Which components of teacher competence determine whether teachers enhance self-regulated learning? Predicting teachers' self-reported promotion of self-regulated learning by means of teacher beliefs, knowledge, and self-efficacy

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Abstract

In this study, the predictive value of three aspects of teacher beliefs regarding teachers' promotion of self-regulated learning (SRL) is modelled by means of structural equation modelling. These include teacher beliefs on (1) instructing SRL, (2) regarding their own self-efficacy towards the promotion of SRL, and (3) their epistemological beliefs regarding learning. 173 primary school teachers participated in the study. Path analysis revealed that teachers' beliefs on instructing SRL, along with their self-efficacy beliefs regarding the promotion of SRL, were predicting teachers' promotion of SRL mostly positively. The results offer new insights into teacher beliefs and how they account for self-reported teacher practice regarding the promotion of SRL. This study is particularly innovative as it is the first study in the field of teachers and SRL to investigate teacher beliefs and teacher self-efficacy as potential determinants of teachers' promotion of SRL in the classroom. These results can serve to construct a model of teachers' promotion of SRL, as well as provide ideas on how to help teachers supporting SRL. This study is frontline as it appears that no other research has been published on teachers' beliefs, in particular self-efficacy beliefs, towards promoting SRL and how these are related to teachers' promotion of SRL. Most research on teachers and SRL has so far focused on training teachers, but no model of the professional competence of teachers in this area exists until now.

1.   Theoretical background

A large amount of research on the impact of self-regulated learning (SRL), as well as on factors that determine the use of SRL and how SRL can be fostered in learners, has been examined in the past. However, there is still a lack of research on what determines teachers' promotion of SRL. When looking at the literature, one can imagine the amount of research in the area of SRL as being similar to the shape of a funnel: the numerous studies on the impact that SRL has on a learner's achievement and motivation have drawn the interest of many researchers to investigate, as a next step, how SRL in learners can be improved. Several meta-analyses on how to promote SRL have summarized the considerable number of training studies in the field of SRL (see e.g., Hattie, Biggs & Purdie, 1996; Dignath, Büttner & Langfeldt, 2008). When looking further at how teachers can enhance their students' SRL, the amount of research decreases substantially (for a literature review on the role of the teacher in promoting SRL, see Moos & Ringdal, 2012). And finally, only few studies have explicitly searched for reasons why some teachers do, while others do not promote SRL in their classrooms, in particular with regard to their instruction of SRL strategies (e.g., Chatzistamatiou, Dermitzaki & Bagiatis, 2014; Dignath-van Ewijk, Dickhäuser & Büttner, 2012). Many studies in the past showed that individual factors, such as teaching self-efficacy, value beliefs, etc., are related and/or affect teachers' reports regarding several aspects of instructional quality, as well as covering aspects of supporting students' autonomy while learning (e.g., Kunter, Tsai, Klusmann, Brunner, Krauss & Baumert, 2008). However, knowing more about what determines whether teachers promote SRL would be helpful to generate ideas on what teachers should develop in order to enhance SRL in their students and how teachers can be supported during the process of teacher training (see Kramarski, Desoete, Bannert, Narciss & Perry, 2013).

To fill this gap, we investigated several potential predictors in order to learn what determines teachers' self-reported promotion of SRL. The aim of the study was to investigate the impact of potential determinants for teachers' promotion of SRL, including teacher beliefs, teacher self-efficacy, and teacher knowledge, on teachers' self-reported promotion of SRL in the classroom in order to find out which teacher characteristics should be addressed when training teachers in SRL. Teachers had to fill out questionnaires regarding their educational beliefs, self-efficacy beliefs, and their knowledge on how to support students' SRL, and they also had to rate their promotion of SRL while they taught. The teacher characteristics which were assessed should be placed in a general model of teaching competence.

1.1   Promotion of Self-Regulated Learning

Zimmerman (2000) defines self-regulated learners as learners who set themselves goals, plan their actions to pursue these goals, monitor their learning, and finally evaluate their learning process. In terms of a feedback loop, the result of this evaluation influences and regulates the following learning process. When looking at how teachers can foster SRL in students, Paris and Paris (2001) describe two different ways: directly, by providing students with knowledge and skills on how to self-regulate (teaching them strategies in terms of informed training (Brown, Campione & Day, 1981), and indirectly, by arranging the learning environment in a constructivist way so that students can and have to self-regulate their learning (e.g., by offering choices to students and providing them with situations in which they can take over responsibility for their learning) (Pressley, Harris & Marks 1992).

Although some literature can be found on how to promote SRL among students using specific interventions (see e.g., Dignath, 2009; Paris & Paris, 2001; Perry & VandeKamp, 2000; Perry, Phillips & Dowler, 2004; Pressley et al., 1992), only little research has been published so far about teachers' actual promotion of SRL in the classroom. The few observational studies that have been conducted in order to register in how far teachers foster SRL among their students have concluded that teachers spend only little time on strategy instruction, even if they often design learning environments which require self-regulation (see e.g., Bolhuis & Voeten, 2001; Dignath et al., 2013; Hamman, Berthelot, Saia & Crowley, 2000; Spruce & Bol, 2014; Moely et al., 1992). The outcomes of those studies raise the question, why teachers do not

invest more in preparing their students for self-regulation. Do teachers not support the idea of self-regulated and strategic learning (teacher beliefs), or do they not know *how* to support it (teacher knowledge)? And how are both, beliefs and knowledge, related?

1.2   Teacher Beliefs and Teacher Knowledge

When looking at teacher beliefs, a clear labelling of the constructs of beliefs and knowledge seems necessary. While beliefs are supposed to be more affective in this distinction, knowledge is supposed to have the higher epistemic status by being more justifiable when compared with beliefs (Fenstermacher, 1984). Although the terms have been used interchangeably in teacher education literature (Hofer & Pintrich, 1997), we draw on the terminology used by Pajares (1992) when reviewing the literature of teacher beliefs and teacher knowledge: "Belief systems, unlike knowledge systems, do not require general or group consensus regarding the validity and appropriateness of their beliefs. Individual beliefs do not even require internal consistency within the belief system. This nonconsensuality implies that belief systems are by their very nature disputable, more inflexible, and less dynamic than knowledge systems." (Pajares, 1992, p. 311). Beliefs are supposed to include value commitments, epistemological beliefs, subjective theories about learning, and goals. Furthermore, motivational orientations cover teachers' self-referred cognitions – in particular locus of control and self-efficacy – as well as their intrinsic motivation (Baumert & Kunter, 2006, 2013).

1.3   Epistemological Beliefs

Beliefs on fostering SRL could be influenced by more general beliefs on the nature of learning and knowing: epistemological beliefs. Epistemological beliefs refer to the assumptions an individual has about the origin, nature and structure of knowledge and knowing (Schraw, Crippen & Hartley, 2006). Hofer and Pintrich (1997) identified three lines of research on epistemological beliefs. The first line of research has dealt with developmental models of beliefs about knowing and knowledge, building on the initial work of Perry (1970). The second line of research has focused on the consequences of epistemological assumptions on the way people think and reason. The last and most recent line of research has been concerned with the structure of a system of beliefs and how these beliefs influence comprehension and academic achievement (e.g., Schommer, 1990; Schommer- Aikins, 2004).

Schommer has developed a taxonomy of beliefs consisting of four more or less independent dimensions: *Innate Ability* (learning is not changeable, but rather a fixed ability), *Quick Learning* (content is either learned quickly or not at all), *Simple Knowledge* (most important information is rather simple), and *Certain Knowledge* (information does not change over time). These four dimensions were extracted by factor analysis with each factor seen as a continuum. The factor *Innate Ability* is probably of central importance for the promotion of SRL in our study and will therefore be described later on in more detail compared with the other three factors of which detailed descriptions can be found elsewhere (e.g., Hofer & Pintrich, 1997).

Several researchers have found significant relationships between epistemological beliefs and SRL (see e.g., Pieschl, Stahl & Bromme, 2008 or Schommer, 1990 for epistemological beliefs in general; see e.g., Bendixen & Hartley, 2003 for innate ability). In the way that this relationship can be found between learners' epistemological beliefs and their self-regulation, one can assume that such a relationship exists between teachers' epistemological beliefs and their promotion of self-regulation. If the assumption that learning and knowing is something that a learner cannot change or influence, then the learner does not feel capable to self-regulate his or her learning. If a teacher assumes that learning and knowing is not changeable, why would he or she try to teach self-regulation of learning? In a meta-synthesis, Hattie (2013) synthesized the results of several meta-analyses on the effect that teacher beliefs have on their effectiveness. He found a strong effect of teachers' epistemological beliefs related to their conceptions of teaching and learning (Hattie, 2013). Several studies on the association of teachers' epistemological beliefs and their instruction

point into this direction as teachers' epistemological beliefs affect their curricular and pedagogical decisions (for an overview, see Schraw et al., 2006). However, results are sometimes unclear and other studies found the impact of epistemological beliefs on teaching competence to be mixed (e.g., Creemers et al., 2013; Shraw & Olafson, 2003; Sosu & Gray, 2012).

Bell (2006) examined the effects of SRL and epistemological beliefs on academic achievement while holding constant the effects of self-efficacy and prior college academic achievement. He found students' prior academic achievement and their expectancy to be the only significant predictors for academic achievement. However, he argues that students' self-regulation, as well as their epistemological beliefs, probably influence students' expectancy, which in turn influences academic achievement, but he did not show any own predictive value in the multiple regression analyses that he had run (Bell, 2006). We therefore decided to analyze the impact of epistemological beliefs in another way so that we can account for indirect effects on our outcome variable, as epistemological beliefs might not directly influence teachers' self-reported promotion of SRL, but only indirectly via more specific teacher beliefs.

1.4   Beliefs on the Promotion of Self-Regulated Learning

To our knowledge, only few studies thus far have been conducted in order to investigate the relationship between teachers' educational beliefs and teachers' promotion of SRL. Lombaerts and colleagues have addressed the question of the relationship between Flemish primary school teachers' beliefs and their self-reported teaching practice by developing questionnaires to investigate teacher beliefs on promoting SRL (Lombaerts, Engels, van Braak & Athanasou, 2009), as well as on teachers' realization of self-regulation during their teaching (Lombaerts, Engels & Athanasou, 2007). They found teacher beliefs about SRL in primary school to be a significant predictor for teachers' self-reported recognition of SRL. These teacher beliefs were predicted significantly by beliefs about teacher-level influence on SRL, but not by beliefs about school context influence on SRL. Thereby, teacher beliefs about teacher-level influence on SRL cover aspects like e.g., beliefs on instructional pedagogy, and on innovations in teaching and learning (sample item: *Personal insight into how to support self-regulated learning does influence the introduction of self- regulated learning in my classroom.*), while beliefs about school-level influence on SRL include beliefs on the stimulation of SRL by the school as an organization, collaboration of teachers as part of the school culture, or curriculum changes (sample item: *The level of involvement of our team in the school development plan influences the introduction of self-regulated learning in my classroom.*) (see Lombaerts et al., 2009). Moreover, another significant predictor for teachers' self-reported recognition was teacher-level satisfaction, which was in turn predicted by school context satisfaction, itself not having any direct predictive value for self-reported teacher behavior. The main conclusion of Lombaerts and his colleagues (2009) is that beliefs about teacher-level influence on SRL predict teachers' self-reported behavior directly, but beliefs about school context influence on SRL do not.

Vandevelde, Vandenbussche and Van Keer (2012) conducted a study with Flemish primary school teachers that revealed that teachers who report developmental educational beliefs reported to implement SRL more often than teachers holding transmissive educational beliefs. Teachers' implementation of SRL was assessed using the scale that Lombaerts and colleagues had developed and used in their study (Lombaerts et al., 2007).

Dignath-van Ewijk & Van der Werf (2012) examined the predictive value of Dutch primary school teachers' educational beliefs and their knowledge about promoting SRL for their realization of supporting SRL in the classroom. Their results showed that teacher beliefs on SRL predict teachers' self-reported implementation of SRL, contrary to teachers' general educational beliefs, or to teachers' knowledge on promoting SRL. Moreover, they found that teachers were more positive towards the realization of a constructivist learning environment in general than towards the instruction of SRL strategies.

Spruce and Bol (2014) examined the relationship between (1) teacher beliefs and (2) knowledge and (3) the observed classroom practice of ten American primary and middle school teachers in a qualitative case

study. They found teachers often deviated within these three constructs: out of the ten teachers that they observed in classrooms, teachers with high knowledge regarding the promotion of SRL and rather positive beliefs reached only low observation scores when promoting SRL; teachers having a positive attitude towards SRL and possessing high knowledge regarding the promotion of SRL was not reflected in their promotion of SRL, which the researchers observed (Spruce & Bol, 2014).

These studies have investigated the predictive value of teacher beliefs and, regarding teacher knowledge, the promotion of SRL on behalf of teachers. However, none of the studies have considered the impact of teachers' self-efficacy on implementing SRL in the classroom.

1.5 Self-Efficacy Beliefs

When looking at motivational orientations, self-efficacy and locus of control play an important role in determining teacher behavior (see e.g., Baumert & Kunter, 2006, 2013; Kunter, 2013). The feeling of control over the behavior in question arises from self-efficacy theory (Bandura, 1977). According to Bandura (1977), self-efficacy beliefs represent a judgment of one's capabilities to reach a certain goal. With regard to teacher efficacy, Tschannen-Moran and Woolfolk (2001) define teachers' efficacy beliefs as an assessment of "his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Woolfolk, 2001, p. 783).

Bandura (1986) proposed that people with high self-efficacy beliefs are more likely to perform better and show a higher frustration tolerance than people with low self-efficacy beliefs. Self-efficacy beliefs would, therefore, play an important role in one's motivation to initiate an effort, the persistence of effort, and the way in which one deals with setbacks (Skaalvik & Skaalvik, 2010). Four factors are supposed to determine a person's self-efficacy: (1) personal experience of success or failure (also: enactive attainment) whose interpretation is closely related to people's beliefs and values, (2) vicarious experience (also: modeling) which is influencing the knowledge of what is "right" and "wrong", (3) social persuasion in terms of encouragement or discouragement, as well as (4) the perception of physiological reactions (Bandura, 1977). These four factors also affect teachers' beliefs and knowledge which will, in turn, act as determinants for teachers' self-efficacy. These sources of efficacy beliefs are considered to provide the basis for one's task analysis and appraisal of one's personal competence. The resulting judgment of the match of task requirements and personal ability creates the teachers' efficacy belief (Tschannen-Moran, Hoy & Woolfolk-Hoy, 1998).

How is the self-efficacy of teachers linked to teacher beliefs, knowledge, and behavior? A large amount of research on teacher efficacy has evolved within the last decades (see Klassen, Tze, Betts & Gordon, 2011 for a review). Research has shown the relationship between self-efficacy and teacher behavior (see e.g., Guo, Piasta, Justice & Kaderavek, 2010; Holzberger, Phillip & Kunter, 2013; Tschannen-Moran & Woolfolk Hoy, 2001). Studies have found e.g., a significant relationship between teachers' self-efficacy and teacher beliefs towards instructional innovation (e.g., Ghaith & Yaghi, 1997; Guskey, 1988) and instructional strategies (e.g., Tschannen-Moran & Johnson, 2011; Wertheim & Leyser, 2002; Swars, 2005), and a relationship between teachers' self-efficacy and a control orientation against teacher control of students (Woolfolk & Hoy, 1990). With regard to the promotion of SRL, Chatzistamatiou et al. (2014) found that teachers' self-reported strategies to enhance students' SRL in mathematics were predicted by their own self-efficacy beliefs. Perry, Hutchinson, and Thauberger (2008) asked teachers about their instruction of strategies and found teachers to be positive towards the idea of fostering self-regulation of their students, but they did not know how to do this. Beside the pure knowledge of doing so, the teachers' self-efficacy on feeling competent enough to handle this might play a role.

1.6   Hypotheses

In this study, we wanted to investigate determinants of teachers' promotion of SRL when looking at teacher beliefs and teacher knowledge. Although also other variables on the institutional level or the teacher level can have an impact on teachers' promotion of SRL, we focused on variables on the teacher level in our investigation in order to start researching potential determinants on a micro-level first.

The relationships between the above mentioned concepts, on which we base the theoretical model, can be derived from the theory as follows (see Figure 1 for a graphical illustration on the predicted relationships):

a) Firstly, general teacher beliefs are assumed to predict more specific teacher beliefs (Pajares, 1992). Therefore, epistemological beliefs about learning as a fixed or changeable ability (in terms of rather general teacher beliefs) are assumed to predict teachers' beliefs on the promotion of SRL (in terms of rather specific beliefs).

b) Second, knowledge is assumed to be predicted by one's beliefs. In how far teachers learn new knowledge and how new information will be integrated into their existing knowledge base, will be predicted by the beliefs that teachers already report (Ertmer, 2005). Thus, teacher beliefs are assumed to predict teacher knowledge on the promotion of SRL.

c) Third, most researchers agree on the strong impact that teacher beliefs have on teaching behavior. Most empirical evidence suggests that teacher beliefs have a stronger impact on teaching behavior than does teacher knowledge (see e.g., the reviews of Kagan, 1992, and Pajares, 1992). We therefore assume that teacher beliefs predict teacher knowledge, and that both teacher beliefs and teacher knowledge predict self-reported teacher practice, with teacher beliefs being a stronger predictor than teacher knowledge.

d) Whether an intention is carried out as a certain behavior depends not only on one's beliefs, but also on one's perceived behavioral control (Ajzen, 1991; Bandura, 1977). The self-efficacy of teachers to promote SRL is thus supposed to predict teachers' self-reported promotion of SRL, next to teacher beliefs and teacher knowledge.

e) Finally, self-efficacy is supposed to be determined by several factors (see point described earlier in this section), of which the interpretation is influenced by one's beliefs and knowledge (Bandura, 1977). We therefore assume that teacher beliefs and teacher knowledge will predict the self-efficacy of teachers.
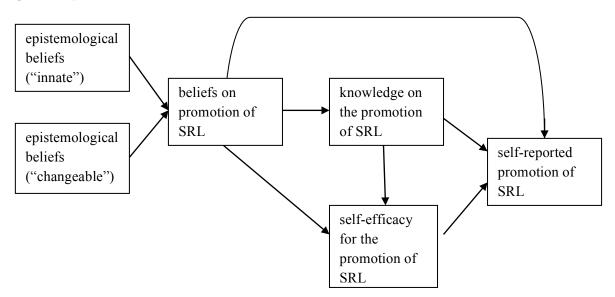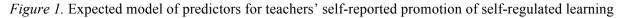
2.   Methods

2.1   Sample

Primary school teachers from southern Germany had been contacted via email and telephone to ask if they could complete a questionnaire on teachers' knowledge and beliefs towards SRL. One hundred and seventy-three primary school teachers participated in the study, which equates to a response rate of 41%. The data from 140 teachers was complete and could be included in the analyses. Teachers were mainly female (87.1%), and ranged in age from 22 to 64 years (M= 39.6 years, SD=12.63) and had on average 15.06 years of teaching experience (SD=12.91).

2.2   Procedure

In order to find out whether teacher beliefs and knowledge predict teachers' self-reported promotion of SRL, a path analysis was conducted. As we assumed beliefs and self-efficacy to predict teachers' self-reported practice, self-reported teacher behavior was regressed on beliefs regarding the promotion of SRL, as well as epistemological beliefs, on knowledge, and on self-efficacy within the path analysis. Furthermore, epistemological beliefs as more general beliefs on learning were assumed to predict teacher beliefs on the promotion of SRL, as those are more specific. Figure 1 shows the model that was specified based on the previously described theories.

Figure 1. Expected model of predictors for teachers' self-reported promotion of self-regulated learning

The questionnaires were administered to all teachers within a time period of two weeks. Most schools received the questionnaires personally; only schools which were situated more than 40 km away received the questionnaires by post. One week after administration, the completed questionnaires were collected from the schools. The questionnaire took approximately 30 minutes to complete. Teachers were told about the purpose of the study. Questions from the questionnaire were to be answered with regard to teaching in grade 4 of primary school[1] to allow for comparisons among teachers.

2.3   Instruments

The teacher questionnaire consisted of four self-reporting scales and one open question regarding teacher knowledge. Teachers first had to answer the open question that aimed at assessing their knowledge on promoting SRL before possibly being influenced by the content of the items in the questionnaires. Next, teachers had to answer questions using the scales measuring teacher beliefs on SRL, teacher self-efficacy beliefs, as well as epistemological beliefs. Finally, the questionnaire contained a scale assessing teachers' self-reported promotion of SRL. The order of the scales was chosen in a way that minimizes influences from answering one scale to the next.

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[1] In the German school system, students enter primary school at the age of six (1st grade) and leave primary school after 4th grade.

2.3.1 Teacher epistemological beliefs

Teachers' epistemological beliefs regarding learning were measured using the subscale for *Fixed Ability* from a German translation of the *Epistemological Questionnaire* by Schommer (1990) (Schiefele, Moschner & Husstegge, 2002). *Innate,* or *Fixed Ability,* draws on the concept of individuals' implicit theories of intelligence by Dweck and Legget (1988) who found individuals to differ in their view on intelligence as being a fixed versus a malleable entity. Although Schommer (1990) treated the five items assessing *Innate,* or *Fixed Ability,* as being one scale, we decided to include two subscales: one measuring the belief whether learning skills are innate (sample item: "There exists an innate talent, which determines how quickly one can learn."), and one measuring the belief whether learning behavior is changeable (sample item: "The ability to learn can hardly be influenced through practice."). In former research from Schommer, the subset of items that measured *Ability to Learn Is Innate*, was assumed to be part of the factor *Fixed Ability*; however, it had not consistently loaded on this factor, but on the factor *Quick Learning* (see Hofer & Pintrich, 1997). Schommer (1990) had developed the questionnaire to assess the epistemological beliefs of learners. In our study, we assessed the epistemological beliefs of teachers who completed the questionnaire in the first instance from the perspective of a teacher and not of a learner. For teachers, it makes sense by nature that learning is changeable; otherwise, their entire profession would come into question. However, there is variance in teachers' beliefs regarding fixed ability that we wanted to be able to capture. Epistemological beliefs were therefore assessed by means of two subscales: the belief whether learning skills are innate, and the belief whether learning behavior is changeable. The teachers rated each item on a six-point Likert scale ranging from *not true at all* to *completely true*. Internal consistency for the subscale *Innate* was .57 and for the subscale *Changeable,* .62. Although .57 is a low coefficient by most reliability standards, results from other studies using the measurement of epistemological constructs have presented reliability coefficients in this range (see e.g., Hofer, 2000; Schraw et al., 2002). Since the problem to be expected from relatively low internal consistency is low statistical power, only the subscale *Changeable,* which consisted of three items and still had an acceptable reliability of α = .62, was kept in the analysis.

2.3.2 Teacher beliefs on SRL

Teacher beliefs on instructing SRL were assessed with a German version of the *Self-Regulated Learning Teacher Belief Scale* (Lombaerts et al., 2009). The twelve items from this scale focused on teachers' beliefs about supporting primary school students' self-regulation of learning using different measures (sample item: "The instruction of learning strategies leads to students being better in evaluating their learning.") and had to be rated on a five-point Likert scale. The internal consistency (Cronbach's α) for the German version of this scale in our sample was .80.

2.3.3 Teacher self-efficacy beliefs

To measure teachers' beliefs regarding their own self-efficacy with regard to the promotion of SRL, the *Teacher-Self-Efficacy Scale* by Schmitz und Schwarzer (2000), consisting of ten items, had been tailored to the context of SRL. Item formulations had been adapted in order to assess specific teacher self-efficacy beliefs concerning the promotion of SRL (example: "I know that I manage to help even to the most difficult students to learn the learning content." [original item] was changed to "I know that I manage to help even to the most difficult students to learn how to learn the learning content themselves." [adapted item]). For this adapted scale, we found an internal consistency of α = .81 in this sample.

2.3.4 Teacher knowledge

Teacher knowledge was assessed by means of an open-ended question developed by Lonka, Joram, and Bryson (1996), asking teachers about the best way to enhance the learning behavior of students, teaching them learning to learn and why. Dignath-van Ewijk & Van der Werf (2012) have developed a coding scheme for this question in order to code the answers of teachers according to models of direct and indirect ways of fostering SRL. The teachers' written answers were transcribed and coded for data analyses according to this

coding scheme using two different coders. The coding was based on a theoretical foundation of promoting SRL which states that teachers should both provide students with autonomy to regulate their own learning themselves (indirect way of promoting SRL) and to teach them SRL-strategies on how to deal with such an autonomy (direct way of promoting SRL). In terms of scaffolding, the more students are used to self-regulation, the less the teacher has to structure him- or herself (so he or she can shift from a more direct way of promoting SRL, to a more indirect way). Providing students with SRL-strategies without enabling them to self-regulate their learning by means of a learning environment that offers the students opportunities to take over responsibility, is not supposed to foster students' SRL, as they learn in a theoretical way about self-regulation but do not have the chance to practice it. The same applies the other way around: creating a learning environment that provides students with autonomous learning opportunities, but that doesn't teach them how to handle such autonomy, does not foster SRL, as many students will not be able to take over the responsibility for their learning when they lack SRL-strategies. To this effect, teachers should do both: provide students with learning environments that allow them self-regulation and provide them with strategies to handle these learning environments more effectively (see Dignath, 2009; Paris & Paris, 2001). We therefore coded teacher responses to whether teachers did not show any knowledge of promoting SRL (coded as 0: no answer or answer that does not fit to the question, e.g.: "Caring for a nice atmosphere in which the pupils feel comfortable."), only partial knowledge - so either mentioning the composition of an autonomous learning environment (coded as 1: example item: "Cooperative learning, as learning with peers leads to discussions and that leads to a better understanding instead of the teacher saying how it has to be and then it is like that.", or the instruction of SRL-strategies - (coded as 1: "Analysing together with the pupils how they learn and make them get to know also other strategies/ways of learning."), or whether they showed full knowledge (mentioning both, characteristics of an autonomous learning environment, as well as strategy instruction (coded as 2: "On the one hand it is important for pupils to be allowed to work on their own ideas. On the other hand, for some pupils with a greater need for structure, it can also be good to first get familiar with certain learning processes and to first learn how to do that."). Teacher answers for the composition of a learning environment that supports self-regulation were coded according to the coding scheme of an observation instrument developed by Dignath-van Ewijk et al. (2013) in order to assess teachers' promotion of SRL in the classroom. This coding scheme included categories for teaching formats like cooperative learning, discovery learning, providing students with choices, situated learning, and problem-based learning. Teacher answers concerning the instruction of SRL-strategies were sorted according to the same coding scheme containing strategy categories like metacognitive strategies (planning, monitoring, evaluating, reflecting), cognitive strategies (organization, elaboration, problem solving), and motivation strategies (e.g., attribution, feedback seeking, cooperation, etc.). For a more precise description of the coding scheme, see Dignath-van Ewijk et al., 2013 and Dignath-van Ewijk & Van der Werf, 2012). Teachers were allowed to give more than one answer to that question. This is even desirable as teachers would have to mention at least one direct and one indirect way of fostering SRL in order to reach the highest rating. Interrater reliability computed with Cohen's Kappa revealed an agreement of $\kappa = .83$.

2.3.5   Teachers' self-reported promotion of SRL

A German version of the *Self-Regulated Learning Inventory for Teachers* (Lombaerts et al., 2007) was used to assess teachers' self-reported promotion of SRL in their classroom. The questionnaire of Lombaerts et al. (2007) consists of 24 items, capturing SRL during the three phases of Zimmerman's (2000) model of SRL: a planning phase, an action phase, and a self-reflection phase (sample item: "My pupils work on tasks that require them to plan their work themselves towards a deadline."). We included 16 items from this questionnaire into our questionnaire as some items did not match our interest in teachers' promotion of SRL, but we additionally included five items regarding the direct instruction of SRL strategies (sample item: "I ask my students to work independently without explicitly discussing learning strategies beforehand.") developed by Dignath-van Ewijk & Van der Werf (2012). All items had to be rated on a six-point Likert scale ranging from *never* to *always*. The reliability estimate (Cronbach's α) for the overall scale in our research was .90.

Table 1

Overview of instruments used

Construct	Instrument	Number of items	Example Item
Teacher beliefs on instructing SRL	German version of the *Self-Regulated Learning Teacher Belief Scale* (Lombaerts, Engels, Van Braak & Athanasou, 2009)	12	The instruction of learning strategies can be realized in primary school.
Teachers' epistemological beliefs regarding learning	German translation of the *Epistemological Questionnaire* by Schommer 1990 (Schiefele, Moschner & Husstegge, 2002)	5	There exists an innate talent which determines how quickly one can learn.
Teachers' beliefs regarding their own self-efficacy	*Teacher-Self-Efficacy Scale* by Schmitz und Schwarzer (2000)	10	I know that I can teach learning strategies even in difficult situations.
Teachers' self-reported promotion of SRL	German version of the *Self-Regulated Learning Inventory for Teachers* (Lombaerts, Engels & Athanasou, 2007)	21	I teach my students how to plan one's learning.
Teachers' knowledge on how to promote SRL	Open-ended question developed by Dignath-van Ewijk & Van der Werf (2012) based on Lonka et al. (1996)	1	According to you: what is the best way to teach students learning to learn? Why?

Table 2

Means, standard deviations and Cronbach alpha reliabilities

Construct	M	SD	Cronbach's α
Teacher beliefs on instructing SRL	2.74	.42	.80
Teachers' epistemological beliefs regarding learning	subscale "innate": 3.54	.84	.57
	subscale "changeable": 1.25	.72	.62
Teachers' beliefs regarding their own self-efficacy	1.78	.41	.81
Teachers' knowledge on how to promote SRL			Cohen's Kappa: 83%
Teachers' self-reported promotion of SRL	2.58	.59	.90

2.4   Path Analysis

We used path modelling as an extension of multiple regression in order to test both direct and indirect (mediator) effects on the dependent variable. For the model proposed from the data in this study, we included indicators of teacher beliefs (including epistemological beliefs, beliefs on SRL, and self-efficacy beliefs) and teacher knowledge, as well as teachers' self-reported promotion of SRL as an outcome measure that is predicted by the other variables in the model.

Since we did not want to estimate any latent variables, including an explicit estimation of measurement errors, we chose path analysis instead of structural equation modelling using STATA. Path analysis is based on multivariate regression modelling which allows for more than one dependent variable and the analysis of mediator effects, using one regression equation per endogenous variable derived from the path diagram. The relative strength of the postulated effect is presented in terms of path coefficients, most commonly indicated by the beta coefficient. Teachers' self-reported promotion of SRL, as the criterion measure, is considered to be under the influence of all other variables in the model, either directly or when mediated through other variables.

3.   Results

3.1   Test for Multivariate Normality

We conducted the Doornik-Hansen test for multivariate normality (Doornik & Hansen, 2008) for the five variables included in the model in order to show that the data was normally distributed ($\text{Chi}^2=9.34$, $p=.50$).

3.2   Scale Intercorrelations

Table 3 provides an overview of correlations among the scales. Results were largely consistent with the hypothesized predictions that can be found in Figure 1. Scores measuring epistemological beliefs concerning the belief of ability as being changeable correlated negatively with teacher beliefs on SRL (r=--.19), teacher self-efficacy beliefs (r=--.21), and self-reported promotion of SRL (r=--.21). Epistemological beliefs scores did not correlate with teacher knowledge, which was not consistent with our predictions. Teacher beliefs on SRL correlated positively with teacher knowledge (r=.37), teacher self-efficacy beliefs (r=.43), and teachers' self-reported promotion of SRL (r=.49). Self-efficacy beliefs further correlated positively with teacher knowledge (r=.33) and teachers' self- reported promotion of SRL (r=.56). Finally, teacher knowledge also correlated with teachers' self-reported promotion of SRL (r=.36).

Table 3

Overview of correlations among the scales

	Teacher Knowledge	Teacher Beliefs on SRL	Teacher Self-efficacy	Teachers' self-reported promotion of SRL	Teachers' Epistemological Beliefs "changeable"
Teacher Knowledge	1.00				
Teacher Beliefs on SRL	0.37***	1.00			
Teacher Self-efficacy	0.33**	0.43***	1.00		
Teachers' self-reported promotion of SRL	0.36***	0.49***	0.56***	1.00	
Teachers' epistemological beliefs "changeable"	0.09	-0.19*	-0.21*	-0.20*	1.00

Note: *Correlation is significant at the .05 level, one-tailed. **Correlation is significant at the .01 level, one-tailed. ***Correlation is significant at the .001 level, one-tailed.

Intercorrelations among teacher knowledge, teacher beliefs, teacher self-efficacy, self-reported teacher behavior, and teachers' epistemological beliefs (N=140)

3.3 Path Modelling Regression Analyses

Path regression analyses were then conducted according to the hypotheses specified earlier in order to predict teachers' reported promotion of SRL directly through teachers' knowledge, beliefs and self-efficacy towards the promotion of SRL, as well as indirectly through teacher beliefs. Theoretically, we assumed that all variables would predict teachers' self-reported promotion of SRL; however, not all of them would have a direct effect. Compared to the fully saturated model, we therefore omitted the direct paths between epistemological beliefs and self-efficacy of promoting SRL, and between epistemological beliefs and self-reported SRL. We calculated direct, indirect, and total effects for all endogenous variables by applying Sewall Wright's multiplication rule as the path tracing rule: each structural equation is multiplied by its predetermined variables (Wright, 1934). We used STATA 13 to estimate the path model and tested the model fit using maximum likelihood estimation. The likelihood ratio, chi square, and corresponding p value, RMSEA and CFI, were calculated to assess the model fit.

The initial path model contained five predictors and had an $R^2=.38$, indicating that the model explains 38% of the variance in teachers' self-reported promotion of SRL. Chi square indicated that the model could be improved in order to fit the data accordingly compared to the fully saturated model: χ^2 (2, N = 140) = 8.06, p = 0.02. In a next step, we therefore added the two omitted paths to the model. The path from epistemological beliefs to self-efficacy in promoting SRL was significant (p = 0.01), while the path from epistemological beliefs to self-reported SRL was not significant (p = 0.17). Finally, we added the former path to the model. This model did not fit the data significantly worse than the fully saturated model: χ^2 (1, N = 140) = 1.85, p = 0.17. Compared to the baseline model without any predictors, the revised model was highly significant (Likelihood ratio chi square = 144.76; p < .001). As additional measures of fit, the RMSEA and CFI were calculated and both indicated an acceptable fit (RMSEA = .076; P(RMSEA<.05) =

.25; CFI = .994). As the evidence on the investigated constructs would allow for several theoretical assumptions, we tested five different models and compared their fit indices, as summarized in table 4:

Table 4

Goodness-of-fit-indices for the compared models

Model 1	Model 2	Model 3	Model 4	Model 5
beliefs predicts knowledge and self-efficacy; and self-efficacy is predicted by knowledge and by beliefs	beliefs predicts knowledge and self-efficacy	beliefs, knowledge, and self-efficacy do not predict each other	self-efficacy is predicted by knowledge and beliefs	knowledge predicts beliefs and self-efficacy
Chi2 = 1.853 RMSEA = 0.076	Chi2 = 15.960 RMSEA = 0.219	Chi2 = 36.996 RMSEA = 0.279	Chi2 = 21.473 RMSEA = 0.258	Chi2 = 28.084 RMSEA = 0.239

Only for the model in which beliefs predicts knowledge and self-efficacy, while knowledge also predicts self-efficacy, the goodness-of-fit indices are acceptable. We therefore rejected the four alternative models and worked with the model presented in Figure 2.
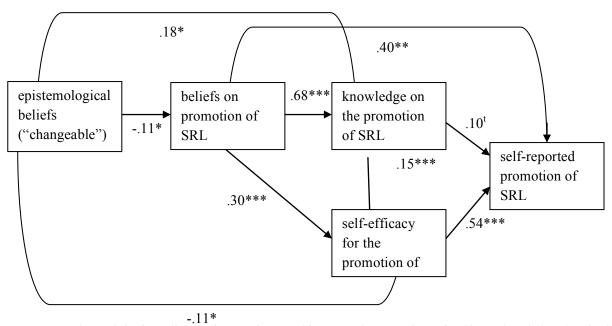

Figure 2. Path model of predictors for teachers' self-reported promotion of self-regulated learning including estimates (beta weights) of direct and indirect effects and explained variances (adjusted R^2 coefficients). *p<.05; **p < .01; ***p < .001; ^{t}p < .10.

Based on the theoretical assumptions, we expected all variables to predict teachers' self- reported promotion of SRL, though not all variables were assumed to have a direct effect on the promotion of SRL. The revised model indicates that teachers' self-reported promotion of SRL is predicted by the groups of variables: teacher beliefs, teacher knowledge, and teachers' self-efficacy towards promoting SRL. We found

direct effects on teachers' self-reported promotion of SRL only for teacher beliefs on fostering SRL and for teachers' self-efficacy towards promoting SRL..

Teachers' self-efficacy towards fostering SRL had the largest direct effect (*ß*=.36, p<.001), followed by teacher beliefs (*ß* =.28, p<.001). We found no significant path from teacher knowledge on the promotion of SRL to teachers' self-reported promotion of SRL (*ß* =.13, p=.07). No direct effect had been assumed from the teachers' epistemological beliefs on teachers' self-reported promotion of SRL. However, teachers' epistemological beliefs were found to have an indirect effect on teachers' self-reported behavior in the classroom (see Table 5).

Teachers' self-efficacy was strongly predicted by teachers' beliefs (*ß* =.31, p<.001) and teachers' knowledge on promoting SRL (*ß*=.29, p<.001), and negatively by teachers' epistemological beliefs (*ß* =-.18, p<.05) (teachers who assumed learning behavior to be changeable reported a higher self-efficacy than teachers who assumed learning to be a fixed ability).

We found teacher beliefs on the promotion of SRL to be a highly significant predictor for teacher knowledge in this field (*ß* =.36, p<.001), but also teachers' epistemological beliefs on the changeability of learning ability played a significant role (*ß* =.16, p<.05), with teachers believing in learning as a fixed ability showing more knowledge on the promotion of self-regulation strategies than teachers who didn't assume learning to be a fixed ability.

Finally, teacher beliefs on the promotion of SRL were predicted negatively by teachers' epistemological beliefs in a way that teachers who believed in learning ability as not being fixed, were more positive towards the promotion of SRL (*ß* =-.18, p<.05).

Table 5 reports regression coefficients of the path regression analyses for direct, indirect, and total effects.

Table 5

Direct, indirect, and total effects for coefficients of the revised path model

	Direct effect	Indirect effect	Total effect
	b (SE)	b (SE)	b (SE)
Beliefs promotion of SRL ←	-.11 (.05)*	0 (no path)	-.11 (.05)*
Epistemological beliefs			
Knowledge promotion of SRL ←			
Beliefs promotion of SRL	.68 (.15)***	0 (no path)	.68 (.15)***
Epistemological beliefs	.18 (.09)*	-.07 (.04)*	.11 (.09)
Specific self-efficacy beliefs ←			
Beliefs promotion of SRL	.30 (.07)***	.10 (.02)***	.40 (.08)***
Knowledge promotion of SRL	.15 (.04)***	0 (no path)	.15 (.04)***
Epistemological beliefs	-.10 (04)*	-.02 (.02)	.12 (.05)**
Promotion of SRL ←			
Beliefs promotion of SRL	.40 (.11)***	.28 (.05)***	.68 (.12)***
Knowledge promotion of SRL	.10 (.05)^t	.08 (.02)***	.18 (.06)**
Specific self-efficacy beliefs	.54 (.11)***	0 (no path)	.54 (.11)***
Epistemological beliefs	0 (no path)	-.10 (.05)*	-.10 (.05)*

Note: ***p < .001; **p < .01; *p < .05; ^{t}p < .10.

4.   Discussion

4.1   Contribution of the study

Contrary to the field of SRL, which has been covered by a large amount of research in the meantime, teachers' promotion of SRL has been a rather neglected field in this research area, leaving many questions open about how teachers can improve students' self-regulation and how they can be supported. This study contributes to the field of SRL in adding to what we already know about why teachers do or do not promote SRL during their teaching. As research in this area has shown, teachers do not promote strategy instruction very often during their teaching (see e.g., Bolhuis & Voeten, 2001; Dignath-van Ewijk et al., 2013; Hamman et al., 2000; Lombaerts et al., 2007; Spruce & Bol, 2014; Vandevelde et al., 2012). Only few studies present results about teacher characteristics that have an impact on teachers' support for SRL during their teaching (Dignath-van Ewijk & Van der Werf, 2012; Lombaerts et al., 2009; Spruce & Bol, 2014; Vandevelde et al., 2012), and if they do, they only cover single aspects such as teachers' educational beliefs or their knowledge. In order to build a model of teachers' promotion of SRL, we need to know more about the teacher variables that predict teachers' promotion of SRL and how they might interact with each other. Moreover, most studies have investigated single aspects of the promotion of SRL without drawing on a model of teachers' professional competence. The present results provide us with a further insight into the predictors of teachers' enhancement of SRL embedded in a framework on teacher competence.

4.2   Summary

In this study we investigated the predictive impact of primary school teachers' epistemological beliefs, their beliefs and their knowledge on the promotion of SRL, and teachers' self-efficacy beliefs as determinants of teachers' self-reported promotion of SRL in the classroom. As the results show, teachers' self-efficacy towards promoting SRL has the strongest direct predictive value on self-reported teacher behavior, while teacher beliefs have a strong direct and indirect impact via teacher self-efficacy and teacher knowledge. Teacher knowledge has a direct, as well as an indirect, effect via teacher self-efficacy. Teachers' epistemological beliefs towards the changeability of learning ability shows a direct effect on teacher beliefs towards the promotion of SRL, and it shows a direct effect on teachers' self-efficacy beliefs in a way that teachers, who do not assume learning to be changeable, show lower self-efficacy and less positive beliefs towards the promotion of SRL. Moreover, we found a direct effect of teachers' epistemological beliefs on teacher knowledge with teachers, who assume learning not to be changeable, showing more knowledge regarding the promotion of SRL.

The results offer new insights into teacher beliefs and how they might account for teacher (self-reported) behavior regarding the promotion of SRL. The more teachers feel capable of instructing self-regulation strategies, and to manage self-regulating students, the more they report to promote more SRL when they teach. Furthermore, the more teachers report to believe that students can benefit from SRL, the more they report to support their students by supplying them with self-regulation strategies, and by offering learning situations that allow for self-regulation. Finally, the more teachers have knowledge on how to foster SRL, the more they report to show supporting teaching behavior with regard to SRL.

4.3 Conclusions

The following conclusions can be drawn with regard to our hypotheses:

4.3.1 Hypothesis 1: Epistemological beliefs about learning as fixed or changeable ability (in terms of rather general teacher beliefs) are assumed to influence teachers' beliefs on the promotion of SRL(as these are more specific).

The more teachers think of learning as not being changeable, the less positive they are towards the promotion of SRL. This result is not surprising: why would a teacher, who does not believe in the nature of learning as something to change and to develop, support the idea of students taking over responsibility for their own learning. As a fixed ability, learning to self-regulate can hardly make sense. It also supports the findings of Pajares (1992) that more general beliefs predict more specific beliefs.

4.3.2 Hypothesis 2: Teacher beliefs are assumed to affect teacher knowledge on the promotion of SRL.

First, we found that teachers, who think of learning as not being changeable, report more knowledge than teachers who do not. At first sight, this result seems to be counterintuitive, but when looking at the operationalization of teacher knowledge, the finding makes more sense. Teacher answers that included only one of the two aspects of fostering SRL – 1. creation of a learning environment that allows for students' self-regulation or 2. instruction of strategies that help students to handle a self-regulatory learning environment effectively – were ranked lower than teacher answers that included both aspects. However, most teachers, who included only one aspect, focused on the autonomous learning environment, and not on strategy instruction. This result replicates the results of former studies showing that most teachers, who support SRL in school, particularly associate this with allowing students to have more freedom, but rarely providing them with the necessary strategies to deal with this autonomy (see e.g., Bolhuis & Voeten, 2001; De Kock, Sleegers & Voeten, 2005; Dignath-van Ewijk et al., 2013). The results found here might indicate that teachers who think of learning as not being changeable, cannot integrate the idea of providing students with autonomy as a mean to support their self-regulation (lower ranked teacher answer) into their concept of knowledge. If, at all, they might accept the idea of giving students more autonomy by additionally teaching them first how to regulate this autonomy (higher ranked teacher answer).

Secondly, as assumed, the results showed that teachers, who are positive towards the promotion of SRL, also share the idea of providing students with strategy knowledge, as well as with autonomy.

4.3.3 Hypothesis 3: Teacher beliefs and teacher knowledge have direct effects on self-reported teacher behavior, with teacher beliefs being a stronger predictor than teacher knowledge.

Teachers who know about the importance of creating a learning environment that allow students to self-regulate, and who are aware of the importance of providing students with the necessary strategies to deal with more autonomy, report to also implement these factors in their teaching. Furthermore, our results confirm former evidence on the significance of teacher beliefs and teacher knowledge for self-reported teaching behavior. Although both can play a role for teachers' self-reported practice in the classroom, teacher beliefs seem to have a larger impact than does their knowledge (knowledge was not significant on the 5% level): on the one hand, by directly and strongly influencing teachers' self-reported practice, and on the other hand, by influencing teacher knowledge and teacher self-efficacy which again predict teachers' self-reported practice as well. This conforms with former evidence of teacher knowledge and teacher beliefs in general (see for an overview e.g., Pajares, 1992) and more specifically for the promotion of SRL, as well as with the results of Spruce and Bol (2014). Although their findings of ten teachers did not deliver quantitative results, their descriptives showed that those teachers with the highest scores in classroom observations (i.e. teacher behavior) also reached higher scores for teacher beliefs, but not for teacher knowledge. Looking at it the other way around, teachers with the highest scores on teacher beliefs also achieved higher observation scores, while teachers with the highest scores on teacher knowledge achieved only low observation scores. One could therefore assume that teacher beliefs would also be a better predictor for teacher behavior than teacher knowledge (Spruce & Bol, 2014).

Teachers' epistemological beliefs were not found to directly predict teachers' self-reported practice. This is also in line with former research in which no close alignment between teachers' epistemological world views and their teaching practice could be found (Olafson & Schraw, 2006), although the results in this area are mixed (see Creemers et al., 2013; Shraw & Olafson, 2002; Sosu & Gray, 2012). Ravindran, Greene and DeBacker (2005) studied the relationships between several epistemological beliefs and the meaningful cognitive engagement of preservice teachers. Although they could find positive relationships between most epistemological beliefs and cognitive engagement, the factor *innate ability* did not turn out to directly predict the cognitive engagement of preservice teachers (Ravindran et al., 2005).

4.3.4 Hypothesis 4: Teachers' self-efficacy to promote SRL predicts teachers' self-reported promotion of SRL, next to teacher beliefs and teacher knowledge.

The amount in which teachers feel competent enough to foster their students' self-regulation depends on their beliefs, as well as on their knowledge. This result is also in line with the results of Chatzistamatiou et al. (2014) who found teachers' self-efficacy beliefs to predict teachers' instruction of SRL in mathematics. It is also in line with the teachers' answers that Perry et al. (2008) found, showing that teachers might have a positive attitude towards SRL, but that they just do not feel able to support their students with their self-regulation. Moreover, self-efficacy seems to play an even bigger role rather than just being another component in the model, as self-efficacy has the strongest predictive value among teacher beliefs and teacher knowledge.

4.3.5 Hypothesis 5: Teacher beliefs and teacher knowledge predict teachers' self-efficacy.

As expected, we found that the more positive teachers are towards the promotion of SRL in primary school classrooms, and the more they know about supporting their students' self-regulation, the more competent they feel with handling a learning environment conducive to self-regulation. As the goodness-of-fit indices had suggested, our initial model showed options to be improved in order to fit the data accordingly. We therefore refitted the model by including another path from teachers' epistemological beliefs to teachers' self-efficacy. Initially, we did not assume teachers' epistemological beliefs to predict teacher self-efficacy towards promoting SRL directly, but rather only through teachers' beliefs specifically towards the promotion of SRL. However, this added path does make sense theoretically when considering teachers' self-efficacy as beliefs as well. The self-efficacy beliefs of teachers can be considered as specific beliefs, as well, that are supposed to be influenced by more general beliefs (Pajares, 1992). It is therefore theoretically reproducible that there is a direct path from teachers' beliefs of learning as changeable to their self-efficacy beliefs about feeling able to promote SRL in their classrooms.

4.4 Limitations

As for all research on SRL or its promotion by teachers, which is carried out by means of self-report, this limitation also applies to this study: teachers might have tried to present themselves in a socially desired way, or, in other words, more positive (or negative) towards the promotion of SRL then they actually are. Moreover, the questionnaire data implies the risk that teachers might not understand or misunderstand certain items. Finally, having asked teachers questions retrospectively, teacher answers might be incorrect due to problems with recall. All variables had been assessed by means of self-reporting. This problem seems to be the smallest with regards to teacher knowledge, since knowledge can somehow be assessed more objectively than can be beliefs. The problem is biggest for teacher behavior which was assessed as the teachers' self-reported practice, since teachers might have answered in a most socially desirable way here. Classroom observations would be more objective and could add to the reliability of the data in order to judge the teachers' promotion of SRL (see e.g., Dignath-van Ewijk et al., 2013). Furthermore, by solely relying on the teachers' self-report, all answers have been assessed within the same sample. High intercorrelations between all variables could be attributed to teachers following the same answering pattern for all questionnaires. By including an external perspective, e.g. of the students or external classroom observers, this problem could be resolved. Moreover, we have limited this investigation to potential determinants on the

teacher level. Yet, research by Lombaerts et al. had shown that variables on the school level and on the student level could also have an impact on teachers' promotion of SRL (Lombaerts et al., 2007). Future research should also include these aspects in order to broaden the picture. Particularly with regards to adaptive teaching, teachers' reactions to student variables might play an important role. Finally, the generalizability of our results is limited to the limited sample size. As participation in the study was voluntary, it might be that only very motivated teachers or teachers who have been interested in SRL already agreed to participate. Our sample would then not be representative. Yet, the results can provide interesting first insights into the interrelation of determinants of the promotion of SRL which should be investigated further with a larger sample.

4.5   Implications for future research

4.5.1   Implications for intervention research on SRL

Research on the role of teachers in the promotion of SRL is most notably intervention research. However, interventions to help teachers promote SRL in their classrooms mainly focus on the instruction of what SRL is and how teachers can create learning environments to foster SRL. First, when developing and evaluating interventions, researchers should also include information about a potential inheritability of learning abilities in order to correct misconceptions of teachers. Second, as the results show, teachers' attitudes towards how beneficial SRL is for their students, their epistemological beliefs on whether the learning behavior of their students is innate or not, as well as teachers' own self-efficacy to promote SRL, should be addressed in order to integrate not only cognitive, but also motivational aspects in teacher training.

4.5.2   Implications for research on teacher knowledge and SRL

Concerning theoretical contributions to the research of teachers' promotion of SRL, the question of what teacher knowledge on the promotion of SRL implies and how it relates to epistemological beliefs has to be investigated further. In this study, teacher knowledge on promoting SRL was defined as a two-folded construct, including the instruction of strategies plus the design of the learning environment (see Dignath-van Ewijk et al., 2013; Paris & Paris, 2001). More detailed analyses of these two aspects and their relation to teachers' beliefs and behavior are needed to understand the result found in this study. Wilson and Bai (2010) investigated the relationship between teachers' metacognitive knowledge and their pedagogical understandings of what is necessary for the teaching of metacognition. They found that teachers' understanding of metacognition was related to their ideas of instructional strategies for SRL (Wilson & Bai, 2010). Based on their results, it would be interesting to further investigate in how far teachers' understanding of SRL and metacognition influences their knowledge on how to promote SRL among their students as two steps in their knowledge of promoting SRL: 1. the understanding of SRL could serve as prior knowledge, and 2. the understanding of teaching SRL would then be based on this prior knowledge. Future research should take this first step of knowledge on SRL into account when investigating further determinants of teachers' promotion of SRL.

4.5.3   Implications for research on teacher self-efficacy and SRL

Former research has shown the negative consequences of low self-efficacy in teachers, e.g. in terms of teacher burnout (Skaalvik & Skaalvik, 2007) or lower instructional quality (Tschannen-Moran & Johnson, 2011; Wertheim & Leyser, 2002; Swars, 2005). Low teacher self-efficacy can have a negative impact on what teachers dare to try out in their classrooms. On the other hand, Holzberger et al. (2013) investigated not only the effect of self-efficacy on instructional quality, but, in a longitudinal design, also the impact of instructional quality on teacher self-efficacy in the following school year. Although their results also supported the results of former research on the effect of self-efficacy on instructional quality, they additionally found a reciprocal effect (Holzberger et al., 2013). Their findings suggest that self-efficacy and teacher behavior have rather a reciprocal relationship than just a one-sided one. As Holzberger et al. (2013)

argue, the experience that teachers make during teaching is used as feedback from the students about the teachers' instructional success. This feedback can serve in terms of one of Bandura's four factors that determine a person's self-efficacy as described earlier: enactive attainment (Bandura, 1986). For our study, this implies that it would be interesting to investigate in how far teachers' promotion of SRL can predict teachers' self-efficacy. Such a reciprocal relationship between teachers' self-efficacy and their promotion of SRL would not only be interesting for the theoretical understanding of how these aspects of teacher competence are related, but it would also have implications for research on teacher training. Future research should investigate in how far students' reactions on teachers' behavior could serve as a feedback for the teacher on his or her success in promoting SRL among the students, and in how far this feedback can serve to enhance teachers' self-efficacy for continuing to foster SRL.

When implementing innovative teaching in schools, the self-efficacy of teachers should be taken into account in order to succeed with the implementation. This implies close cooperation with teachers, including getting to know what teachers find doable and finding out how to support them.

4.5.4   *Implications for research in other contexts*

Finally, it would be interesting to conduct a similar study with high school teachers in order to compare the results found here with teachers from different contexts and different subject matters. We know from meta-analysis that, for the training of SRL, different training characteristics are more or less effective for primary versus secondary school students and for different school subjects (Dignath et al., 2008). Therefore, one can assume that, for the promotion of SRL, teachers might have made different experiences with different groups of students or within different subjects that affect their beliefs.

4.5.5   *Implications for research on building a model on teachers' promotion of SRL*

When looking at the literature on SRL, one finds only the lack of a clear model on teaching SRL. Although there are contributions on how SRL should be promoted (e.g., Paris & Paris, 2001; Pressley et al., 1992; for an overview, see Dignath, 2009), no specific model of teacher competence to foster SRL exists yet. Future research should connect the findings of studies on determinants of teachers' promotion of SRL (e.g., Dignath-van Ewijk & Van der Werf et al., 2012; Lombaert et al., 2009; Spruce & Bol, 2014; Vandevelde et al., 2012) and merge them with findings on how to assess teachers' behavior in the classroom with regard to fostering SRL by means of more sophisticated methods than self-reporting (see e.g., Dignath-van Ewijk et al., 2013 for observation methods on promoting SRL) in order to collect more information on teacher competence in effectively promoting SRL.

Keypoints

- This study reports research on determinants of teachers' self-reported promotion of self-regulated learning - an area which remains a gap in research on self-regulated learning.

- The investigation includes teacher beliefs on (1) teachers' self-reported practice on instructing SRL, (2) teachers' self-efficacy with regard to promoting SRL, and (3) teachers' epistemological beliefs regarding learning.

- Path analyses were conducted and reveal new insights into constructing a model of teachers' self-reported promotion of SRL in the classroom.

- A large teacher sample participated in the study in order to provide representative classroom data.

- The study is innovative as there is no research yet regarding teacher beliefs and teacher self-efficacy predicting teachers' self-reported practice of enhancing SRL.

Acknowledgments

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*, 191.

Bandura (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Baumert, J. & Kunter, M. (2013). The COACTIV model of teachers' professional competence. In M. Kunter, J. Baumert, W. Blum, U. Klusmann, S. Krauss & M. Neubrand (Eds.), *Cognitive activation in the mathematics classroom and professional competence of teachers* (pp. 25-48). New York: Springer US.

Baumert, J. & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keyword: Professional competence of teachers. *Zeitschrift für Erziehungswissenschaft, 9*, 469-520.

Bell, P. D. (2006). Can factors related to self-regulated learning and epistemological beliefs predict learning achievement in undergraduate asynchronous Web-based courses? *Perspectives in Health Information Management/AHIMA, American Health Information Management Association, 3,* 7.

Bendixen, L. D. & Hartley, K. (2003). Successful learning with hypermedia: The role of epistemological beliefs and metacognitive awareness. *Journal of Educational Computing Research, 28*, 15-30.

Bolhuis, S. & Voeten, M. J. M. (2001). Toward self-directed learning in secondary schools: what do teachers do? *Teaching and Teacher Education, 17*, 837–855.

Brown, A. L., Campione, J. C. & Day, J. D. (1981). Learning to learn: On training students to learn from texts. *Educational Researcher, 10*, 14-21.

Canrinus, E. T., Helms-Lorenz, M., Beijaard, D., Buitink, J. & Hofman, A. (2012). Self-efficacy, job satisfaction, motivation and commitment: Exploring the relationships between indicators of teachers' professional identity. *European Journal of Psychology of Education, 27*, 115-132.

Chan, W. Y., Lau, S., Nie, Y., Lim, S. & Hogan, D. (2008). Organizational and personal predictors of teacher commitment: The mediating role of teacher efficacy and identification with school. *American Educational Research Journal, 45*, 597–630.

Chatzistamatiou, M., Dermitzaki, I. & Bagiatis, V. (2014). Self-regulatory teaching in mathematics: relations to teachers' motivation, affect and professional commitment. *European Journal of Psychology of Education, 29*, 295-310.

De Kock, A., Sleegers, P. & Voeten, M. J. M. (2005). New learning and choices of secondary school teachers when arranging learning environments. *Teaching and Teacher Education, 21*, 799–816.

Dignath-van Ewijk, C., Dickhäuser, O. & Büttner, G. (2013). Assessing how teachers enhance self-regulated learning - a multi-perspective approach. *Journal of Cognitive Education and Psychology, Special Issue on Self-Regulated Learning, 21*, 338-358.

Dignath-van Ewijk, C. & Van der Werf, G. (2012). What teachers think about self-regulated learning: An investigation of teacher beliefs about enhancing students' self-regulation and how they predict teacher behavior. *Education Research International*, doi:10.1155/2012/741713.

Dignath, C. (2009). *Different aspects of the promotion of self-regulated learning: a multi-method investigation on the instruction of self-regulated learning at primary and secondary school*. Dissertation Universität Frankfurt.

Dignath, C., Büttner, G. & Langfeldt, H.-P. (2008). How can primary school students acquire self-regulated learning most efficiently? A meta-analysis on interventions that aim at fostering self-regulation. *Educational Research Review, 3*, 101-129.

Doornik, J. A. & Hansen, H. (2008). An Omnibus Test for Univariate and Multivariate Normality. *Oxford Bulletin of Economics and Statistics, 70, Supplement*, 927-939.

Dweck, C. S. & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: the final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*, 25–39.

Fenstermacher, G. D. (1994). The knower and the known: The nature of knowledge in research on teaching. *Review of Research in Education, 20,* 3-56.

Fives, H. (2003, April). What is teacher efficacy and how does it relate to teachers' knowledge? A theoretical review. *American Educational Research Association Annual Conference, Chicago*.

Ghaith, G. & Yaghi, H. (1997). Relationships among experience, teacher efficacy, and attitudes towards the implementation of instructional innovation. *Teaching and Teacher Education, 13*, 451-458.

Guo, Y., Piasta, S. B., Justice, L. M. & Kaderavek, J. M. (2010). Relations among preschool teachers' self-efficacy, classroom quality, and children's language and literacy gains. *Teaching and Teacher Education, 26*, 1094-1103.

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching and Teacher Education, 4*, 63-69.

Hamman, D., Berthelot, J., Saia, J. & Crowley, E. (2000). Teachers' coaching of learning and its relation to students' strategic learning. *Journal of Educational Psychology*, *92*, 342.

Hattie, J. (2013). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Hattie, J., Biggs, J. & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research, 66*, 99-136.

Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology, 25*, 378-405.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, *67*, 88-140.

Holzberger, D., Philipp, A. & Kunter, M. (2013). How teachers' self-efficacy is related to instructional quality: A longitudinal analysis. *Journal of Educational Psychology*, *105*, 774-786.

Kagan, D. M. (1992). Implication of research on teacher belief. *Educational Psychologist, 27*, 65–90.

Klassen, R. M., Tze, V. M., Betts, S. M. & Gordon, K. A. (2011). Teacher efficacy research 1998–2009: signs of progress or unfulfilled promise?. *Educational Psychology Review*, *23*, 21-43.

Kramarski, B., Desoete, A., Bannert, M., Narciss, S. & Perry, N. (2013). New perspectives on integrating self-regulated learning at school. *Education Research International, 2013,* Article ID 498214.

Kramarski, B. &. Michalsky, T. (2009). Investigating preservice teachers' professional growth in self-regulated learning environments. *Journal of Educational Psychology*, 101, 161–175.

Kunter, M. (2013). Motivation as an aspect of professional competence: Research findings on teacher enthusiasm. In M. Kunter, J. Baumert, W. Blum, U. Klusmann, S. Krauss & M. Neubrand (Eds.), *Cognitive activation in the mathematics classroom and professional competence of teachers* (pp. 273-289). New York: Springer US.

Kunter, M., Tsai, Y. M., Klusmann, U., Brunner, M., Krauss, S. & Baumert, J. (2008). Enjoying teaching: Enthusiasm and instructional behaviors of secondary school mathematics teachers. *Learning and Instruction, 18*, 468-482.

Lombaerts, K., Engels, N. & Athanasou, J. A. (2007). Development and validation of the Self-Regulated Learning Inventory for Teachers. *Perspectives in Education, 25*, 29–47.

Lombaerts, K., Engels, N., Van Braak, J. & Athanasou, J. A. (2009). Development of the Self-Regulated Learning Teacher Belief Scale. *European Journal of Psychology of Education, 1*, 79-96.

Lonka, K., Joram, E. & Bryson, M. (1996). "Conceptions of learning and knowledge: does training make a difference?" *Contemporary Educational Psychology, 21*, 240–260.

Moely, B. E., Hart, S. S., Leal, L., Santulli, K. A., Rao, N., Johnson, T. & Hamilton, L. B. (1992). The teacher's role in facilitating memory and study strategy development in the elementary school classroom. *Child Development, 63*, 653-672.

Moos, D. C., & Ringdal, A. (2012). Self-regulated learning in the classroom: A literature review on the teacher's role. *Education Research International, 2012,* Article ID 423284.

Muis, K. R. (2007). The role of epistemic beliefs in self-regulated learning. *Educational Psychologist, 42*, 173-190.

Olafson, L. & Schraw, G. (2006). Teachers' beliefs and practices within and across domains. *International Journal of Educational Research, 45*, 71-84.

Pajares, M. F. (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research, 62*, 307–332.

Paris, S. G. & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational psychologist, 36*, 89-101.

Perry, N. E., Hutchinson, L. & Thauberger, C. (2008). Talking about teaching self-regulated learning: scaffolding student teachers' development and use of practices that promote self-regulated learning. *International Journal of Educational Research*, 47, 97–108.

Perry, N. E., Phillips, L. & Dowler, J. (2004). Examining features of tasks and their potential to promote self-regulated learning. *The Teachers College Record, 106*, 1854-1878.

Perry, N. E. & VandeKamp, K. J. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research, 33*, 821-843.

Perry, W. J. R. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.

Pieschl, S., Stahl, E. & Bromme, R. (2008). Epistemological beliefs and self-regulated learning with hypertext. *Metacognition and Learning, 3*, 17-37.

Pressley, M., Harris, K. R. & Marks, M. B. (1992). But good strategy instructors are constructivists!, *Educational Psychology Review, 4*, 3–31.

Ravindran, B., Greene, B. A. & DeBacker, T. K. (2005). Predicting preservice teachers' cognitive engagement with goals and epistemological beliefs. *The Journal of Educational Research, 98*, 222-232.

Schiefele, U., Moschner, B. & Husstegge, R. (2002). *Skalenhandbuch SMILE-Projekt*. [Scale handbook of the SMILE project] Bielefeld: University of Bielefeld.

Schmitz, G. S. & Schwarzer, R. (2000). Selbstwirksamkeitserwartung von Lehrern: Längsschnittbefunde mit einem neuen Instrument. [Perceived self-efficacy of teachers: Longitudinal findings with a new instrument] *Zeitschrift für Pädagogische Psychologie, 14*, 12-25.

Schommer-Aikins, M. (2004). Explaining the epistemological belief system: Introducing the embedded systemic model and coordinated research approach. *Educational Psychologist*, *39*, 19-29.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82,* 498-504.

Schraw, G., Crippen, K. J. & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, *36*, 111-139.

Schraw, G. & Olafson, L. (2003). Teachers' epistemological world views and educational practices. *Journal of cognitive education and psychology*, *3*, 178-235.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational researcher, 15*, 4-14.

Sinatra, G. M. & Kardash, C. M. (2004). Teacher candidates' epistemological beliefs, dispositions, and views on teaching as persuasion. *Contemporary Educational Psychology*, *29*, 483-498.

Skaalvik, E. M. & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education, 26*, 1059-1069.

Skaalvik, E. M. & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology, 99*, 611.

Sosu, E. M. & Gray, D. S. (2012). Investigating change in epistemic beliefs: An evaluation of the impact of student teachers' beliefs on instructional preference and teaching competence. *International Journal of Educational Research*, *53*, 80-92.

Spruce, R. & Bol, L. (2014). Teacher beliefs, knowledge, and practice of self-regulated learning. *Metacognition and Learning*, 1-33.

Swars, S. L. (2005). Examining Perceptions of Mathematics Teaching Effectiveness among Elementary Preservice Teachers with Differing Levels of Mathematics Teacher Efficacy. *Journal of Instructional Psychology*, *32*, 139-147.

Tillema, H. H. (1995). Changing the professional knowledge and beliefs of teachers: a training study. *Learning and Instruction*, 5, 291–318.

Tschannen-Moran, M. & Johnson, D. (2011). Exploring literacy teachers' self-efficacy beliefs: Potential sources at play. *Teaching and Teacher Education*, *27*, 751-761.

Tschannen-Moran, M. & Woolfolk Hoy, A. (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education, 17*, 783-805.

Tschannen-Moran, M., Hoy, A. W. & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, *68*, 202-248.

Vandevelde, S., Vandenbussche, L. & Van Keer, H. (2012). Stimulating self-regulated learning in primary education: Encouraging versus hampering factors for teachers. *Procedia-Social and Behavioral Sciences*, *69*, 1562-1571.

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In Rychen, D. S. & Salganik., L. H. (Eds.), *Defining and Selecting Key Competencies (pp. 45-65)*. Ashland, OH: Hogrefe.

Wertheim, C. & Leyser, Y. (2002). Efficacy beliefs, background variables, and differentiated instruction of Israeli prospective teachers. *The Journal of Educational Research*, *96*, 54-63.

Wilson, N. S. & Bai, H. (2010). The relationships and impact of teachers' metacognitive knowledge and pedagogical understandings of metacognition. *Metacognition and Learning*, *5*, 269-288.

Wright, S. (1934). The method of path coefficients. *The Annals of Mathematical Statistics*, *5*, 161-215.

Woolfolk, A. E. & Hoy, W. K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology, 82*, 81-91.

Yadav, A. & Koehler, M. (2007). The role of epistemological beliefs in preservice teachers' interpretation of video cases of early-grade literacy instruction. *Journal of Technology and Teacher Education*, *15*, 335-361.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego, CA, US: Academic Press.