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Process-oriented design principles for promoting self-regulated learning in primary teacher education

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Many recent studies have stressed the importance of students' self-regulated learning (SRL) skills for successful learning. Consequently, primary teacher educators are stimulated by their policy makers to increase their students' SRL opportunities in the educational pre-service program. However, primary teacher educators often find it difficult to implement these innovations in their teaching. In the present study, a literature search concerning SRL was conducted. Based on this search, seven process-oriented design principles were formulated, resulting in a 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.

Keywords: higher education; pre-service teacher learning; process-oriented learning; scaffolding; self-regulated learning

1. Introduction

This article 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.

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 stimulated 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 for realizing their own choices. Due to this individualization process, there is more focus on individual students with their own talents (Bronneman-Helmers, 2007). Consequently, the educational setting 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 that can support this knowledge construction (Bronneman-Helmers, 2007), have increased the interest in SRL in educational practice.

1.2 Primary teacher education and SRL

Teacher education is a field that 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 lack of transfer from theory to practice. Student teachers are often not able to use the knowledge and skills provided in their own classrooms (Korthagen, Klaassen, & Russell, 2000).

In answer to this problem, teacher educators are challenged to increase student teachers' SRL opportunities in the educational program (Kremer, Hayon, & Tillema, 1999). Students who can better regulate 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). That may also be the case with students in teacher education. In addition, the SRL concept can be very useful in the specific context of student teacher learning since student teachers can adopt this self regulation in their teaching (Kremer-Hayon & Tillema, 1998).

As a consequence, student teachers have to learn as professionals and construct their own knowledge to develop an attitude of reflective inquiry and to experiment with ideas and teaching skills to enable lifelong learning (Kremer-Hayon & Tillema, 1999).

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1.3 Problem definition

Although teacher educators support the importance of the SRL concept (Kremer-Hayon & Tillema, 1999), they often find it difficult to foster student teachers' SRL in the educational pre-service program (Lunenberg & Korthagen, 2005; Van Petegem, Donche, & Vanhoof, 2005). Many practising teacher educators have not been prepared for this changing role during their education (Korthagen, Claassen, & Russel, 2000) and are often worried about their decreasing role of knowledge provider (Kremer-Hayon & Tillema, 1999). So, the professional development of teacher educators deserves more attention to increase student teachers SRL opportunities in the educational pre-service program (Könings, Brand-Gruwel, S., & 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 was as follows: Which SRL principles for primary teacher education are distinguished in the literature? The present article represents a SRL search, aimed at describing a specific set of design principles for primary teacher education.

The article continues with a description of the literature search. Then, the findings from the literature search are outlined, resulting in process-oriented design principles for primary teacher education. These principles are summarized in a SRL model for primary teacher education. Finally, the findings are discussed and indications for future research are formulated.

2. Review of the literature

To be able 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 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 Educational 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. Five 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 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) modeling of metacognitive skills, 5) scaffolding, 6) conditions, 7) collaboration, and 8) learning task. These main themes were also incorporated in Appendix A. The first theme represented a general theme that was used in section one of the present article The remaining seven themes provided the conceptual framework for section three of the present article, leading to the process-oriented design principles.

3. Findings from the literature

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 a 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 summarized and visualized in a SRL model for primary teacher education (Figure 1).

3.2 Findings concerning a successful SRL implementation

3.2.1 Knowledge building

Although the increase of students' SRL opportunities is recommended by several researchers (e.g. Simons, Van der Linden, & Duffy, 2000; Zimmerman, 2002), disputes about the effectiveness 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 a prerequisite in the process of establishing 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. A lack of metacognitive skills or knowledge might threaten the exploration of new insights during learning (Stijnen, 2003).

So, teachers cannot expect their students to regulate their learning all by themselves. 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).

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.

So, 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.

3.2.3 Modelling skills

Teaching metacognitive skills demands overt and explicit demonstration of often hidden learning and thinking activities (Zimmerman, 2000), also in the context of teacher education (Kramarski & Michalsky, 2009). 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 by 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 a model learn or perform. At the second level (emulation), the learner imitates performances of a model's skill with social assistance. At the third level (self-control), the learner independently shows a model's skill 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 improve the transfer between theory and educational practice (Lunenberg, Korthagen, & Swennen, 2007).

Altogether, 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.

3.2.4 Scaffolding

To ensure successful knowledge building, Hmelo-Silver, Duncan, and Chinn (2007) stress the important role of teachers in providing considerable guidance to students. Kirschner, Sweller, and Clark (2006) emphasize the importance for students to possess sufficient high prior knowledge to be able to internally guide themselves. Only then the guidance of the teacher can decrease.

These findings indicate the importance of finding 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, 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).

3.2.5 Conditions

Students in teacher education 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, and teachers subsequently are not able to implement it in their teaching (Könings, Brand-Gruwel, & van Merriënboer, 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 an adequate preparation of teachers is necessary for a successful implementation of SRL in classrooms. The effective integration of SRL in the educational program 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, Donche, & Vanhoof, 2005). Furthermore, learners are not always motivated to invest much time and energy in developing adequate learning skills (Van Hout-Wolters, Simons, & Volet, 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, Brand-Gruwel, & van Merriënboer, 2007; Vermunt & Verschaffel, 2000).

The school context and culture may also be obstacles to implementing an innovative design like process-oriented learning (Könings, Brand-Gruwel, & van Merriënboer, 2007; Van Hout-Wolters, Simons, & Volet, 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.

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 taking good advantage 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 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.

3.3 Findings concerning the learning task

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 and 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.

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).

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.

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.

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).

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).

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.

3.3.8 Time management

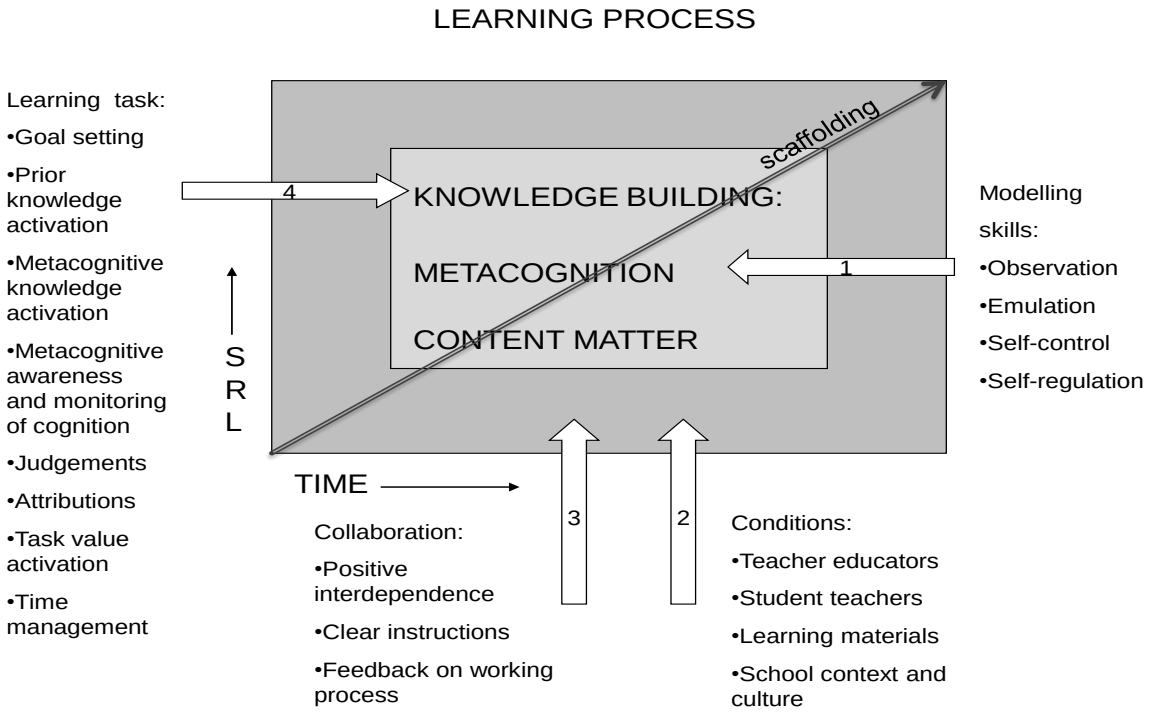
Time management involves making schedules for studying and allocating time for different activities (Pintrich, 2000) and is an important component of SRL (Dembo & Eaton, 2000). The key factor of time management is prioritizing activities each day. Students make decisions and form intentions about how they will allocate their effort and the intensity of their work.

3.4 Construction of the SRL model

In this section, the findings from the literature were discussed, aimed at formulating relevant SRL recommendations for primary teacher education. Seven process-oriented design principles

were distinguished. All design principles are theoretically underpinned in this article and outlined in the SRL model for primary teacher education (Figure 1).

Figure 1. SRL model for primary teacher education



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 drawn 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) was stressed. This gradual increase in SRL is also displayed in Figure 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 was 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.

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 large 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 in the educational pre-service program

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 behaviors expected from the teachers (Könings, Brand-Gruwel, S., & van Merriënboer, 2007). Therefore, in a follow up study, 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 and gradually increasing student teachers' SRL opportunities in the educational pre-service program. In this way, a better balance between student-centered and teacher-centered approaches in primary teacher education can be achieved.

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Appendix 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 processes as social phenomena	Collaboration
Bronnenman-Helmers (2007)	Report	NL	C	SE	Educational reform in the Netherlands	Importance
Butler (2002)	Journal article	US	C	SE/HE	Instructional SRL model Productive, unproductive attribution	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 including feedback	Learning task
Dembo & Eaton (2000)	Journal article	US	C	SE	Academic achievement Time management/ Learning and performance goals	Importance Learning task
Eccles & Wigfield (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	Importance

					Student and teacher control	Knowledge building
Hmelo-Silver, Duncan, & Chinn (2006)	Journal article	US	C	G	Academic achievement Innovative approaches	Importance Scaffolding
Hattie &Timperly (2007)	Journal article	NZ	C	G	Feedback model	Learning task
Kirschner, Sweller, & Clark (2006)	Journal article	NL	C	G	Student guidance	Knowledge building
Könings, Brand-Gruwel, & van Merriënboer (2007)	Journal article	NL	E	SE	Teachers' professional development	Conditions
Korthagen, Klaassen, & Russell (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, Korthagen, & Swennen (2007)	Journal article	NL	E	TE	Teachers' professional development	Modelling
Nicol & Macfarlane-Dick (2006)	Journal article	UK	C	HE	Feedback principles	Learning task
Nietfeld, Ciao, & Osborne (2006	Journal article	US	E	HE	Metacognition, academic achievement	Learning task
Norton & Hathaway (2010)	Book chapter	US	E	TE	Teachers' guidance	Collaboration
Nota, Soresi, & Zimmerman (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
Putnam & Borko (2004)	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, Van der Linden, & Duffy (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
Van Eekelen, Boshuizen, & Vermunt (2005)	Journal article	NL	E	HE	Teachers' SRL	Conditions
VanderStoep, Pintrich, & Fagerlin (1996)	Journal article	US	E	HE	Academic achievement	Importance
Van Hout-Wolters, Simons, & Volet (2000)	Book chapter	NL	C	G	Difficulties SRL implementation	Conditions
Van Petegem, Donche, & Vanhoof (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
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	Content/metacognition Scaffolding Importance

					Components	Conditions
Wigfield, Hoa, & Klauda (2007)	Book chapter	US	C	G	Facilitative role	Collaboration
Windschill (2002)	Journal article	US	C	G	SRL Framework	Importance
Wood, Bruner, & Ross (1976)	Journal article	US	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