SRL opportunities.

The relationship between student teachers' SRL opportunities and their use of metacognitive learning strategies was firstly studied by means of correlation analyses (Table 5.2).

Table 5.2. Pearson correlation coefficients between SRL opportunities, metacognition and motivation

Scale	Condition	SRL opportunities	Motivation
Metacognition	Pre-test	0.544[*]	0.212[*]
	Post-test	0.542[*]	0.338[*]
Study Process	Pre-test	0.545[*]	
	Post-test	0.531[*]	
Study Content	Pre-test	0.434[*]	
	Post-test	0.385[*]	
Motivation	Pre-test	0.210[**]	
	Post-test	0.500[*]	
Intrinsic goal orientation	Pre-test	0.230[*]	
	Post-test	0.557[*]	
Intrinsic goal avoidance	Pre-test	-0.242[*]	
	Post-test	-0.140[*]	
Extrinsic goal orientation	Pre-test	0.534[*]	
	Post-test	0.589[*]	
Extrinsic goal avoidance	Pre-test	-0.391[*]	
	Post-test	-0.219[*]	
Task value	Pre-test	0.505[*]	
	Post-test	0.648[*]	
Expectancy	Pre-test	0.275[*]	
	Post-test	0.582[*]	
Test anxiety	Pre-test	-0.363[*]	
	Post-test	-0.126[*]	

[*] significance: $p < 0.01$, one-tailed
[**] significance: $p < 0.05$, one-tailed

Significant correlations at the 0.01 significance level were found between student teachers' SRL opportunities and their use of metacognitive learning strategies both before (r = 0.544) and after (r = 0.542) increasing the SRL opportunities. These results indicate a moderate positive relationship between the provided SRL opportunities in educational pre-service programs and student teachers' use of metacognitive learning strategies. The same holds for the separate constructs within metacognition: 'study process' (r = 0.545 in the pre-test and 0.531 in the post-test) and 'study content' (r = 0.434 in the pre-test and 0.385 in the post-test).

In order to analyse the dynamics in student teachers' SRL opportunities and their use of metacognitive learning strategies, independent-samples t-tests were

applied secondly. Since the pre- and post-test samples of the present study are not independent, the independent-samples t-tests were only applied to estimate the significance of the increase of student teachers' use of metacognitive learning strategies. Independent-samples t-tests assume the covariance between the two samples to be zero, which is not the case between our pre- and post-test samples. As a consequence, the estimated significance of the metacognitive increase is too low and therefore presents minimum values. Table 5.3 represents student teachers' use of metacognitive learning strategies before (pre-test) and after (post-test) increasing student teachers' SRL opportunities in the educational pre-service program.

The results of the independent-samples t-tests were confirmed by applying paired-samples t-tests. Because the quantitative measurements of the pre- and post-test were conducted anonymously, analyses were performed on the level of the student groups. Table 5.4 represents student teachers' use of metacognitive skills for learning before (pre-test) and after (post-test) increasing student teachers' SRL opportunities for all participating 17 groups.

Table 5.3. Results of the independent-samples t-tests for metacognition and motivation

Scale	Conditions	M	SD	K-S	p	F	p	t	df	p
Metacognition	Pre test	51.88	10.47	1.145	0.145	4.211	0.041	4.940	354	0.000[*]
	Post test	57.02	9.16	0.730	0.661					
Study process	Pre test	42.16	8.22	1.158	0.137	4.332	0.038	4.017	357	0.000[*]
	Post test	45.43	7.18	0.744	0.638					
Study content	Pre test	9.85	3.10	1.088	0.187	0.487	0.486	5.171	371	0.000[*]
	Post test	11.49	3.02	1.633	0.010					
Motivation	Pre test	113.05	12.22	0.759	0.612	0.919	0.339	0.659	336	0.255
	Post test	112.14	13.00	1.148	0.143					
Expectancy	Pre test	27.11	4.46	0.924	0.360	2.317	0.129	2.069	353	0.020[**]
	Post test	28.14	4.89	0.744	0.588					

[*] significance: p < 0.01, one-tailed
[*] significance: p < 0.05, one-tailed

Table 5.4. Results of the paired-samples t-tests for metacognition and motivation

Scale	Conditions	M	SD	K-S	p	t	df	p
Metacognition	Pre-test	52.03	4.87	0.547	0.925	8.418	16	0.000[*]
	Post-test	57.01	4.19	0.851	0.463			
Study process	Pre-test	41.97	3.91	0.568	0.904	5.525	16	0.000[*]
	Post-test	45.32	3.34	0.728	0.664			
Study content	Pre-test	9.58	1.34	0.409	0.996	8.273	16	0.000*
	Post-test	11.49	1.39	0.696	0.718			
Motivation	Pre test	112.41	5.17	0.738	0.647	0.886	16	0.195
	Post test	111.31	8.18	0.823	0.508			
Expectancy	Pre-test	26.94	1.87	0.782	0.573	1.948	16	0.035[**]
	Post-test	27.91	3.12	0.604	0.859			

[*] significance: $p < 0.01$, one-tailed
[**] significance: $p < 0.05$, one-tailed

Concerning the conditions for t-tests, the p values of the Kolmogorov-Smirnov test in the independent (Table 5.3) and paired-samples (Table 5.4) t-tests demonstrated higher values than 0.05 for all constructs, except for 'study content' in the post-test of the independent t-test ($p = 0.010$). So, except for 'study content', the samples of the measured constructs were normally distributed. Second, the values of Levene's Test for Equality of Variances in Table 5.3 indicate that the homogeneity of variance assumption was considered. In the case of metacognition and 'study content', the values for F were large (respectively 4.221 and 4.332) and the p values were less than 0.05 (respectively 0.041 and 0.038), indicating that the variances were heterogeneous which violates a key assumption of the t-test. Therefore, for metacognition and 'study content.' the alternative way of computing the t-test was performed that accounted for heterogeneous variances and provided accurate results even when the homogeneity assumption had been violated.

Student teachers' use of metacognitive learning strategies increased significantly at the 0.01 significance level between the pre- and post-test as can be seen in the results of the independent-samples t-tests ($t = 4.940$) and the paired-samples t-tests ($t = 8.418$). The same holds for the sub constructs 'study process' ($t = 4.017$ in the independent-samples t-tests and $t = 5.525$ in the paired-samples t-tests) and 'study content' ($t = 5.171$ in the independent-samples t-tests and $t = 8.273$ in the paired-samples t-tests) that were also enhanced at a significant level in the research period. This conclusion was in line with the moderate positive correlations between student teachers' SRL opportunities and their use of metacognitive learning strategies. So, student teachers' use of metacognitive skills rose to a higher level after increasing the SRL opportunities in the educational pre-service program.

Finally, regression analyses were performed to investigate whether student teachers' level of SRL opportunities predicted their use of metacognitive learning strategies. Table 5.5 displays the results of regression analyses with student teach-

ers' SRL opportunities as the independent variable and their use of metacognitive learning strategies as the dependent variable. The results indicated once more that the degree of SRL opportunities was a significant positive predictor of the metacognition score at the 0.01 significance level (B = 0.689). Hence, student teachers that receive more SRL opportunities in educational programs use more metacognitive learning strategies.

Table 5.5. Regression analyses with SRL opportunities as the independent variable and metacognition and motivation as the dependent variables

	t	p	B
SRL opportunities			
(Constant)	17.808	0.000	32.180
Metacognition	13.352	0.000[*]	0.689
(Constant)	38.977	0.000	98.144
Motivation	5.719	0.000[*]	0.409

* significance: p < 0.01

In sum, as hypothesized, student teachers' use of metacognitive learning strategies increased significantly at the 0.01 significance level during one semester in learning environments with increased SRL opportunities. Qualitative analyses confirmed these results. In addition, qualitative analyses identified student teachers' need for more explicit metacognitive strategy instruction. These findings correspond with the recommendations of Butler (2003), Veenman et al. (2006) and the literature review of Chapter 2, indicating the necessity for primary teacher educators to explicitly model metacognitive learning strategies to their student teachers. In short, primary student teachers benefit most from explicit strategy instructions.

Qualitative analyses indicated that the level of student teachers' former education might influence student teachers' use of metacognitive skills. Riding and Al-Sanabani (1998) also state that intelligent students are more likely to develop learning strategies to supplement their leaning style than less intelligent students. Contrary to this advise, explicit training of metacognitive learning strategies was shown to to be rare in primary student teachers' classrooms. These findings are in line with the results of Kistner et al. (2010) who conclude that a great amount of strategy teaching occurs in an implicit way because teacher educators often find it difficult to serve as a role model. Teacher educators are absolutely willing to invest effort in the instruction of metacognition within their lessons, but they need the 'tools' for implementing metacognition as an integral part of their lessons and for making students aware of their metacognitive activities and the usefulness of those activities (Veenman et al., 2006).

Taking the coaching/judging construct of the SRLOQ as an example, student teachers are often required to provide feedback to peers during working on their

assignments. According to Hattie and Timperly (2007), effective external feedback needs to be clear, purposeful, meaningful, and compatible with students' prior knowledge to provide logical connections. Furthermore, it needs to encourage students' active information processing, have low task complexity, relate to specific and clear goals, and provide little threat to students' feelings of self-efficacy. However, most student teachers have not been taught how to ask for and how to provide feedback. By modelling the necessary metacognitive skills, teacher educators can make their teaching more explicit and improve the transfer between theory and educational practice. During modelling, the following four steps of Schunk and Zimmerman (2007) can be used: (1) observation: learners can induce the major features of the skill from watching a model learn or perform; (2) emulation: the learner imitates performances of a model's skill with social assistance; (3) self-control: the learner independently shows a model's skill under structured conditions; and (4) self-regulation: the learner shows an adaptive use of skills across changing personal and environmental conditions.

Student teachers' motivation for learning increases significantly during one semester in learning environments with increased SRL opportunities.

The relationship between student teachers' SRL opportunities and their motivation for learning was firstly studied by means of correlation analyses (Table 5.2). The relationship between student teachers' SRL opportunities and their motivation for learning was shown to be significantly positive at the 0.05 significance level in the pre-test ($r = 0.210$) and at the 0.01 significance level ($r = 0.500$) in the post-test. So, weak to moderate positive relationships were found between student teachers' SRL opportunities in the educational pre-service program and their motivation for learning. In addition, all separate constructs within motivation also correlated significantly with SRL at the 0.01 significance level. In line with the expectations, the sub constructs 'Intrinsic goal avoidance', 'Extrinsic goal avoidance' and 'Test anxiety' correlated negatively with SRL and the other sub constructs ('Intrinsic goal orientation', 'Extrinsic goal orientation', 'Task value' and 'Expectancy') showed positive correlations with SRL.

Secondly, independent-samples t-tests ($t = 0.659$) and paired-samples t-tests ($t = 0.886$) showed no significant increase of student teachers' motivation for learning before (pre-test) and after (post-test) increasing student teachers' SRL opportunities. These results are presented in Tables 5.3 and 5.4. By contrast, the results did indicate a significant increase at the 0.05 significance level of the expectancy component within the motivational construct in both the independent-samples t-tests ($t = 2.069$) and the paired-samples t-tests ($t = 1.948$). Thus, contrary to student teachers' motivation for learning in general, student teachers' expectancy did increase after experiences with SRL opportunities in the educational pre-service program.

Finally, Table 5.5 indicates the results of regression analyses with student teachers' SRL opportunities as the independent variable and their motivation for learning as the dependent variable. The results show that the amount of SRL opportunities was a significant positive predictor of the motivational score at the 0.01 significance level ($B = 0.409$). In short, student teachers that receive more SRL opportunities in the educational program are more motivated towards learning.

Altogether, it can be concluded that student teachers' motivation for learning was enhanced during one semester in learning environments with increased SRL opportunities, but not to a significant level. Thus, the expectations of the second hypothesis could not be confirmed. However, student teachers' expectancy, a component within the motivational construct, did increase significantly in the research period. Similarly, qualitative analyses revealed that student teachers appreciated the SRL increase and felt more confident towards the transfer from theory to their own classroom practice, the assignments and the final test: 'Because we cooperated actively, we were forced to think about the subject matter of teaching, resulting in better remembrance and more confidence'.

Nevertheless, student teachers also stressed the important role of teacher educators in providing a sufficient knowledge base to avoid uncertainty. These findings corresponded with earlier findings of a theoretical study (see Section 2.3) in which primary teacher educators were advised to focus on knowledge building in the domain (subject area) by creating a gradual transfer from teacher control to student control ('scaffolding'). The qualitative findings of the present study confirmed the importance to pay attention to the conditions that can hinder or foster smooth SRL implementation in primary teacher education, namely (1) teacher characteristics, (2) student characteristics, (3) characteristics of learning materials and (4) characteristics of the school context and culture.

Primary teacher educators indicated to be better prepared for a gradual SRL implementation in educational pre-service programs by applying the SRL model and according SRLOQ. Nevertheless, unlike experienced teacher educators, starting teacher educators were often so pre-occupied with their daily routine of teaching that they needed much encouragement to create real SRL opportunities. Second, although student teachers appreciated SRL, they were not always motivated to invest much time and energy in developing adequate learning skills. For example, several student teachers experienced peer feedback as an obligatory part of the assignments instead of a useful procedure to improve their work. In the case of learning materials, student teachers stressed the importance for all teacher educators to use the learning materials, for example the electronic learning environment, in the same way. Finally, a supportive school context and culture were also shown to be important aspects for a gradual SRL implementation. Primary teacher educators that perceived their schools as being more supportive were more motivated and persistent towards SRL implementation.

Qualitative findings indicated that primary student teachers appreciated collaborative tasks. By discussion, argumentation, and reflection upon the task at hand, deeper processing of the information and richer and more meaningful learning was achieved. Nevertheless, student teachers also stressed the importance for all individual members of the group to actively cooperate. When this was not the case, the advantages of the joined effort were decreased and student teachers gave privilege to working alone.

To create appropriate learning tasks, the 'Four Component Instructional Design (4C-ID) model (Van Merriënboer & Kirschner, 2007) was shown to be a useful instrument for primary teacher educators. The basic claim of the 4C-ID model is that all environments for complex learning can be described in terms of four interrelated components: (1) learning tasks (i.e., meaningful whole tasks, based on real-life tasks that require the integrated use of knowledge, skills, and attitudes); (2) supportive information (i.e., information that helps learners to perform the problem-solving and reasoning aspects of the tasks); (3) procedural information (i.e., information that explains how to perform the routine aspects of the task); and (4) part-task practice (i.e., additional practice to develop routine aspects of the task to a very high level of automaticity).

Student teachers' motivation for learning is significantly related to student teachers' use of metacognitive learning strategies.

The relationship between student teachers' use of metacognitive learning strategies and their motivation for learning was studied by means of correlation analyses (Table 5.2). In line with the third hypothesis, the results did show significant, although weak positive correlations at the 0.01 significance level both in the pre-test (r = 0.212) and the post-test (r = 0.338). In other words, student teachers' use of metacognitive skills and motivation for learning seem to strengthen one another during the learning process, but only to a limited extent.

5.4   Conclusions and discussion

The present study searched for dynamics of primary student teachers' use of metacognitive learning strategies and motivation for learning in learning environments with increased SRL opportunities. The results show that student teachers' use of metacognitive learning strategies increased significantly during one semester in learning environments with increased SRL opportunities. This indicates that teacher educators can play a major role in developing student teachers' use of metacognitive learning strategies by increasing student teachers' SRL opportunities in teacher education programs. So, in line with the findings of several researchers (e.g., Riding & Al-Sanabani, 1998), it is possible for student teachers to develop metacognitive

learning strategies to cope with situations for which the individual's style is not naturally appropriate.

However, such enhancement of student teachers' use of metacognitive skills is only achieved by explicit strategy promotion to support student teachers' learning. To reach this aim, the training and fostering of student teachers' metacognitive knowledge and learning strategies should be incorporated in primary student teachers' education and training. Hattie (2009) also emphasizes the importance for teacher educators to support student teachers to develop a series of learning strategies that enables them to construct their own learning. The teaching of these strategies needs to be planned, deliberate and explicit, and part of active programs to teach specific skills and deeper understanding. During this process, the following modelling phases are important: observation, emulation, self-control and self-regulation. By using such modelling, teacher educators can make their teaching more explicit and improve the transfer between theory and educational practice.

In addition, the metacognitive instruction of underachieving student teachers needs to vary between student teachers suffering from an availability deficiency and student teachers with a production deficiency of metacognition (Veenman et al., 2006). The first group does not have sufficient metacognitive knowledge and skills at their disposition and needs metacognitive instruction from the beginning. The latter group has a certain level of metacognitive knowledge and skills at their disposition, but fail to use their metacognition due to task difficulty, test anxiety, lack of motivation, or their inability to see the appropriateness of metacognition in a particular situation. Their instruction can be limited to guiding metacognitive activity during task performance.

Student teachers' motivation for learning was also enhanced during one semester in learning environments with increased SRL opportunities, but this increase appeared not to be significant. One reason for the absence of motivation effects may be that the temporal interval in the present study was too brief for the effects to be detected. However, the increase of student teachers' expectancy, a component within the motivational scale, was shown to be significant. Student teachers indicated appreciation of the increased SRL opportunities in the curriculum. They felt more confident in using the provided knowledge and skills in their own classrooms and towards the assignments and the final test. Several factors might have influenced student teachers' motivation for learning in the research period. To ensure successful SRL implementation, it is important for teacher educators: (1) to create an adequate knowledge base by gradually increasing student teachers' SRL opportunities; (2) to pay attention to the conditions that can hinder or foster a gradual SRL increase; (3) to support student teachers' collaborative learning processes; and (4) to develop appropriate learning tasks. These factors are explained in the coming sections.

Student teachers stressed the importance for teacher educators to provide an ade-quate knowledge base to avoid uncertainty. According to student teachers, teacher educators are experts in the relevant subject domain and it is their task to make this domain more accessible to student teachers. For example, student teachers like to know the criteria for judging their work in advance. Therefore, in line with earlier findings of a theoretical study (see Chapter 2), primary teacher educators are ad-vised to focus on knowledge building in the domain by organizing a gradual devel-opment from teacher control to student control in the educational pre-service pro-gram. The SRLOQ (see Appendix 3.A) can be applied as a diagnostic instrument during this implementation process. Teacher educators can be trained in using the SRL model (see Figure 2.1) and according SRLOQ to be better prepared for SRL im-plementation in teacher education programs.

In an optimally scaffolded instruction, teacher educators gradually decrease as-sistance when the student teachers are able to perform more independently (Salo-nen, Vauras, & Efklides, 2005). However, Salonen et al. (2005) report about 'scaffold mismatches' in their research, meaning that sometimes mismatches occur between the learners' needs and the guidance of the teacher. In their study of metacognition as a socio-cognitive phenomenon was shown that students' judgments of their own metacognitive experiences are more closely related to their performance than the judgments of peers or teachers. Peers' and teachers' judgments are presumably driven by normative criteria of performance or by theory- or belief-driven views about ability.

Thus, if we are to gradually increase student teachers' SRL opportunities in edu-cational pre-service programs, it is essential for teacher educators to demonstrate flexibility (the ability to accommodate flexibly to individual characteristics and needs), sensitivity (the ability to sense and to respond to 'online' changes in each particular learner's cognitions, motivations, affects, and moods); and responsive-ness (the ability to respond systematically, coherently, and as immediately as possi-ble to learners' cognitive efforts, and motivational, affective, and social responses). To establish and maintain a dynamic match between student teachers and teacher educators, the professional development of teacher educators needs to differenti-ate between experienced and starting teacher educators.

Besides an adequate preparation of teacher educators to obtain successful SRL implementation, student teachers must be aware of the importance of SRL for their academic success. Also, in line with the findings of Sim and Hew (2010) in higher education settings, reflective learning in (electronic) learning environments requires clear instructions and sufficient time to be appreciated and adopted in student teachers' learning. Finally, it is important for policy makers to embed SRL as a cen-tral issue within educational pre-service programs.

To avoid problematic collaboration circumstances that can decrease student teachers' motivation for learning, teacher educators must pay attention to positive

interdependence in the group, clear instructions on how to co-operate and appropriate feedback on the co-operating process (Bolhuis & Voeten, 2001). In addition, the transaction costs (communication and coordination within the group) should be kept to a minimum to ensure positive interdependence (Kirschner, Paas, & Kirschner, 2009).

Considering the learning task, the 4C-ID model (Van Merriënboer & Kirschner, 2007) can be an appropriate model for primary teacher education. Student teachers start with relative simple, but realistic situations that contain all essential aspects of the complex task. Then, student teachers gradually receive more complex assignments, characteristic for their professional situation. In this way, a better transfer between theory and practice can be achieved.

In line with earlier theoretical findings (e.g., Berger & Karabenick, 2011), the relationship between student teachers' use of metacognitive learning strategies and their motivation for learning, was shown to be positively significant, but weak, in the present study. Thus, primary student teachers' use of metacognitive skills and motivation for learning seem to strengthen one another during the learning process, but only in a minor way. Therefore, motivation and cognition must be conceived as interacting constructs in research regarding SRL. Together, these components are assumed to influence students' involvement with their learning and, consequently, academic performance (Eccles & Wigfield, 2002; Pintrich, 2000, 2004).

A first limitation of the present study is that no control group was assessed. The point of reference used was the starting situation of student teachers' SRL opportunities. Other experiences by teacher educators and student teachers between the pre- and post-test might have influenced the results of the study. Second, all participating teacher educators volunteered to cooperate and can therefore not be regarded as a fully representative sample of the population. To broaden the perspective on the relationships between SRL, motivation for learning and the use of metacognitive learning strategies, future research would benefit from applying (on-line) measurement methods to obtain behavioural measures during task performance over a longer period of time. For example, instruments like 'Regulation of Motivation' (Wolters, 2003) can measure the motivational construct to evaluate changes in motivation. In this way, motivation is assessed as a process or an event instead of a product or an aptitude (Winne & Perry, 2000). In the same matter, metacognitive feelings, judgments/estimates, and thoughts students are aware of during task performance can be assessed during learning (Efklides, 2006). Future research can also aim at the measurement of student teachers' study results after increasing their SRL opportunities in similar educational pre-service settings. Finally, it would be interesting to search for possible reciprocal effects between motivation and metacognition in primary teacher education.

In general, this study revealed that the level of SRL opportunities in pre-service teacher learning environments is a moderate predictor of primary student teachers'

use of metacognitive learning strategies and motivation for learning, both important constructs for their academic career.

Appendix 5.A. Questions semi-structured interviews

Questions student teachers

1.	What stroke you most during the semester concerning your teachers' behaviour?
2.	Can you give an example of such behaviour?
3.	How did you react on this behaviour of the teacher?
4.	Can you explain how this teaching behaviour influenced your motivation for learning (intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy and test anxiety)?
5.	Can you give an example of the influence of your teachers' behaviour on your motivation for learning?
6.	Can you explain how this teaching behaviour influenced your use of metacognitive learning strategies (study process, study content)?
7.	Can you give an example of the influence of your teachers' behaviour on your use of metacognitive learning strategies?
8.	Can you give your teacher any compliments?
9.	Can you give your teacher any advices?

Questions teacher educators

1.	What stroke you most during the research period concerning your students' behaviour?
2.	For what reason did you make the choices concerning the implementation of SRL opportunities?
3.	Are you satisfied with the choices you have made concerning the implementation of SRL opportunities?
4.	Would you make the same choices if you would have the chance to repeat the intervention trajectory?
5.	What changes did you observe in your students' motivation for learning (intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy and test anxiety) in the research period?
6.	Can you give examples of the observed changes in students' behaviour concerning their motivation for learning?
7.	What changes did you observe in your students' use of metacognitive learning strategies (study process, study content) in the research period?
8.	Can you give examples of the observed changes in students' behaviour concerning their use of metacognitive learning strategies?
9.	What difficulties occurred while increasing your students' SRL opportunities in your lessons?
10.	What next step would be a logical choice for you in the coming lessons?
11.	Can you explain why you would make this choice?
12.	In what way did you provide a sufficient knowledge base for your students?
13.	Are you satisfied with the choices you have made concerning the provided knowledge base?
14.	In what way did you integrate metacognitive skills and content matter during teaching?
15.	Are you satisfied with the choices you have made concerning the integration of metacognitive skills and content matter during teaching?
16.	In what way did you model metacognitive skills to your students?

17.	Are you satisfied with the choices you have made concerning the modelling of metacognitive skills to your students?
18.	In what way did you scaffold the SRL opportunities in your teaching during the semester?
19.	Are you satisfied with the choices you have made concerning the scaffolding of SRL opportunities in your teaching?
20.	In what way did conditional factors (teacher characteristics, student characteristics, characteristics of learning materials and characteristics of the school context and culture) hinder or foster SRL development in your teaching?
21.	Are you satisfied with the way you dealt with the conditional factors that hindered or fostered SRL development in your teaching?
22.	Can you give suggestions to improve the intervention trajectory?

Chapter 6

Promoting self-regulated learning in online learning networks

Abstract

Many recent studies have stressed the importance of students' self-regulated learning (SRL) skills for successful learning. Consequently, teacher educators have begun to increase student teachers' SRL opportunities in educational pre-service programs. Although primary teacher educators are aware of the importance of SRL, they often find it difficult to implement opportunities in their teaching. To provide more insight into relevant SRL aspects and support implementation in pre-service teacher education, this study first explores the benefits of online SRL learning networks. The authors then present seven SRL design principles for primary teacher education, and show the results of implementing these principles in non-formal learning contexts. Finally, based on the positive results of the implementation process, the authors describe emerging trends for SRL learning networks to enhance further use in pre-service teacher learning programs. In such educational settings, the SRL design principles can be used as a holistic framework.

6.1 Primary teacher education and self-regulated learning

Teacher education has traditionally focused on relaying subject knowledge and teaching skills (Kremer-Hayon & Tillema, 1999). However, researchers and practitioners in the field have noticed a consistent decline in transfer from theory to practice (Korthagen, Klaassen, & Russell, 2000). In other words, primary student teachers (i.e., prospective primary teachers) are often not able to apply the knowledge and skills they have learned in their teacher education programs in real classroom contexts.

In response to this problem, many primary teacher educators (i.e., teachers of prospective primary teachers) are now working to increase student teachers' self-regulated learning (SRL) opportunities throughout their initial training (Lunenberg & Korthagen, 2003). SRL has shown to foster students' deep and meaningful learning, resulting in significant gains in learning, problem solving, transfer and academic achievement in general (e.g., Nota, Soresi, & Zimmerman, 2004; Sundre & Kitsantas, 2004). To attain such an environment, teacher educators often must adjust their own instructional behaviour so that they might enhance students' self-regulation.

In general, SRL is a goal-oriented process, proceeding from a forethought phase and continuing through self-monitoring and self-control to self-reflection (Pintrich, 2000, 2004). The most important aspect of SRL is that students can monitor, control, and regulate their own cognitive actions (Pintrich, 2000; Veenman, Van Hout-Wolters, & Afflerbach, 2006; Zimmerman, 2001), an act commonly referred to as metacognition. By using metacognitive skills, student teachers can become aware of and monitor their progress towards their goals. As a result, students can improve their learning and comprehension, realizing any adaptive changes in their learning (Vermunt & Verloop, 1999).

6.2 Defining the problem

Although primary teacher educators understand the importance of the concept of SRL (Kremer-Hayon & Tillema, 1999), they often find it difficult to actually foster it in educational pre-service programs (Korthagen et al., 2000). Since many practicing teacher educators do not have previous experience with SRL, they are still somewhat unprepared for the change and are often worried about their decreasing role as knowledge providers (Kremer-Hayon & Tillema, 1999). In order to improve the implementation of SRL in pre-service education programs, more attention must be focused on the professional development of teacher educators.

Based on the findings of a theoretical review study (see Chapter 2) and two empirical studies (see Chapters 4 and 5), the present analysis provides more insight into relevant SRL design principles and how to best implement them in pre-service

teacher education. In response to the fourth general research question of this thesis (see Section 1.1), the focus of the present elaboration is on the usefulness of informal online learning networks to further implement SRL opportunities in primary student teachers' learning programs.

The research questions are as follows:
1. What is the value of online learning networks for SRL implementation in primary teacher education?
2. Which SRL design principles are distinguished in research literature (see Chapter 2)?
3. In what way are the SRL design principles useful for primary teacher educators (see Chapters 4 and 5)?
4. What are emerging trends for online learning networks to support SRL implementation?

In the following sections, the importance of online learning networks for SRL implementation in primary teacher education is introduced first. Then, seven SRL design principles for primary teacher education are outlined, followed by their application in non-formal empirical settings within primary teacher education. Finally, based on the findings of the empirical studies, recommendations to enhance SRL implementation through online learning networks are outlined.

6.3   The value of online learning networks for SRL implementation in primary teacher education

For successful implementation of an innovative design like SRL, educational developers must be very explicit about the behaviours they expect from teacher educators (Könings, Brand-Gruwel, & Van Merriënboer, 2007). Since many teacher educators have little to no previous experience in such an instructional design, they are sometimes ill prepared to fully implement it in their teaching (Könings et al., 2007). Hence, teacher educators play a crucial role in the interpretation of SRL design and its translation into educational practice.

Similarly, the intervention studies of the present thesis (see Chapters 4 and 5) noted that primary teacher educators need informal SRL trajectories such as online interaction because learning networks are not limited by geography, space, or time. Rather, they can provide experiences for extending learning beyond the classroom walls that can be applied in classroom practice.

To fulfil this need, Laferrière, Lamon, and Chan (2006) indicate that learning networks can enhance lifelong learning for teacher educators. Redmond and Lock (2009) also report on similar online learning networks where student teachers, teacher educators, and practicing teachers discussed current issues such as SRL.

Their research shows that the participants were involved in meaningful conversations that provided rich understanding of teaching practice by creating transfers between theories, experiences and realities of teaching in contemporary contexts. Thus, professional learning networks strongly influence teachers' professional roles, can lead to changes in their classroom activities, and consequently can have positive effects on students' learning progress (Lieberman & Wood, 2003).

In general, more focus is now being placed upon social aspects that influence learning and professional development (Brown & Duguid, 2001), as well as the spontaneous and informal learning processes in the development of social capital (Wenger, Trayner, & De Laat, 2011). Rapid technological developments enable this social knowledge construction in educational practice (Brown & Duguid, 2001; Lieberman & Wood, 2003). Technology can promote the building of learning networks, where people with common interests work and learn together although they may be separated by time and location (Shoffner, 2009). Technologies such as email, discussion boards, and weblogs provide opportunities for learning networks, in which teacher educators can reflect on practice with colleagues, share expertise, and build a common understanding of new instructional SRL approaches for classroom practice.

Based on an international literature study, Villegas-Reimers (2003) concludes that network learning is an important way for teachers to professionalize, because it joins teachers with different classroom experiences and a common desire to work on challenges and questions in social learning settings. In the development of social learning, Wenger et al. (2011) distinguish "communities" from "networks." Communities (or learning teams) can be defined as "groups of people that work together cohesively toward a common goal" (Dechant, Marsick, & Kasl, 1991, p.1). In such communities, the learning partnership creates an identity around a common agenda or area for learning. The term "network" refers to a set of connections among people. Networks using information technology can optimize the connectivity among teachers. Strengthening existing connections, enabling new connections and getting a speedy response can increase the extent and density of the network. The interplay between community and network processes thus enhances social learning.

6.4 Design principles for a successful implementation of self-regulated learning

To provide more insight into relevant SRL aspects during teaching, Section 2.3 of the present thesis formulated seven SRL design principles for primary teacher education that can play an important role in increasing student teachers' SRL opportunities in educational pre-service programs (see Figure 2.1).

The first principle suggests that teacher educators should create a sufficient knowledge base for their students. Teacher educators cannot expect their students to immediately regulate their learning all by themselves. As experts in the relevant subject-matter domain, the teacher educator must make this domain more accessible to student teachers (Bolhuis & Voeten, 2001).

To do this, teacher educators should integrate the necessary metacognitive skills and content matter into their teaching, comprising the second design principle. As part of the third principle, this integration should be modeled upon the following four regulatory skill levels (Schunk & Zimmerman, 2007):

- Level 1. Observation: Learners can induce the major features of the skill from watching someone model learning or performing.
- Level 2. Emulation: The learner, with assistance from the group, imitates the model's performance.
- Level 3. Self-control: The learner independently performs under structured conditions.
- Level 4. Self-regulation: The learner shows an adaptive use of skills across changing personal and environmental conditions.

In the fourth principle, control of the learning processes should gradually transfer from teacher to student ("scaffolding"). To ensure successful knowledge building, teacher educators must provide considerable guidance to students (Kirschner, Sweller, & Clark, 2006). In this way, student teachers gain sufficient prior knowledge to be able to internally guide them. Only then should the guidance of the teacher educator begin to decrease.

The fifth principle moves past successful knowledge building to encompass knowledge of the conditional factors that can foster or hinder successful implementation (see Section 2.3.2.5). This ensures that teacher educators are adequately prepared for their job, that they use suitable (digital) learning materials, to relay to their students a solid understanding of the significance of SRL and to create an appropriate school context and culture. Student teachers stress the importance for all teacher educators to use any learning materials (e.g., an electronic learning environment) in the same way. In line with the findings of Sim and Hew (2010) in higher education settings, student teachers note that reflective learning in electronic environments requires clear technological instructions and sufficient time to be appreciated and adopted in student teachers' learning.

The sixth principle stresses the engagement of student teachers in collaborative (digital) learning environments. Student collaboration facilitates the development of SRL (Wigfield, Hoa, & Klauda, 2007). When students have collaborative projects to complete, they make special effort to contribute significantly to the group. Also, encouraging students to consult with peers can lead them to utilize their classmates as knowledge resources. To instill such an environment, teacher educators should

ensure positive interdependence in the group, provide clear instructions to student teachers, and provide adequate feedback on their working process.

Finally, the seventh SRL design principle explores the relevant aspects of the learning task (i.e., assignments student teachers have to accomplish).

- *Goal setting:* Academic goals are important variables for student teachers because they serve as self-defining reference points that determine the next processes of SRL, such as planning, executing, and monitoring (Schunk & Ertmer, 2000).

- *Prior knowledge activation:* This enables student teachers to understand the task and its goals, to recognize the required knowledge for performing it, and to distinguish the several characteristics and their prediction of performance (Eilam & Aharon, 2003).

- *Metacognitive knowledge activation:* This includes the activation of knowledge about cognitive tasks and cognitive strategies in the SRL forethought phase (Pintrich, 2000, 2004).

- *Metacognitive awareness and monitoring of cognition:* As a core component within information processing models of self-regulation (e.g., Nietfeld, Cao, & Osborne, 2006), it is important for student teachers to develop thinking activities to decide on learning contexts, to exert control over their processing and affective activities and to steer the course and outcomes of their learning (Vermunt & Verloop, 1999).

- In the SRL self-reflection phase, Pintrich (2000, 2004) distinguishes two cognitive key processes.

- The first process involves learners' *"judgments" and evaluations of their performance of the task*. Students can learn to make judgments about the way their work relates to the criteria.

- The second concerns students' *"attributions" for performance*. Attributions are beliefs concerning the causes of outcomes (Butler, 2002). Teacher educators can facilitate effective self-regulation by providing attribution feedback to students that indicates factors students can control, such as effort and strategy use (Schunk, 2007).

- *Task value activation:* This process encompasses perceptions of the relevance, utility and importance of the task (Pintrich, 2000).

- *Time management:* This important component of SRL (Dembo & Eaton, 2000) may involve making schedules for studying and allocating time for different activities.

6.5   Application of the SRL design principles in primary teacher education

In the research projects as presented in this thesis, the SRL design principles were successfully applied in non-formal teacher education learning settings (see Chapters 4 and 5). In such settings, there is an explicit learning intention, but the participants do not receive a formal certificate after completion of the course of learning. In these learning settings, the dynamics of student teachers' use of metacognitive learning strategies and motivation for learning were measured in environments with increased SRL opportunities. The research was conducted in educational theory courses containing lectures and moments of guidance. In total, 14 teacher educators and 393 first- and second-year student teachers of seven primary teacher education institutes in the Netherlands participated. During one semester, teacher educators participated in training courses and tutorial conversations aimed at increasing student teachers' SRL opportunities in the curriculum.

In these empirical studies, a mixed methods pre- and post-test design was used. To collect quantitative data regarding student teachers' motivation for learning and use of metacognitive learning strategies, a questionnaire was developed. Semi-structured interviews and tutorial conversations were used to track qualitative data on teacher educators and student teachers.

The results of the empirical studies demonstrated that the SRL design principles provide more insight for primary teacher educators into relevant SRL aspects and can help guide further implementation. Furthermore, the studies showed that student teachers' use of metacognitive learning strategies increased significantly during one semester in learning environments with increased SRL opportunities. This indicates that teacher educators can play a major role in developing student teachers' use of metacognitive learning strategies by increasing student teachers' SRL opportunities. In addition, qualitative analyses identified student teachers' need for more explicit metacognitive strategy instruction. These findings corresponded with the recommendations of Veenman et al. (2006) and the literature review of Chapter 2, indicating the necessity for primary teacher educators to explicitly model metacognitive learning strategies to student teachers.

Although student teachers' motivation for learning correlated significantly positive with SRL opportunities and SRL was shown to be a significant positive predictor of the motivation score, the increase of student teachers' motivation for learning appeared not to be significant during that one semester. One potential reason for the absence of motivation may be that the temporal interval was too brief for the effects to be detected. However, the increase of student teachers' expectancy, a component within the motivation scale, was shown to be significant. The expectancy scale includes control belief and self-efficacy for learning and performance (e.g., "I think that I will get good grades for this course."). Student teachers indicated appreciation of the increased SRL opportunities in the curriculum. Nevertheless,

they also stressed the importance for teacher educators to provide an adequate knowledge base to avoid uncertainty. For example, student teachers like to know the criteria for judging their work in advance. Therefore, teacher educators are advised to focus on knowledge building in the domain, including both metacognitive skills and content matter (see Sections 2.3.2.1 and 2.3.2.2).

In general was revealed that the level of SRL opportunities in pre-service teacher learning environments is a strong predictor of primary student teachers' use of metacognitive learning strategies and enhances student teachers´ motivation for learning, both important for their academic career.

6.6   Exploring SRL design principles in online learning networks

Networked learning is increasingly considered as a powerful way to stimulate and facilitate teachers' professional development in educational settings (Lieberman & Wood, 2003). In such learning and knowledge-building communities, teachers interact with peers, students, information and recourses by studying authentic problems (Laferrière et al., 2006). However, informal learning networks only result in innovative communities of practice if they are successfully facilitated. To enhance networked learning in the start-up phase, Hanraets, Hulsebosch, and De Laat (2011) distinguish five recommendations that are very similar to those of the SRL design principles:

- Facilitators must demonstrate a facilitating role instead of a directing role.
- Participants must feel responsible for their network activity (i.e., shared ownership).
- Participants must possess sufficient networking skills.
- Face-to-face and online interactions need to be combined.
- Support from management and direct supervisors is necessary.

Zooming in on the third recommendation concerning networking skills, Laferrière et al. (2006) illustrated that internet-based technologies support teachers' opportunities for reflective and collaborative learning. However, teachers and school managers are often not trained to develop competencies for networked learning such as reflective dialogues. Moreover, the culture in educational settings is often not conducive to learning networks. Since the effects of online learning vary depending on the self-regulation of learning by participating teacher educators (Laferrière et al., 2006), participants must be coached intensively, for example, in the use of technology. Thus, in line with the recommendations of the SRL design principles, the transition from guided learning to SRL should be a gradual process ("scaffolding") in web-supported learning networks for professional development.

In such networks, teacher educators can gain more practice modelling metacognitive skills to their student because explicit training of metacognitive learning

strategies tends to be rare in primary student teachers' classrooms (see Chapters 4 and 5). These findings echo the results of Kistner et al. (2010), who conclude that a great amount of strategy teaching occurs in an implicit way because teacher educators often find it difficult to serve as a role model. Teacher educators are absolutely willing to invest effort in the instruction of metacognition within their lessons, but they need the "tools" for implementing metacognition as an integral part of their lessons and for making students aware of their metacognitive activities and the usefulness of those activities (Veenman et al., 2006).

The empirical studies of the present thesis (see Chapters 4 and 5) also showed that teacher educators could improve their students' learning tasks (the seventh SRL design principle) by utilizing real-life problems that require the integrated use of knowledge, skills, and attitudes. The 'Four Component Instructional Design (4C-ID) model (Van Merriënboer & Kirschner, 2007) can be applied during this exercise in learning networks. In the 4C-ID model, student teachers start with relative simple but realistic situations that contain all essential aspects of the complex task, and then gradually receive more complex authentic assignments characteristic for their professional situation. This improves the transfer between theory and practice.

The gradual shift in control over learning processes from teacher to student (or "scaffolding"), as stressed in Section 2.3.2.4, offers a final example for further exploration of SRL design principles in online learning networks. In most primary teacher education programs, there exists a gap between SRL opportunities in the second and the third years (see Chapters 4 and 5). In the first two years--the major phase--educational programs are mainly teacher-centred. From the start of the third year, student teachers are often asked to self-regulate their learning by applying all they learned in self-chosen specializations, resulting in their graduation paper. In learning networks, the SRL design principles can be further utilized to enable primary teacher educators to implement SRL opportunities in their teaching, gradually moving from teacher to student regulation of the learning process.

In summary, qualitative analyses of the empirical studies showed teacher educators' need to further develop the SRL design principles for application in classroom practice. By creating online learning networks, teacher educators can be better equipped to elaborate the SRL principles. In addition, in line with the "knowledge building" and "scaffolding" principles, online learning networks should be gradually developed.

6.7   Discussion

Successful SRL implementation requires explicit instructions about the teaching behaviours expected from teacher educators. Teacher educators sometimes labor under the false assumption that they can invest less time in the guidance of their

students, mistakenly expecting them to work more independently than they may be able. Proper SRL development demands adequate guidance and thorough preparation by teacher educators, and they must always consider new ways to elicit goal setting, planning, monitoring, control and reflection by student teachers themselves.

Teacher educators also have to pay attention to individual differences between students, and must provide each student with specific guidance and feedback. They should be flexible enough to share control with their students. Actively involving students in preparing lesson plans, for example, can lead to prior knowledge activation. Overall, the key is to find out what students already know and what they want to learn.

In fact, perhaps the increase of student teachers' SRL opportunities demands even more effort and attention of teacher educators than the regular approach. As noted earlier, the use of informal trajectories such as online learning networks can help support teacher educators' long-term professional development and enhance lifelong learning. As stated by Laferrière et al. (2006), formal training courses in which experts transmit de-contextualized knowledge do not provide deep learning for teachers; effective learning is situated and needs to be grounded in teachers' own practice, experience, and community.

Within their own cultural contexts, teacher educators can create online learning networks where they interact with colleagues, student teachers, information, and resources as they tackle real-life challenges. After proper training in the SRL principles, teacher educators can better utilize these networks to adequately transfer knowledge and ensure it can be put into practice by student teachers. In this way, teacher educators can continue learning within their organizations, an important step towards lifelong learning.

Chapter 7
General conclusions and discussion

7.1   Introduction

In the field of cognitive psychology, social constructivist learning theories are re-garded as the leading paradigm in recent years (Loyens, 2007). These theories em-phasize the importance for learners to be actively engaged in constructing their own understanding. One of the shared assumptions of social constructivist learning theo-ries is the importance of self-regulated learning (SRL) as the key component for successful learning in school and beyond (Boekaerts, 1999; Zimmerman, 2001).

There is much empirical evidence that SRL is of great value for students' aca-demic success (e.g., Hmelo-Silver, Duncan, & Chinn, 2007; Simons, Van der Linden, & Duffy, 2000). Research has generated a generally agreed upon picture of the 'ide-al learner', who likely is self-regulating. These scientific perceptions give rise to embrace such student qualities as a desirable goal to strive for within primary teacher education. A second reason in favour of SRL implementation in pre-service teacher programs concerns the current lack of transfer from theory to practise that internationally affects teacher education settings (Korthagen, 2010). Consequently, primary teacher educators are urged by policy makers to equip their student teach-ers with learning skills to become adaptive learners and employees.

However, when students are required to learn independently without sufficient guidance from the teacher, the learning situation often results in a "laissez-faire" approach where students cannot flourish as successful learners (Bolhuis & Voeten, 2001; Taks, 2003). In other words, teachers have to exert enough control on stu-dents' learning processes and guide students through the curriculum in small steps to enable them to achieve adequate academic results (Brophy & Good, 1986; Eshel & Kohavi, 2003; Kirschner, Sweller, & Clark, 2006; Stijnen, 2003). Grounded on this more behaviouristic point of view, Van der Werf (Wubbels et al., 2006) concludes that the empirical findings of educational research do not allow for extensive im-plementation of SRL.

It seems as if research has created a paradox between teacher-centred and stu-dent-centred dimensions of learning. In our view, instead of describing them as bipolair fenomena, teacher-centred and student-centred learning should rather be seen as dimensions of a learning continuum on which diverse positions are possible. In line with this statement, the present thesis aimed at finding a successful balance between teacher- and student-centred learning within primary teacher education curricula.

However, there is no common research opinion about the factors that must be considered to achieve such a balance in primary teacher education. In answer to this problem, the assumed positive relationship between SRL and academic success was object of study in this PhD research. More specific, the aim was to measure effects of student teachers' increased SRL opportunities on their motivation for learning and use of metacognitive learning strategies, both important for their aca-

demic career. In this way, more insight was gained into essential aspects that influence student teachers' academic development in learning environments with increased SRL opportunities.

Besides the relationships between SRL, motivation and metacognition, the research projects reported in this dissertation also focussed on the professional development of teacher educators in the SRL implementation process. Although primary teacher educators support the importance of the idea of SRL, they often find it difficult to actually foster it in educational pre-service programs (Korthagen, Klaassen, & Russell, 2000). In response to this problem, this thesis also studied how teacher educators can be supported in the SRL implementation process. In this way, this PhD research contributes to the discussion how to best implement SRL in pre-service teacher education by creating an appropriate balance between student- and teacher-directed learning.

The aims of this PhD research were split into 4 general research questions as formulated in Section 1.1. These research questions are addressed as 4 main themes in this chapter: (a) the self-regulated learning model for primary teacher education (Section 7.1.1), (b) the 'Self-Regulated Learning Opportunities Questionnaire': a diagnostic instrument (Section 7.1.2), (c) self-regulated learning, metacognitive and motivational development (Section 7.1.3), and (d) promoting self-regulated learning in learning networks (Section 7.1.4). Subsequently, strengths and limitations are provided (Section 7.2), followed by suggestions for future research (Section 7.3). Finally, theoretical and practical implications of this PhD research (Section 7.4) are discussed.

7.1.1 The self-regulated learning model for primary teacher education

In answer to the first research question of this PhD research (see Section 1.1), the theoretical review study of Chapter 2 results in seven SRL design principles that are embedded in an SRL model for primary teacher education. The large majority of the elements incorporated in the theoretical SRL study of this dissertation addresses issues or areas that have received significant research attention over a long time span. By presenting them in a clarifying SRL model (see Figure 2.1) including seven process-oriented design principles for primary teacher education, more insight into relevant SRL aspects is provided.

The principles of the SRL model point out the importance: (1) to create a sufficient knowledge base for student teachers in the domain (subject area); (2) to facilitate this knowledge building by integrating the necessary metacognitive skills and content matter during teaching; (3) to model these metacognitive skills by using four regulatory skill levels, namely observation, emulation, self-control and self-regulation; (4) to gradually develop from teacher control to student control over learning processes (scaffolding); (5) to be aware of the conditional factors that can

hinder or foster SRL development; (6) to engage student teachers in collaborative learning environments; and (7) to pay attention to the relevant SRL aspects of the learning task (goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgments, attributions, task value activation and time management).

7.1.2   The 'SRL Opportunities Questionnaire': A diagnostic instrument

Although the SRL model is a useful model for primary teacher educators in the SRL implementation process (as can be seen in the empirical studies of Chapters 4 and 5), an innovative design like the implementation of SRL needs to be more explicit about the teaching behaviours expected from the teachers. In the case of SRL implementation, it is important for teacher educators to search for a balance between teacher-centred and student-centred learning in the learning program, gradually moving from teacher to student regulation of the learning process (Figure 2.1, fourth SRL design principle). Therefore, in response to the second question of the research reported in this dissertation (see Section 1.1), Chapter 3 further elaborates the principles of the SRL model towards a diagnostic instrument for classroom practice ('SRL Opportunities Questionnaire' - SRLOQ). This instrument can support teacher educators in assessing SRL opportunities in educational pre-service programs on five scales: planning, monitoring of the learning process, zone of proximal development, coaching/judging and collaboration.

In the intervention studies (see Chapters 4 and 5), it is demonstrated that the SRLOQ (Appendix 3.A) provides a good grip for primary teacher educators in the SRL implementation process. By attending training courses that explain the principles of the SRL model, and individual tutorial conversations, based on the measured degree of SRL opportunities with the SRLOQ, teacher educators are able to assess student teachers' SRL opportunities on the five scales.

7.1.3   Self-regulated learning, metacognitive and motivational development

The empirical intervention studies of this dissertation searched for relationships between student teachers' SRL opportunities, their' use of metacognitive skills and their motivation for learning in the context of primary teacher education (see Section 1.1, research question 3).

To be able to measure student teachers' metacognitive and motivational development, the 'Motivation and Metacognition Questionnaire' (MMQ) was developed (see Section 4.2.2.2, Appendix 4.A). The MMQ consists of nine scales. For the metacognition part, two scales are distinguished: study process and study content. The motivation section comprises seven scales: intrinsic goal orientation, extrinsic goal

orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy, and test anxiety.

Then, the SRL model, the SRLOQ and the MMQ were applied in two empirical studies in primary teacher education that searched for dynamics of student teachers' use of metacognitive learning strategies and motivation for learning in learning environments with increased SRL opportunities. In Chapter 4, the pilot study is outlined, followed by the main study in Chapter 5 that searched for the mentioned relationships on a larger scale.

Motivation and metacognition were analysed because of their relevancy in determining student teachers' academic success. In the case of motivation, several researchers (e.g., Pintrich, 2000, 2004) demonstrate that higher motivation results in higher academic achievement. When it comes to metacognition, many studies (e.g., Vermunt & Verloop, 1999) that student teachers' use of metacognitive skills can improve their learning and comprehension, finally resulting in better academic performance. As for the relatedness between student' motivation and use of learning strategies, many researchers (e.g., Bruinsma, 2004) indicate that more motivated students are more likely to use more metacognitive strategies and are more effective in their effort regulation.

The research findings concerning SRL, metacognition and motivation are described in the next three sections in this chapter: (1) the relationship between SRL and metacognition (Section 7.1.3.1), (2) the relationship between SRL and motivation (Section 7.1.3.2) and (3) the relationship between metacognition and motivation (Section 7.1.3.3).

7.1.3.1 Self-regulated learning and metacognition

Results of the empirical studies (see Sections 4.3 and 5.3) show that student teachers' use of metacognitive learning strategies increased significantly during one semester in learning environments with increased SRL opportunities. These findings lead to the conclusion that primary teacher educators can play a major role in developing student teachers' use of metacognitive learning strategies by increasing student teachers' SRL opportunities in classroom practice.

To ensure successful knowledge building (Figure 2.1, first SRL design principle), the importance for teacher educators to focus on increasing both student teachers' content matter and metacognitive skills is emphasized (Figure 2.1, second SRL design principle). Primary student teachers' brain is still developing (Crone, 2008). Especially the brain area's that are important for planning, an important metacognitive skill, have not yet reached the adult status. For that reason, it is advised to create opportunities for student teachers to practice the necessary metacognitive skills. In short, primary student teachers benefit most from explicit metacognitive strategy instructions.

To facilitate the training of metacognitive skills, teacher educators can arrange learning environments that enable student teachers to practice self-regulation. In such settings, the four phase social cognitive model of the development of SRL (Schunk & Zimmerman, 2007) can be applied (Figure 2.1, third SRL design principle). In this model, four regulatory skill levels are distinguished. At the first level (observation), learners can induce the major features of the skill from watching someone model learning or performing. At the second level (emulation), the learner, with assistance from the group, imitates the model's performance. At the third level (self-control), the learner independently performs under structured conditions. At the final level (self-regulation), the learner shows an adaptive use of skills across changing personal and environmental conditions. By using such modelling, teacher educators can make their teaching more explicit and improve the transfer between theory and educational practice (Lunenberg, Korthagen, & Swennen, 2007).

7.1.3.2 Self-regulated learning and motivation

Although student teachers' motivation for learning correlated significantly positive with SRL opportunities and the level of SRL opportunities was shown a significant positive predictor of the motivation score, the increase of student teachers' motivation for learning appeared not significant during that one semester. However, the increase of student teachers' expectancy, a component within the motivation scale, was shown significant. The expectancy scale includes control belief and self-efficacy for learning and performance, e.g., 'I believe I will receive an excellent grade in this class'.

Notwithstanding the positive relationship between SRL and motivation, primary student teachers also stress the important role of teacher educators in providing a sufficient knowledge base to avoid uncertainty. Successful knowledge building (Figure 2.1, first SRL design principle) is only established by a gradual development ('scaffolding') from teacher control to student control over learning processes (Figure 2.1, fourth SRL design principle). Contrary to these findings, most educational programs in primary teacher education display a gap concerning SRL opportunities between the major (mainly teacher-centred) and minor (mainly student-centred) phase of learning programs (see Chapters 4 and 5). By applying the SRL model and according SRLOQ, primary teacher educators and policy makers can assess student teachers' SRL opportunities in educational programs, a first step towards gradual SRL increase in primary teacher education.

Besides the necessary attention for the professional development of teacher educators in SRL implementation processes, it is also important to pay attention to student characteristics, characteristics of learning materials and characteristics of the school context and culture (Figure 2.1, fifth SRL design principle). Most primary student teachers are not aware of the importance of SRL for their academic success and therefore (perhaps) less motivated to cooperate actively. For example, several

student teachers experience peer feedback as an obligatory part of the assignments instead of a useful procedure to improve their work. So, teacher educators to obtain successful SRL implementation must explain the importance of SRL for students' academic performance.

It is also eminent for teacher educators to apply the learning materials, for example the electronic learning environment, in the same way as their colleagues. In line with the findings of Sim and Hew (2010) in higher education settings, student teachers put forward that reflective learning in electronic learning environments requires clear technological instructions and sufficient time to be appreciated and adopted in student teachers' learning.

Finally, a supportive school context and culture enhances teacher educators' motivation and persistence towards SRL implementation (Könings, Brand-Gruwel, & Van Merriënboer, 2007; Van Hout-Wolters, Simons, & Volet , 2000; Vermunt & Verschaffel, 2000). Hence, it is important for policy makers to embed SRL as a central issue within educational programs.

7.1.3.3 Metacognition and motivation

Finally, although to a minor extent, the relationship between student teachers' use of metacognitive learning strategies and their motivation for learning was shown positively significant in the main study. Therefore, metacognition and motivation must be conceived as interacting constructs in research regarding SRL. Together, these components are assumed to influence students' involvement with their learning and, consequently, academic performance (Eccles & Wigfield, 2002; Pintrich, 2000, 2004).

7.1.4 Promoting self-regulated learning in online learning networks

In response to the fourth research question of this dissertation (see Section 1.1), Chapter 6 outlines the advantages of informal online learning networks for student teachers, teacher educators and practicing teachers to support the implementation of student teachers' SRL opportunities in educational pre-service learning programs. Such learning environments combine both face-to-face learning in classroom settings as well as distance learning in online learning networks in blended learning experiences. In this way, primary teacher educators and practicing primary teachers can guide their student teachers more intensively during learning and student teachers obtain more flexible and individual opportunities for SRL.

Chapter 6 describes three possible themes that can be explored and further concretized in such online learning environments: (1) modelling of metacognitive skills to student teachers by using the four modelling phases of Schunk and Zimmerman's (2007) model (observation, emulation, self-control and self-regulation); (2) improving student teachers' learning tasks by applying the 'Four Component

Instructional Design (4C-ID) model of Van Merriënboer and Kirschner (2007); and (3) creating a gradual SRL increase ('scaffolding') within educational pre-service learning programs by applying the SRLOQ.

7.2   Strengths and limitations

An innovative educational design like SRL must provide teachers much guidance for how to implement it in practice (Könings et al., 2007). Therefore, a strength of this thesis concerns the development of the SRL model and additional questionnaire to support primary teacher educators in the implementation of student teachers' SRL opportunities in their learning programs. In this way, the teaching behaviours expected from the teachers are made explicit.

In line with this strength, the research projects presented in this dissertation posess a practise-based character that is a vital concern of our department, the Scientific Centre for Teacher Research (LOOK), an expertise centre within the Open Universiteit in the Netherlands. Through practise-based research in close collaboration with teachers and schools, the professional development of teachers is stimulated, thereby contributing to the quality of teachers in the Netherlands. From this point of view, the design of the empirical studies in this PhD research allowed for cooperation between educational designers and teacher educators.

Also, the development of the assessment instrument shows analytic rigour by presenting a thorough construction process of scale development, score validation, further validation of the SRLOQ in primary teacher education, and a confirmatory factor analysis. Similarly, student teachers' motivation for learning and their use of metacognitive skills were assessed using both quantitative and qualitative methods. In this mixed methods pre-and post-test design, quantitative and qualitative analyses were based on the data of the pre- and the post-test for all participating teacher educators. In line with Miles and Huberman (1994), the collected data of the used instruments were analysed and related by triangulation to enhance the internal validity of the results.

Some critical remarks about this PhD research can be made. A limitation of the empirical intervention studies is that no control group was assessed. The point of reference used was the starting situation of student teachers' SRL opportunities. Other experiences by teacher educators and student teachers between the pre- and post-test might have influenced the results of the study.

Besides this, it is a general risk of innovations such as SRL that educational designers develop a blueprint for a powerful learning environment that teachers subsequently do not or cannot fully implement in their teaching (Könings et al., 2007). Although the SRL model and additional assessment instrument are supportive for teacher educators in the SRL implementation process, this instrumental develop-

ment only accounts for a first step in adopting student teachers' SRL opportunities in pre-service teacher education.

Finally, the positive relations between student teachers' SRL opportunities and their metacognitive and motivational development are only proven in the context of primary teacher education. It remains unclear in what way primary student teachers can best transfer their SRL expertise towards the children in their own classrooms. In general, one has to keep in mind that the findings were shown to be positive only in structured learning environments with sufficient attention for students' knowledge building (Figure 2.1, first design principle). To establish such learning conditions, it is important for teacher educators to scaffold student teachers' learning (Figure 2.1, fourth SRL design principle). Student teachers must possess sufficient prior knowledge to be able to internally guide them. Only then can the guidance of the teacher educator decrease.

7.3   Suggestions for future research

The studies presented in this dissertation gave rise to new questions that future research might address. One of the aims of the research projects presented in this dissertation was to study in detail how primary teacher educators can be supported in the SRL implementation process. Although the SRL model and according diagnostic questionnaire are useful instruments for teacher educators to assess student teachers' SRL opportunities, successful implementation of SRL demands further elaboration of the innovative learning environments. Teacher educators would, for example, benefit from further adjustments of the 4C-ID model (Van Merriënboer & Kirschner, 2007) towards primary teacher education to make it directly applicable for classroom settings. A possible manner for student teachers, teacher educators, and practicing teachers to design such alterations can be discussed in online learning networks. The SRL recommendations concerning the learning task (Figure 2.1, seventh SRL design principle) can be embedded in the 4C-ID model. A second issue that can be elaborated in such learning networks is for teacher educators and practicing teachers to gain more experience into the modelling of metacognitive skills to primary student teachers. In this way, the transfer between an educational design like SRL and the implementation in classroom practice can be strengthened.

The empirical intervention studies were carried out in a one-semester teacher education program. To provide more insight into the way student teachers develop as self-regulated learners, future research would benefit from monitoring student teachers over a longer period of time. In such longitudinal research, online measurement methods, for example by following participants in online learning networks, can be applied to obtain behavioural measures during student teachers' task performance. In such learning settings, instruments like 'Regulation of Motivation'

(Wolters, 2003) can be applied to measure the motivational construct to evaluate changes in motivation. In this way, motivation is assessed as a process or an event instead of a product or an aptitude (Winne & Perry, 2000). In the same matter, metacognitive feelings, judgments/estimates, and thoughts students are aware of during task performance can be assessed during learning (Efklides, 2006).

The findings concerning the positive relatedness between motivation and metacognition of the main study (see Section 5.3) are in line with other research (e.g., Berger & Karabenick, 2011). However, there is insufficient understanding about the reciprocal effects between motivation and metacognition. Based on the research of Berger and Karabenick (2011) is expected that this relationship is unidirectional: motivation predicts the use of metacognitive learning strategies, but the use of metacognitive learning strategies does not predict the motivation for learning. It would be interesting to broaden the understanding about possible reciprocal effects between motivation and metacognition in primary teacher education.

Finally, the research projects presented in this dissertation explored motivation and metacognition as intervening variables between SRL opportunities and academic achievement. Future research can aim at the measurement of student teachers' study results and study delay after increasing their SRL opportunities in similar educational pre-service settings.

7.4   Implications

The research projects presented in this dissertation have some interesting theoretical and practical implications. SRL is increasingly implemented in primary teacher education, because it is believed to better prepare students for successful learning in school and beyond. Therefore, the questions of how to best implement SRL in educational pre-service teacher programs and the effectiveness of this SRL enhancement for students' academic success are important for educational researchers, practitioners and policy makers.

The findings of this PhD research underline the important role of primary teacher educators in increasing student teachers' SRL opportunities in learning programs. In such innovative learning environments, teacher educators are advised to gradually move from teacher control to student control over learning processes (fourth SRL design principle) for successful knowledge building (first and second SRL design principles). To support a gradual SRL increase, teacher educators to assess student teachers' SRL opportunities in educational pre-service programs can use the SRLOQ. As for metacognition, teacher educators are encouraged to explicitly model metacognitive learning strategies (third SRL design principle) because primary student teachers benefit most from explicit strategy instructions.

Successful implementation of SRL also requires awareness of the conditional factors (fifth SRL design principle) that influence innovation processes. One has to pay attention to adequate preparation of teacher educators, the comprehension of the significance of SRL by student teachers, the use of adequate learning materials and an appropriate school context and culture. To achieve a situation where teacher educators collaborate (sixth SRL design principle) with colleagues, student teachers, information, and resources as they tackle SRL challenges, it is advised to use online learning networks. Networked learning is increasingly considered as a powerful way to stimulate and facilitate teachers' professional development in educational settings (Lieberman & Wood, 2003).

In such networks, teacher educators are better equipped to elaborate the SRL design principles, for example the necessary adjustments of the learning task (seventh SRL design principle), to make the task suitable for SRL experiences. The following advices concerning the learning task are important for teacher educators while implementing SRL in primary teacher education: (1) Create a gradual increase from teacher-directed towards student-direct learning when it comes to 'goal setting'; (2) Activate student teachers' prior knowledge and connect to their zone of proximal development; (3) Activate student teachers' metacognitive knowledge by scaffolding the structure of learning tasks and incorporating several feedback moments in the assignments; (4) Activate student teachers' metacognitive awareness and monitoring of cognition by providing useful feedback that activates their information processing; (5) Help student teachers clarify what good performance is and support them in making judgements about the way their work relates to previously formulated criteria; (6) Provide attribution feedback to student teachers which stresses factors they can control; (7) Demonstrate the value of tasks by applying good examples of the usefulness in classroom practice, and (8) Encourage student teachers to develop a working plan and support them in time management processes.

This thesis sought for the ideal learning environment that does not distinguish between student- and teacher-centred dimensions of learning, but adapts its instruction based on the needs of the students in a specific learning situation. A major misunderstanding about SRL concerns the idea that student teachers can work more independent, and teacher educators are allowed to invest less time in the guidance of student teachers. This is a false assumption. SRL implementation asks for a thorough preparation. Teacher educators have to think about ways to provoke and support goal setting, planning, monitoring, control and reflection by student teachers themselves. Maybe, the increase of student teachers' SRL opportunities in the learning program even demands more effort and attention of teacher educators than the regular approach.

To conclude, in learning environments where student teachers' SRL opportunities gradually increase and teacher- and student-centred dimensions of learning

strengthen one another, successful academic development of student teachers is enhanced. In such learning conditions, primary teacher educators can use the SRL model and according diagnostic instrument to assess student teachers' SRL opportunities in the learning program. In this way, a first step towards a successful balance between student- and teacher-centred dimensions of learning is established in primary teacher education.

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Summary

The motivation for this study of self-regulated learning (SRL) in the context of primary teacher education emerged from both the importance attributed to SRL for student teachers' academic success as well as the need to support teacher educators in the SRL implementation process. The main research goal was to examine in what way a successful balance between student- and teacher-centred dimensions of learning can be established. SRL is an active, constructive process in which learners plan, monitor, and control their own learning. Many recent studies have stressed the importance of students' SRL skills for successful learning. Consequently, primary teacher educators have been encouraged by policy makers to increase their students' SRL opportunities in educational pre-service programs.

However, teacher educators often find it difficult to implement these innovations in their teaching. Therefore, the first general aim of the research projects reported in this dissertation was to study in detail how teacher educators can be supported in the SRL implementation process. As a consequence, a systematic literature search concerning SRL was conducted as described in *Chapter 2* of this dissertation. Based on this search, seven process-oriented design principles for teacher educators were formulated and embedded in an SRL model (see Figure 2.1) for primary teacher education. These recommendations emphasize the importance: (1) to create a sufficient knowledge base for student teachers in the domain (subject area); (2) to facilitate this knowledge building by integrating the necessary metacognitive skills and content matter during teaching; (3) to model these metacognitive skills by using four regulatory skill levels, namely observation, emulation, self-control and self-regulation; (4) to gradually develop from teacher control to student control over learning processes (scaffolding); (5) to be aware of the conditional factors that can hinder or foster SRL development; (6) to engage student teachers in collaborative learning environments; and (7) to pay attention to the relevant SRL aspects of the learning task (goal setting, prior knowledge activation, metacognitive knowledge activation, metacognitive awareness and monitoring of cognition, judgements, attributions, task value activation and time management). In general, this SRL model provides more insight into relevant SRL aspects and can support SRL implementation in pre-service teacher education.

Although the SRL model is a useful model for primary teacher educators in the SRL implementation process, an innovative design like SRL needs to be more explicit about the teaching behaviours expected from the teachers. For that reason, *Chapter 3* elaborates the SRL model towards a diagnostic instrument for teacher educa-

tors that can be applied in classroom settings: the 'SRL Opportunities Questionnaire' (SRLOQ). A four-phase research design was applied consisting of scale development, score validation, further validation of the SRLOQ in primary teacher education, and a confirmatory factor analysis. The final version of the SRLOQ consists of five scales: (1) planning; (2) monitoring of the learning process; (3) zone of proximal development; (4) coaching/judging and (5) collaboration. In Appendix 3.A, all items of the teacher educator's version of the SRLOQ are presented. Quantitative analyses showed that the scores on the 5 scales are consistent and the five dimensional structure of the SRLOQ is acceptable. Besides the instrumental development, Chapter 3 also describes a single case study that illustrates the usefulness of the SRLOQ in classroom practice. Combined with training, teacher educators were able to assess student teachers' SRL opportunities in classroom practice on the five scales.

Besides the necessity to support teacher educators in the SRL implementation process, the effectiveness of increased SRL opportunities for student teachers' academic development was object of study in the present thesis as well. It is generally acknowledged that both metacognition and motivation are relevant in determining academic success. Therefore, **Chapters 4 and 5** explore dynamics of primary student teachers' motivation for learning and use of metacognitive learning strategies in learning environments with increased SRL opportunities. During one semester, teacher educators participated in training courses and tutorial conversations aimed at increasing student teachers' SRL opportunities. First in a pilot study (Chapter 4) with 3 teacher educators and 136 first-year student teachers in 2 primary teacher education colleges in the Netherlands; and second in a main study (Chapter 5) on a larger scale (11 teacher educators and 257 second-year student teachers of 5 primary teacher education colleges in the Netherlands). Student teachers' level of SRL opportunities was measured with the SRLOQ. The 'Motivation and Metacognition Questionnaire' (MMQ), also developed for this research (see Appendix 4.A), was used to measure student teachers' motivation for learning and their use of metacognitive learning strategies. For the metacognition part, two scales were distinguished: study process and study content. The motivation section comprises seven final scales: intrinsic goal orientation, extrinsic goal orientation, intrinsic goal avoidance, extrinsic goal avoidance, task value, expectancy, and test anxiety.

Regarding SRL opportunities and the use of metacognitive skills, correlation analyses outlined significant positive correlations between the two constructs. Also, T-tests showed that student teachers' use of metacognitive skills significantly increased in the research period. Finally, regression analyses outlined that the degree of SRL opportunities was a significant positive predictor of the use of metacognitive skills. In sum, the results indicated that teacher educators can play a major role in developing student teachers' use of metacognitive learning strategies. In the SRL implementation process, a need for more explicit strategy promotion was identified

to support student teachers' learning. During this modelling process, the following phases are important: observation, emulation, self-control and self-regulation.

In the case of SRL opportunities and motivation for learning, these two constructs also correlated positively and the degree of SRL opportunities was demonstrated a significant positive predictor of the motivational score as well. However, student teachers' motivation for learning did not significantly increase between the pre- and post test in the empirical studies. Contrary to these findings, student teachers' expectancy did increase significantly in the empirical studies. Student teachers indicated to appreciate the SRL increase because it made them feel more confident towards the transfer from theory to their own classroom practice, the assignments and the final test. Nevertheless, student teachers also stressed the important role of teacher educators in providing a sufficient knowledge base to avoid uncertainty. To ensure successful knowledge building, a gradual transfer from teacher control to student control ('scaffolding') is therefore emphasized. By attending training courses that explain the principles of the SRL model, and individual tutorial conversations based on the measured degree of SRL opportunities with the SRLOQ, teacher educators are able to assess student teachers' SRL opportunities in the learning program. In this 'scaffolding' process, the SRLOQ can not only be applied as a diagnostic tool for individual teacher educators, but also as a tool for policy makers to establish a gradual SRL increase within educational pre-service programs.

Although to a minor extent, the correlation between metacognition and motivation was shown positively significant in the main study. Hence, motivation and metacognition must be conceived as related constructs in research regarding SRL.

Based on the qualitative results of the empirical studies, it became clear that teacher educators required online trajectories to discuss current issues such as SRL. In response to this request, ***Chapter 6*** explores the benefits of online SRL learning networks to enhance implementation of SRL in pre-service teacher learning programs. In such educational settings, the design principles of the SRL model can be used as a holistic framework. Three emerging trends for SRL learning networks were described: (1) modelling of metacognitive skills by using four phases (observation, emulation, self-control and self-regulation); (2) improving learning tasks by applying the 'Four Component Instructional Design' (4C-ID) model; and (3) creating a gradual SRL increase ('scaffolding') within educational pre-service learning programs by applying the SRLOQ as a diagnostic tool.

Finally, ***Chapter 7*** draws five conclusions for successful SRL implementation in primary teacher education. The first conclusion is that the level of SRL opportunities in pre-service teacher learning environments is a moderate positive predictor of primary student teachers' use of metacognitive learning strategies and their motivation for learning, both important for student teachers' academic success. This conclusion underlines the important role of teacher educators in the SRL implementa-

tion process. The second conclusion is that teacher educators must gradually move from teacher control to student control over learning processes (fourth SRL design principle) to ensure student teachers' sufficient knowledge building (first and second SRL design principles). To support a gradual SRL increase, teacher educators to assess student teachers' SRL opportunities can use the SRLOQ. The third conclusion is that teacher educators must be encouraged to explicitly model metacognitive learning strategies (third SRL design principle) in classroom practice. The fourth conclusion is that successful implementation of SRL requires awareness of the conditional factors (fifth SRL design principle) that influence innovation processes. One has to pay attention to adequate preparation of teacher educators, the comprehension of the significance of SRL by student teachers, the use of adequate learning materials and an appropriate school context and culture. The fifth conclusion is that online learning networks are powerful learning environments for teacher educators to collaborate (sixth SRL design principle) with colleagues, student teachers, and relevant resources as they tackle SRL challenges. For example, the learning task (seventh SRL design principle) can be further elaborated to make it suitable for SRL experiences.

Samenvatting

De aanleiding voor deze studie op het gebied van zelfgestuurd leren (ZGL) binnen lerarenopleidingen primair onderwijs is gelegen in het belang dat aan ZGL toe wordt geschreven voor het academische succes van leraren in opleiding en de behoefte van lerarenopleiders aan ondersteuning bij de implementatie van ZGL binnen het lesprogramma. Het centrale doel was te onderzoeken op welke manier een succesvolle balans tussen student- en docent-gestuurde dimensies van leren kan worden vastgesteld. ZGL is een actief, constructief proces, waarbinnen de lerende zijn eigen leren kan plannen, monitoren en controleren. Veel recente studies hebben het belang aangetoond van het aanleren van zelfgestuurde leervaardigheden voor succesvol leren van studenten. Ten gevolge hiervan worden lerarenopleiders in toenemende mate door beleidsmakers aangemoedigd de zelfgestuurde leermogelijkheden van hun studenten binnen het lesprogramma te verhogen.

Lerarenopleiders vinden het echter vaak lastig om deze vorm van innovatie in hun lesgeven te implementeren. Daarom betrof het eerste doel van de onderzoeksprojecten zoals gepresenteerd in dit proefschrift het in detail bestuderen van de wijze waarop lerarenopleiders kunnen worden ondersteund bij de implementatie van ZGL in hun lesprogramma. Om dit doel te bereiken werd eerst een literatuurstudie uitgevoerd zoals beschreven in *Hoofdstuk 2* van dit proefschrift. Op basis van de bevindingen van deze literatuurstudie werden zeven procesgeoriënteerde ontwerpprincipes geformuleerd en samengevat in een 'Model ZGL' (zie Figuur 2.1) voor lerarenopleidingen primair onderwijs'. Deze aanbevelingen benadrukken het belang van: (1) het creëren van een voldoende kennisbasis voor leraren in opleiding in het domein (vakgebied); (2) het faciliteren van deze kennisopbouw door het integreren van de noodzakelijke metacognitieve vaardigheden en vak-inhouden tijdens het lesgeven; (3) het modelleren van deze metacognitieve vaardigheden door gebruik te maken van vier niveaus, namelijk observatie, emulatie, zelfcontrole en zelfregulatie; (4) het geleidelijk ontwikkelen van docentsturing naar studentsturing binnen leerprocessen (scaffolding); (5) het bewust maken van de conditionele factoren die de ontwikkeling van ZGL kunnen bemoeilijken of versterken; (6) het betrekken van leraren in opleiding in samenwerkende leeromgevingen; (7) het aandacht besteden aan relevante zelfgestuurde leeraspecten van de leertaak, namelijk doelbepaling, voorkennis activering, metacognitieve kennis activering, metacognitief bewustzijn en monitoren van kennis, beoordeling, attributie, taakwaarde activering en tijdmanagement. In algemene zin biedt dit model meer inzicht in relevante factoren op het

gebied van ZGL en kan het de implementatie van ZGL in het lesprogramma onder-
steunen.

Hoewel het 'Model ZGL' een bruikbaar model is voor lerarenopleiders primair
onderwijs, vereist een innovatief ontwerp als ZGL een verdere explicitering voor wat
betreft het gedrag dat van de lerarenopleiders wordt verwacht tijdens het lesgeven.
Om hieraan tegemoet te komen is in **Hoofdstuk 3** het 'Model ZGL' uitgewerkt in de
vorm van een diagnostisch instrument voor lerarenopleiders dat in de klassenprak-
tijk toe kan worden gepast: de 'Vragenlijst Zelfgestuurde Leermogelijkheden' (VZL).
Het onderzoeks-ontwerp bestond uit 4 fasen, namelijk schaalontwikkeling, validatie
van de scores, verdere validatie van de VZL binnen lerarenopleidingen primair on-
derwijs en een 'confirmatory factor analysis'. De finale versie van de VZL bestaat uit
5 schalen: (1) planning; (2) monitoren van het leerproces; (3) zone van de naaste
ontwikkeling; (4) begeleiden/beoordelen en (5) samenwerking. In Bijlage 3.A zijn
alle items van de docentenversie van de VZL opgenomen. Uit de kwantitatieve ana-
lyses bleek dat de scores op de vijf schalen consistent zijn en de vijf dimensionale
structuur van de VZL acceptabel is. Naast de instrumentontwikkeling, beschrijft
Hoofdstuk 3 ook een 'case study' die het nut van de VZL in de klassenpraktijk illu-
streert. In combinatie met training, waren lerarenopleiders in staat om de zelfge-
stuurde leermogelijkheden van leraren in opleiding te diagnosticeren op de 5 on-
derscheiden schalen.

Naast de noodzaak tot het ondersteunen van lerarenopleiders bij de implemen-
tatie van ZGL in hun klassenpraktijk, waren de consequenties van toenemende zelf-
sturing voor de academische ontwikkeling van leraren in opleiding ook onderwerp
van studie in dit proefschrift. In algemene zin wordt erkend dat zowel metacognitie
als motivatie van belang zijn voor succesvol leren. Daarom verkennen de **Hoofd-
stukken 4 en 5** de dynamiek van de studiemotivatie en het gebruik van metacogni-
tieve vaardigheden bij leraren in opleiding in leeromgevingen met verhoogde zelf-
gestuurde leermogelijkheden. Gedurende een semester namen lerarenopleiders
deel aan trainingen en individuele adviesgesprekken, gericht op het verhogen van
zelfgestuurde leermogelijkheden binnen het lesprogramma. Eerst in een pilot studie
(Hoofdstuk 4) met 3 lerarenopleiders en 136 eerstejaars leraren in opleiding van 2
lerarenopleidingen primair onderwijs binnen Nederland; en aansluitend in een
hoofdstudie (Hoofdstuk 5) op grotere schaal (11 lerarenopleiders en 257 tweede-
jaars leraren in opleiding van 5 lerarenopleidingen primair onderwijs binnen Neder-
land). De mate van zelfgestuurde leermogelijkheden werd gemeten met de VZL. De
'Vragenlijst Motivatie en Metacognitie (VMM), ontwikkeld voor dit onderzoek (zie
Bijlage 4.A), werd gebruikt voor het meten van de mate van studiemotivatie en het
gebruik van metacognitieve vaardigheden. Voor het onderdeel metacognitie wer-
den twee schalen onderscheiden: studieproces en studie-inhoud. De motivatiesectie
bevat zeven schalen: intrinsieke doeloriëntatie, extrinsieke doeloriëntatie, intrinsie-

ke doelvermijding, extrinsieke doelvermijding, taakwaarde, geloof in eigen kunnen en testangst.

Op het gebied van ZGL en het gebruik van metacognitieve leerstrategieën, lieten correlatieanalyses een positief significant verband zien tussen deze twee constructen. Daarnaast toonden T-toetsen aan dat het gebruik van metacognitieve leerstrategieën significant steeg in de onderzoeksperiode. Tot slot maakten regressieanalyses zichtbaar dat de mate van zelfgestuurde leermogelijkheden een positief significante voorspeller was van het gebruik van metacognitieve vaardigheden. Samenvattend indiceren de resultaten dat lerarenopleiders een belangrijke rol kunnen spelen bij de ontwikkeling van metacognitieve vaardigheden bij leraren in opleiding. Tijdens de implementatie van zelfgestuurde leermogelijkheden in het lesprogramma, is het van belang de metacognitieve vaardigheden expliciet te trainen. Hierbij zijn vier fasen van modelleren van belang, namelijk: observatie, emulatie, zelfcontrole en zelfregulatie.

Op het gebied van zelfgestuurde leermogelijkheden en studiemotivatie werd ook een positieve significante samenhang tussen beide constructen zichtbaar en bleek de mate van zelfgestuurde leermogelijkheden een significant positieve voorspeller van studiemotivatie. Echter, de studiemotivatie van leraren in opleiding bleek niet significant te zijn gestegen tussen de voor- en nameting in de empirische studies. In tegenstelling tot deze bevindingen, indiceren de resultaten wel een positief significante toename van het geloof in eigen kunnen bij leraren in opleiding. De studenten gaven aan dat ze de toename in zelfsturing waardeerden omdat ze daardoor meer zelfvertrouwen kregen betreffende de transfer tussen de theorie van de opleiding en hun eigen klassenpraktijk, de studieopdrachten en de toetsen. Desalniettemin benadrukten de leraren in opleiding ook het belang van het voorzien in een voldoende kennisbasis door lerarenopleiders om onzekerheid te voorkomen. Om verzekerd te kunnen zijn van voldoende kennisopbouw wordt een geleidelijke overgang van docentsturing naar studentsturing ('scaffolding') benadrukt. Door het volgen van zowel trainingen die het 'Model ZGL' toelichten, als individuele adviesgesprekken gebaseerd op de mate van verstrekte zelfgestuurde leermogelijkheden aan leraren in opleiding (gemeten met de VZL), zijn lerarenopleiders in staat de zelfgestuurde leermogelijkheden van hun studenten in het lesprogramma geleidelijk te verhogen. In dit 'scaffolding' proces kan de VZL niet alleen worden gebruikt als diagnostisch instrument voor individuele lerarenopleiders, maar ook als instrument voor beleidsmakers om een geleidelijke opbouw van zelfsturing binnen de vier leerjaren van de opleiding mogelijk te maken.

De correlatie tussen studiemotivatie en het gebruik van metacognitieve leerstrategieën bleek, in geringe mate, positief significant in de hoofdstudie. Dit betekent dat studiemotivatie en metacognitie moeten worden beschouwd als samenhangende constructen in onderzoek rondom ZGL.

Op basis van de kwalitatieve resultaten van de empirische interventiestudies werd duidelijk dat de lerarenopleiders behoefte hadden aan informele online trajecten om te discussiëren over actuele onderwerpen zoals ZGL. In antwoord op deze behoefte, onderzoekt *Hoofdstuk 6* de voordelen van online SRL leernetwerken ter bevordering van de implementatie van ZGL binnen lerarenopleidingen primair onderwijs. Daarbij kunnen de ontwerpprincipes van het 'Model ZGL' gebruikt worden als een holistisch kader. Drie belangrijke trends voor bespreking in dergelijke leernetwerken werden beschreven: (1) het modelleren van metacognitieve vaardigheden aan de hand van vier fasen (observatie, emulatie, zelfcontrole en zelfregulering); (2) het verbeteren van de leertaak door de toepassing van het 'Four-Component Instructional Design' (4C-ID) model; en (3) het creëren van een geleidelijke verhoging van ZGL ('scaffolding') binnen het curriculum door de toepassing van de VZL als diagnostisch instrument.

Tenslotte presenteert *Hoofdstuk 7* vijf conclusies voor een succesvolle implementatie van ZGL binnen lerarenopleidingen primair onderwijs. Ten eerste wordt geconcludeerd dat de mate van zelfgestuurde leermogelijkheden een gematigd positieve voorspeller is van het gebruik van metacognitieve leerstrategieën en de studiemotivatie, beide van invloed op het uiteindelijke academische succes van leraren in opleiding. Deze conclusie onderstreept de belangrijke rol van lerarenopleiders in het implementatieproces van ZGL. Ten tweede wordt een geleidelijke overgang van docent- naar studentsturing over leerprocessen geadviseerd (ontwerpprincipe 4) om verzekerd te kunnen zijn van een voldoende kennisopbouw (ontwerpprincipes 1 en 2) bij leraren in opleiding. Hierbij kunnen lerarenopleiders gebruik maken van de VZL. De derde conclusie is dat lerarenopleiders moeten worden aangemoedigd om metacognitieve leerstrategieën (ontwerpprincipe 3) expliciet te modelleren in de klassenpraktijk. De vierde conclusie is dat een succesvolle uitvoering van ZGL bewustzijn vereist van de voorwaardelijke factoren (ontwerpprincipe 5) die innovatieve processen beïnvloeden. Men moet aandacht besteden aan een adequate voorbereiding van lerarenopleiders, benadrukking van het belang van ZGL voor leraren in opleiding, het gebruik van adequate leermiddelen en een ondersteunende context en cultuur binnen het instituut. De vijfde conclusie is dat online leernetwerken krachtige leeromgevingen zijn voor lerarenopleiders om samen te werken met collega's, studenten en relevante bronnen (ontwerpprincipe 6) aan uitdagingen zoals ZGL. Zo kan bijvoorbeeld de leertaak (ontwerpprincipe 7) verder worden uitgewerkt teneinde deze geschikt te maken voor ZGL.

Curriculum Vitae

After pre-university secondary education, Emmy Vrieling-Teunter (1968) completed her Bachelor as a primary teacher educator (1990). Between 1990 and 1999 she worked successively as a primary teacher and coordinator of children with special needs. In 2001 she completed her Master degree in Education Sciences at the Open Universiteit in the Netherlands and started working as a primary teacher educator and educational consultant at Iselinge University of Applied Sciences. In 2007, Emmy began as a PhD candidate, guided by her promoters from the Scientific Centre for Teacher Research (LOOK), an expertise centre within the Open Universiteit in the Netherlands. She presented her research at national (VELON, ORD) as well as international (EARLI, SITE) conferences. As of September 2011, she holds a position as an assistant professor at LOOK, where she continues her research in the area of self-regulated learning, motivation, metacognition, learning networks and teachers' professional development.