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Teaching learning strategies: The role of instructional context and teacher beliefs

Abstract

Teaching learning strategies is one important aspect of the consistently claimed promotion of self-regulated learning in classrooms. This study investigated the role of instructional context and teacher beliefs for teachers' promotion of learning strategies. Twenty mathematics teachers were videotaped for five lessons in the ninth grade. Three lessons on the Pythagorean Theorem (introductory unit) and two lessons on word problems (practice unit) represented the two different instructional contexts. An observation instrument was used to code the teachers' promotion of cognitive strategies (organization, elaboration) and metacognitive strategies (planning, monitoring and evaluation). Teacher beliefs were captured by questionnaire. Results show a tendency to teach cognitive strategies more in introductory lessons compared to practice lessons, while planning strategies are more often taught in practice lessons. Regarding teacher beliefs, traditional beliefs (e.g., a formalist view of mathematics) were negatively related to the promotion of some types of strategies (e.g., elaboration), while progressive beliefs (e.g., emphasis on an individual reference norm) were positively associated with teaching several strategy types (e.g., monitoring and evaluation). Thus, teacher beliefs seem to play a role for strategy teaching, which makes them a possible starting point for enhancing the promotion of self-regulated learning and a potential key factor in teacher training.

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Strategievermittlung im Unterricht: Welche Rolle spielen Unterrichtskontext und Lehrerüberzeugungen?

Zusammenfassung

Die Vermittlung von Lernstrategien ist ein wichtiger Bestandteil der Förderung von selbstreguliertem Lernen im Unterricht. Diese Studie untersucht, welche Rolle Unterrichtskontext und Lehrerüberzeugungen für die Vermittlung von Lernstrategien spielen. Von 20 Mathematiklehrkräften wurden jeweils fünf Unterrichtsstunden in der neunten Jahrgangsstufe gefilmt. Drei Unterrichtsstunden zum Thema Satz des Pythagoras (Einführungseinheit) und zwei Unterrichtsstunden zu Textaufgaben (Übungseinheit) stellten verschiedene Unterrichtskontexte dar. Mittels eines Beobachtungsinstruments wurde die Vermittlung von kognitiven Strategien (Organisation, Elaboration) und metakognitiven Strategien (Planung sowie Monitoring und Evaluation) kodiert. Lehrerüberzeugungen wurden mittels Fragebogen erfasst. Es zeigte sich, dass kognitive Strategien tendenziell häufiger in den Einführungsstunden vermittelt wurden, wogegen Planungsstrategien häufiger in den Übungsstunden zum Einsatz kamen. Bezüglich der Lehrerüberzeugungen korrelierten traditionelle Überzeugungen (z.B. formalistische Sicht von Mathematik) negativ mit der Vermittlung von einigen Strategiearten (z.B. Elaboration), fortschrittlichere Überzeugungen dagegen positiv. Lehrerüberzeugungen scheinen demnach eine Rolle für die Strategievermittlung zu spielen. Sie stellen somit einen möglichen Ansatzpunkt dar, um die Förderung von selbstreguliertem Lernen zu verbreiten und sollten in entsprechenden Lehrertrainings berücksichtigt werden.

Schlagworte

Lernstrategien; Selbstreguliertes Lernen; Lehrerüberzeugungen; Unterrichtsforschung

1. Theoretical background

Besides teaching subject related knowledge and skills, one important thing that teachers are expected to do in their classrooms is provide students with knowledge of how to learn: they may teach them how to motivate themselves to start preparing for a test, what steps to take to solve a complex problem, how to monitor their own learning process, etc. That is, they are promoting learning strategies. Strategies are goal-directed, voluntary activities that are not necessarily required to fulfill a task but are means to facilitate performance (Harnishfeger & Bjorklund, 1990). Teaching learning strategies is one important aspect of the promotion of self-regulated learning. In today's constantly changing world with its requirements of lifelong learning, it is of high relevance to be capable to learn in a self-regulated way. Self-regulated learning is defined as "a learner's competence to autonomously

plan, execute, and evaluate learning processes, which involves continuous decisions on cognitive, motivational, and behavioral aspects of the cyclic process of learning" (Wirth & Leutner, 2008, p. 103). Numerous studies point out the importance of self-regulated learning for academic achievement (Dignath & Büttner, 2008; Dignath, Büttner, & Langfeldt, 2008; Zimmerman, 1990; Zimmerman & Schunk, 2001). Thus, it seems of high relevance to teach learning strategies in classrooms so that students can acquire these strategies as prerequisites to regulate their own learning. The present study focuses on teachers' promotion of learning strategies in regular classroom settings and investigates the role of context features and teacher characteristics that may be relevant for strategy teaching.

1.1 Learning strategies in the context of self-regulated learning

During the last decades, self-regulated learning has been under steady investigation and various models and theories on that construct have been developed (e.g., Boekaerts, 1996; 1999; Otto, 2010; Pintrich, 1999; Schmitz & Wiese, 2006; Winne & Hadwin, 1998; Zimmerman, 1998; 2000). A highly influential model is Boekaerts' (1999) three-layer model of self-regulated learning. This model consists of three layers that are embedded into each other and represent the cognitive, metacognitive, and motivational aspects of self-regulation. The inner layer stands for cognitive regulation and deals with learning activities that directly refer to information processing. The middle layer (metacognitive regulation) focuses on the whole learning process as well as on the learner's knowledge and skills to regulate it. The learning process is again embedded into the "self", the learner's own goals, needs, and expectancies, represented by the outer layer (motivational regulation).

To regulate their own learning, learners need to have access to a repertoire of learning strategies that they can apply according to the demands of the ongoing learning situation. Different types of learning strategies that play a role in self-regulated learning can be grouped according to the three layers of Boekaerts' model. Organization and elaboration are typical examples of cognitive strategies (Pintrich, Smith, Garcia, & McKeachie, 1993; Weinstein & Mayer, 1986). Organization strategies are activities that organize and structure the learning material, often with the aim to reduce information (e.g., outlining, visualizing). Elaboration strategies refer to activities that aim at the understanding and longtime retaining of the learning content for example by integrating new information into existing knowledge or by building connections (e.g., activating prior knowledge, summarizing). On the metacognitive layer, strategies such as planning, monitoring, and evaluating the learning process play an important role (Brown, 1987; Pintrich, 1999). Planning strategies help the learner to arrange the learning process for example by setting goals and sub goals for studying and by scheduling strategy use. Monitoring activities go along with the learning process and are meant to check understanding or mastery (e.g., self-testing). They are closely related to evaluation and regulation strategies that serve for evaluating the learning process, for example the effective-

ness of an applied strategy, and for adapting the studying behavior (e.g., rereading). Concerning the motivational regulation, strategies involve aspects that are often summarized by the term resource management. Resource management strategies are used to manage and control the learning environment with the aim to support and sustain the learner's motivation to learn. These strategies include for example the arrangement of the study environment, peer learning and help seeking (Pintrich, 1999; Pintrich et al., 1993).

1.2 Studying teachers' promotion of learning strategies in regular classroom settings

There is strong agreement among researchers that students should be trained to become self-regulated learners and that the promotion of learning strategies should be regular part of teachers' instructional activities (Kramarski, Desoete, Bannert, Narciss, & Perry, 2013). In general, there are two possibilities for teachers to promote learning strategies in the classroom (Paris & Paris, 2001): implicitly and explicitly. Implicit strategy teaching covers teacher utterances or behaviors that are supposed to enhance the use of a learning strategy in students, but that do neither involve informing students about a strategy nor advising them directly to use it. For example, the teacher models the use of a strategy or prompts students to use a strategy by asking questions. In contrast, in explicit strategy teaching the teacher directly advises students to use a certain strategy or even gives concrete information how and in which situations to apply the strategy.

Studies that systematically observed teachers' strategy promotion in real classroom settings reveal that teachers spend only a small part of their instructional activity on teaching learning strategies (Hamman, Berthelot, Saia, & Crowley, 2000; Moely et al., 1992) and that they rather promote strategies in an implicit way than in an explicit way (Dignath-van Ewijk, Dickhäuser, & Büttner, 2013; Kistner et al., 2010). However, there is already some evidence that students benefit from teachers strategy instruction in regular lessons. Students' self-regulation as well as their performance have been shown to be predicted by observed strategy instruction (Dignath-van Ewijk et al., 2013). Kistner et al. (2010), using the same data set as the present study, found strategy teaching to have a positive effect on students' performance. This study, as well as Hamman et al. (2000) and Moely et al. (1992), also shows that teachers highly differ in their amount of strategy instruction. But how do these differences between teachers come about? Thus, as a next step it seems promising to take a closer look at the teacher differences in strategy promotion and to determine their underlying factors. Identifying reasons for differences in teachers' emphasis on learning strategies could give useful hints for interventions that aim at enhancing strategy teaching in classrooms.

Concerning the question of how teacher behavior comes about, several factors can be taken into account. Student as well as teacher characteristics, school and class related variables, features of the taught content or of an instructional unit

may be crucial. Lau (2013) found teacher, student as well as external factors to affect teachers' implementation of self-regulated learning in the classroom. Focusing on teachers' promotion of learning strategies, we investigate the roles of two aspects that have been shown to be relevant in research on classrooms: instructional context and teacher beliefs. Context has been shown to be relevant for specific teaching approaches (e.g., Brock, Rimm-Kaufman, & Wanless, 2014; Llinares & Lyster, 2014), including promotion of self-regulated learning (Hugener, Krammer, & Pauli, 2008) and strategy teaching (Moely et al., 1992). Also, numerous studies found associations between teachers' beliefs and their instructional practices (e.g., Staub & Stern, 2002; Stipek, Givvin, Salmon, & MacGyvers, 2001).

1.2.1   Instructional context

Instructional context, as conceptualized here, refers to any features that characterize a specific teaching situation. These features may include for example the subject matter, the learning content within a subject or the placement of a lesson in an overall instructional unit. Lessons may also differ in their instructional aim and focus mainly on either the introduction of new concepts or on application, exercise, or consolidation.

It can be assumed that features of a particular lesson influence teachers' strategy promotion. Moely et al. (1992) found that the number of suggested strategies varied depending on the subject matter of the observed lessons. Elementary school teachers in classrooms that involved mathematics and language teaching made more suggestions for strategy use than teachers who were only observed during language instruction. Also the pattern of specific types of taught strategies was different in those two kinds of curricula. For example, use of specific aids was the most frequently taught strategy in mixed curricula whereas in language instruction deduction strategies were taught most often. However, in a study on middle school level by Hamman et al. (2000), teachers instructing different subjects (math/science or English/social studies) did not differ in their coaching of learning.

In the context of the German-Swiss video study *Quality of Instruction, Learning, and Mathematical Understanding* Hugener et al. (2008) compared lessons from two different instructional units in mathematics with regard to aspects of adaptive teaching. In lessons on the Pythagorean Theorem that were part of an introductory unit on this theme students were more often given the opportunity to self-control their results, compared to lessons on word problems where practice was the instructional aim. However, for other aspects of adaptive teaching no differences between the two instructional contexts were found.

In sum, results concerning teacher behavior in different instructional contexts are inconsistent. In this study, we follow Hugener et al. (2008) and compare the same introductory and practice lessons with regard to the promotion of learning strategies. It can be assumed that much strategy teaching takes place in introductory units to provide students with strategies that are especially useful for dealing

with the new learning content. Following cognitive psychological research, elaboration and organization are appropriate strategies to foster knowledge acquisition (Ormrod, 2008). In mathematics lessons in which a new mathematical concept is introduced it seems reasonable to focus on elaboration and organization to help students to acquire new content and to build up an understanding of the new concept (Pokay & Blumenfeld, 1990). The teacher may for example activate the students' prior knowledge and ask them to form connections with the new content or let them formulate the new content in their own words. Also, structuring the new learning content may be an appropriate strategy during this learning phase. Thus, introductory lessons provide a high potential to advise students on cognitive strategies and to practice these strategies with them.

On the other hand, strategy teaching also makes much sense in practice units, when students have opportunities to apply strategies themselves. In mathematics lessons that aim at practicing familiar tasks learning can be arranged more student directed compared to situations when completely new content has to be learned. When students are already familiar with the learning content, it is appropriate to employ metacognitive strategies (Pokay & Blumenfeld, 1990). Students are supposed to learn how to deal with tasks independently and to become more and more confident in doing so. In practice lessons teachers may advise their students to plan systematically how to approach the tasks and to monitor and evaluate their progress, for example, to self-test their current mastery of the tasks. Thus, practice lessons are potentially suitable for providing students with metacognitive strategies and opportunities to practice them.

Taken together, both instructional contexts contain a high potential for strategy promotion. Following the argumentation above we assume that introductory and practice lessons differ in the teaching of cognitive versus metacognitive strategies. While the amount of cognitive strategies should be higher in introductory lessons, the amount of metacognitive strategies is supposed to be higher in practice lessons.

Regardless of the total amount of strategy teaching, which is supposed to vary between contexts, teachers are still assumed to be consistent in their tendency to teach strategies across contexts in terms of correlations between contexts. This assumption does not have to be in contradiction to our previous assumptions on differences between contexts. Teachers may focus more on for example elaboration strategies in introductory lessons compared to practice lessons, but the rank order of the different teachers may stay the same for both contexts. In this case, the more elaboration strategies a teacher teaches in introductory lessons, the more he or she also does in practice lessons when compared to the other teachers, even though the total amount may be higher in the introductory lessons.

1.2.2 Teacher beliefs

Teachers' professional competence is supposed to play an important role for instructional practices. Professional competence involves aspects of knowledge such

as general pedagogical knowledge, subject-matter content knowledge, and pedagogical content knowledge as well as beliefs and attitudes, motivational orientations and self-regulation skills (Baumert & Kunter, 2006; Shulman, 1987). Especially the relation between teachers' beliefs and their instructional activities has been investigated in various studies. Beliefs are defined as implicitly or explicitly held subjective conceptions which have an impact on perception and actions (Op't Eynde, De Corte, & Verschaffel, 2002). It seems quite plausible that teachers' beliefs about teaching and learning have an impact on their daily practice in classrooms. Indeed, many studies found an association between teachers' activities in the classroom and their pedagogical beliefs (e.g., Dubberke, Kunter, McElvany, Brunner, & Baumert, 2008; Klieme & Vieluf, 2009; Pauli, Reusser, & Grob, 2007; Peterson, Fennema, Caprenter, & Loef, 1989; Staub & Stern, 2002; Stipek et al., 2001; Vieluf & Klieme, 2011).

In their theoretical framework on teacher competence Kunter et al. (2007) grouped teacher beliefs according to their object and their content. The object of beliefs can for example be the nature of a subject matter (e.g., mathematics) or the nature of teaching and learning in general. Regarding the content of beliefs, traditional and progressive beliefs are distinguished.

Regarding the object, teacher beliefs that have been studied in the context of mathematics education are for example world views of the subject mathematics and beliefs about the motivating effects of different approaches to assess students. Within both objects, beliefs can further be divided into traditional and progressive ones. Concerning world views of mathematics, a formalism aspect and an application aspect of mathematics can be distinguished (Grigutsch, Raatz, & Törner, 1998). The formalism aspect (traditional) emphasizes the learning and executing of definitions, mathematical facts, and procedures, whereas the application aspect (progressive) stresses content related thinking, arguing, and understanding. Teachers can also hold different beliefs about the usefulness of assessment strategies. They could think that extrinsic strategies like grading are motivating for students (traditional, Stipek et al., 2001) or that it is rather motivating to assess them according to an individual reference norm, that is, to make comparisons with their own previous performance (progressive, Rheinberg, 1980). Stipek et al. (2001) studied world views of mathematics and beliefs about motivating students in relation to teachers' classroom activities. They report consistent associations between the concept of mathematics as a set of operations (formalism aspect) and the belief that extrinsic reinforcements are effective strategies for motivating students on the one side and observed classroom practices on the other side. These traditional beliefs were negatively correlated with, amongst others, the emphasis on student autonomy.

Another aspect of teacher beliefs that has been extensively studied in mathematics education is a constructivist view on learning and teaching. In this view, learners actively construct and transform knowledge by integrating new information with prior knowledge. Teachers holding this view encourage students to take an active role in the instructional process and to develop solutions to problems on

their own. In Kunter et al.'s (2007) framework, constructivist beliefs would be described as beliefs about the nature of learning and teaching with regard to the object and as progressive beliefs with regard to content. Constructivist teacher beliefs have been shown, for example, to be associated with teachers' tendency to present demanding mathematical tasks that foster conceptual understanding (Staub & Stern, 2002) and with student oriented practices like group work or student self-evaluation (Klieme & Vieluf, 2009).

However, results on the relation between teacher beliefs and practices are not consistent. Some studies report incongruities between teachers' beliefs and their classroom activities (e.g., Leuchter, Reusser, Pauli, & Klieme, 2008). Pauli et al. (2007) found that teachers' constructivist beliefs only had an effect on the provision of opportunities for independent problem-solving (in terms of instruction that fosters conceptual understanding and higher-order thinking) but not on the provision of opportunities for self-regulated learning (in terms of student autonomy and freedom of choice). In Dignath-van Ewijk and van der Werf's (2012) study, constructivist teacher beliefs did not predict teachers' self-reported attempts to enhance their students' self-regulated learning in the classroom. However, in these studies, the promotion of self-regulated learning was measured by teacher self-reports instead of systematic observation. Furthermore, the implementation of self-regulated learning in the classroom was operationalized in a broad sense that focuses on the learning environment in addition to strategy teaching.

Hence, we are interested in taking a look at the relation of teacher beliefs and a specific aspect of the promotion of self-regulated learning, that is, the teaching of learning strategies, measured by video observation. Following existing research on teacher beliefs and classroom practices, in this study we investigated the role of beliefs about the nature of learning and teaching (progressive: constructivism), about the subject mathematics (traditional: formalist view, progressive: application oriented view), and about assessment approaches (traditional: emphasis on extrinsic motivation, progressive: emphasis on an individual reference norm).

The constructivist view of students as active constructors of their own knowledge should be related to teachers' tendency to promote self-regulated learning in general and to teach all kinds of learning strategies. We assume that teachers holding this view provide their students with means to acquire new learning content independently and to process it intensely. Thus, we expect them to teach cognitive strategies to acquire and retain knowledge as well as metacognitive strategies to structure and monitor their learning process.

Cognitive strategies are usually rather content specific (e.g., drawing sketches in mathematics versus highlighting important words in language instruction), while metacognitive strategies can be used across different contents. Thus, world views that are related to a specific subject matter (i.e., mathematics) are supposed to be related to the teaching of cognitive strategies. A formalist view that stresses one right procedure may be incompatible with the promotion of learning strategies that fosters individual attempts to approach a task. In contrast, an application orient-

ed view that emphasizes thinking processes and real life references may go in line with a strategic and individual approach.

Assessment related beliefs are assumed to affect what teachers think about the importance of self-monitoring and self-evaluation and to what extend they foster these strategies in their students. Teachers who emphasize an individual reference norm should consider it important to teach their students how to monitor their learning progress and to evaluate themselves. In contrast, teachers who emphasize extrinsic motivation should focus more on assessment and grading by the teacher instead of self-evaluation.

1.3 Aim of the study and hypotheses

This study investigates the role of instructional context, with a main focus on the instructional aim of a lesson, and teacher beliefs for teachers' promotion of learning strategies in classrooms. Therefore, the teaching of learning strategies was observed in mathematics lessons that focused on different instructional aims (introduction to new mathematical concepts vs. practice of familiar tasks). Furthermore, teacher beliefs that were supposed to be crucial for the promotion of learning strategies were measured: formalist and application oriented world views of mathematics, relevance of extrinsic motivation and of an individual reference norm, and a constructivist view of learning and teaching.

Concerning the role of the instructional aim of the lesson for teachers' strategy promotion the following hypotheses were investigated:

1. The amount of teaching specific types of learning strategies differs between introductory and practice lessons in mathematics.
   (a) The amount of teaching cognitive strategies is higher in introductory lessons than in practice lessons.
   (b) The amount of teaching metacognitive strategies is higher in practice lessons than in introductory lessons.

2. There is stability regarding the amount of teaching specific types of learning strategies across introductory and practice lessons.

Concerning the role of teacher beliefs for teachers' strategy promotion the following hypotheses were investigated:

3. The amount of teaching specific types of learning strategies is related to teacher beliefs.
   (a) A constructivist view of learning and teaching is positively related to the amount of teaching cognitive as well as metacognitive strategies.

(b) World views of mathematics are related to the amount of teaching cognitive strategies: formalist view in a negative way, application oriented view in a positive way.

(c) Beliefs about the usefulness of assessment approaches are related to the amount of teaching monitoring and evaluation strategies: emphasis on extrinsic motivation in a negative way, emphasis on an individual reference norm in a positive way.

2. Method

This article draws on data from the German-Swiss video study *Quality of Instruction, Learning, and Mathematical Understanding* which investigated instructional quality in mathematics lessons and the effects on student learning and motivation (Klieme, Pauli, & Reusser, 2006; 2009; Klieme & Reusser, 2003). In the present study the video data was reanalyzed within the theoretical framework of self-regulated learning.

2.1 Sample

The total sample of the video study consisted of 20 German and 20 Swiss mathematics teachers. In the present study, we analyzed the complete subsample of 20 German mathematics teachers and their overall 538 secondary school students from the academic-track "Gymnasium" and the intermediate-track "Realschule" (grade 9). The 20 classes were equally distributed over the two school tracks; the mean number of students per class was 27 (SD = 3.1). About half of the students were female (54 %). The mean age was 14.9 years (SD = 0.58). At the time of the video recordings the teachers were already instructing the students in mathematics for at least one year. Overall, the teachers (25 % female) had a mean teaching experience of 16 years (SD = 10.45). Participation was voluntary and students' parental consent was required.

2.2 Measures and procedures

2.2.1 Variation of the instructional context

Each teacher was videotaped for three lessons on the Pythagorean Theorem (introductory lessons) and for two lessons on word problems (practice lessons). Each lesson was approximately 45 minutes. The two kinds of lessons represented the different instructional contexts and differed with regard to their instructional aim. The lessons on the theorem of Pythagoras were the beginning of an *introductory unit* on this topic. Here, a new mathematical concept was introduced to students, and

teachers were advised to carry out one proof for the Pythagorean Theorem during the videotaped lessons. The lessons on word problems were part of a *practice unit* on the application of linear equations. Three algebraic word problems were provided to be worked on during the two lessons, whereof each was available in three different difficulty levels. For each of the three tasks, teachers chose the difficulty level they thought to be adequate for their class. Furthermore, teachers were advised to implement a form of cooperative learning within the two practice lessons. Besides these guidelines, teachers were asked to prepare and conduct both kinds of lessons as usual.

2.2.2 Observation of the promotion of learning strategies

To assess teachers' promotion of learning strategies, the videos were analyzed using a former version of the observation instrument ATES (Assessing How Teachers Enhance Self-Regulated Learning, Dignath-van Ewijk et al., 2013). This instrument consists of a coding scheme to assess teachers' strategy instruction and of rating scales that cover aspects of the learning environment that are supposed to facilitate self-regulated learning among students. Especially important for this study was the coding scheme, which is based on Boekaerts' (1999) self-regulation model and assesses the teaching of specified learning strategies. Minute by minute, the observers coded whether the teacher taught cognitive strategies (elaboration, organization), metacognitive strategies (planning, monitoring and evaluation), and motivational strategies (resource management). As we do not have hypotheses about the resource management strategies we will not further deal with them. The coding scheme covers different qualities of strategy teaching and distinguishes between implicit and explicit strategy teaching. Table 1 gives some examples of teacher statements that were coded as teaching of strategies. If the teacher taught different strategies within one minute, it was possible to code more than one strategy for this minute. If in one minute the teacher was still teaching the strategy from the minute before, it was coded again.

Table 1: Examples of coded strategy teachings with the ATES coding scheme

Strategy	Teacher statement
Cognitive	
Elaboration	"Now we will quickly summarize, so that we know what actually the point is."
Organization	"While working on this kind of task, you should always ask yourself: 'What do I already know?' and 'What am I looking for?'"
Metacognitive	
Planning	"How could we proceed with this problem, which steps could we take?"
Monitoring and evaluation	"Please check your results again!"
Motivational	
Resource management	"I recommend you to share the work with your neighbor."

Note. Adapted from Kistner, Rakoczy, Otto, Dignath-van Ewijk, Büttner, and Klieme (2010, p. 163).

Before the coding procedure started, two observers took part in a 60-hours observation training to get familiar with the observation instrument and to practice coding. After that, the coding scheme was applied to the total of 100 videos. Out of these 100 videos, overall 23 were coded by both observers to check for interrater reliability (15 of the 60 videos of introductory lessons and eight of the 40 videos of practice lessons). Altogether, interrater reliability (Cohen's kappa) was .70 (kappa = .72 for the introductory lessons, kappa = .69 for the practice lessons).

For the practice lessons teachers were asked to implement a form of cooperative learning, and our expectation of a higher amount of teaching metacognitive strategies in these lessons was, amongst others, based on the assumption that learning is more student directed in these lessons. To test whether these preconditions are complied with, two rating scales of the ATES on cooperative learning and on self-direction were used, both consisting of two items that are rated on a 4-point scale. On the cooperative learning scale (α = .77) the observers assessed the quantity and quality of cooperative learning in the classroom. For the self-direction scale (α = .96) they judged the students' opportunities to take responsibility for their own learning as well as the balance between self-directed and teacher-directed learning.

2.2.3 Teacher questionnaire

A teacher questionnaire which covered different aspects of teacher beliefs was administered in the beginning of the school year (see Table 2). Two scales on formalism and application dealt with world views of the subject mathematics and were taken from Grigutsch, Raatz and Törner (1998). Teachers' emphasis on extrinsic motivation was covered by a single item with regard to the belief that grades are an appropriate instrument for motivating students (adapted from Stipek et al., 2001).

Another scale dealt with an individual reference norm (Rheinberg, 1980). It covered the tendency to assess a student's result by comparing it with previous results of the same student. Finally, a scale on a constructivist view of learning and teaching was included (Staub & Stern, 2002, adapted from Fennema, Carpenter, & Loef, 1990). It assessed the degree to which teachers regard students as active participants in the instructional process, who should be encouraged to develop their own solutions to problems. All scales were answered on a 4-point Likert scale ("is not true at all" to "is absolutely true"), except of the one on an individual reference norm, which was a 6-point Likert scale ("does not apply at all" to "applies fully").

Table 2: Scales of the teacher questionnaire on teacher beliefs

Scale	Number of items	Cron- bach's α	Example item
Formalist view of mathematics	4	.80	Characteristics of mathematics are clearness, accuracy and uniqueness.
Application oriented view of mathematics	5	.66	Many aspects of mathematics have a practical value or a direct reference for application.
Relevance of extrinsic motivation	1	–	The more students focus on good grades or achievement, the more they learn.
Individual reference norm	3	.85	By a "good mathematics performance" I mean a math result that exceeds the student's previous result.
Constructivist view of learning and teaching	6	.78	Students learn mathematics best by discovering approaches for solving problems themselves.

3. Results

As not all observed lessons were exactly the same in length, the observed number for each type of strategy was standardized to 45 minutes. For each teacher, the observed numbers of strategies were averaged over three lessons (for the introductory lessons), and over two lessons respectively (for the practice lessons). The average of all five lessons (shown in Table 3) was used for computing correlations with teacher beliefs. Table 3 gives an overview of descriptive statistics and intercorrelations of all variables in the study.

Table 3: Correlations, means, and standard deviations of all variables in the study

Variable	1	2	3	4	5	6	7	8	9	10	M	SD
Strategy teaching												
1. Elaboration	–										7.39	2.65
2. Organisation	.28	–									7.57	3.87
3. Planning	.29	.36	–								1.39	1.14
4. Monitoring and evaluation	.35	.17	.59**	–							1.61	0.98
Learning environment												
5. Cooperation	.33	-.06	.46*	.50*	–						2.04	0.47
6. Self-direction	.08	-.30	.42	.12	.46*	–					1.78	0.48
Teacher beliefs												
7. Constructivist view	.02	.30	.53*	.21	.37	.08	–				3.47	0.48
8. Formalist view	-.57**	-.04	-.04	.14	-.38	-.26	-.21	–			2.81	0.61
9. Application oriented view	.24	.26	.28	.47*	.23	-.10	.49*	-.39	–		3.33	0.37
10. Extrinsic motivation	-.33	-.22	-.17	-.48*	-.15	.18	.03	.15	-.42	–	2.40	0.68
11. Individual reference norm	.16	.50*	.33	.60**	.40	-.25	.37	-.24	-.48*	-.19	3.83	1.32

Note. $N = 20$.

$*p < .05 **p < .01$

Because of the relative small sample size ($N = 20$) of the study, we were still interested in correlations that did not exceed the significance level of .10. These are also reported here and are referred to as non-significant relations.

3.1 Preliminary analyses

Before we report the results concerning our hypotheses we provide information about the quality of strategy teaching and describe the two different instructional contexts.

Applying the coding scheme to the videos in this study revealed that the amount of explicit strategy teaching was rather low in both of the two units (14 % of the overall strategy teaching in the introductory unit, 10 % in the practice unit). As explicit strategy teaching was found to be very rare in this sample, we did not distinguish between different qualities in further analyses but regarded the overall strategy teaching.

In the method section we described the two instructional contexts, reporting that the teachers were told to implement a form of cooperative learning in the practice unit. In fact, the results of the ATES rating scale showed that more cooperative learning took place in the practice lessons, $M = 2.38$, $SD = 0.59$, than in the introductory lessons, $M = 1.70$, $SD = 0.56$, $t(19) = 4.48$, $p < .001$, $d_z = 1.00$. Furthermore, in our hypotheses concerning the two lesson types we argue that teaching is usually more student directed in practice lessons compared to introductory lessons and thus provides a great potential for teaching metacognitive strategies. Looking at the results of the ATES rating scale, self-direction is indeed higher in the practice lessons, $M = 1.97$, $SD = 0.74$, than in the introductory lessons, $M = 1.60$, $SD = 0.47$, $t(19) = 2.15$, $p = .04$, $d_z = 0.48$. These results reveal that the presuppositions we made for comparing the two units with regard to strategy teaching were achieved.

3.2 Promotion of learning strategies in different instructional contexts

Investigating the role of instructional context for teachers' strategy promotion in classrooms we first hypothesized that the teaching of learning strategies differs between lessons with varied instructional aims. In particular, the amount of teaching cognitive strategies is assumed to be higher in introductory lessons than in practice lessons (Hypothesis 1a). Metacognitive strategies, on contrast, are supposed to be taught to a higher amount in practice lessons compared to introductory lessons (Hypothesis 1b). Table 4 shows the means and standard deviations of teaching the different strategies separately for the two lesson types. A MANOVA with repeated measurements for the two cognitive strategy types elaboration and organization revealed no differences between introductory and practice lessons,

$F(2, 18) = 1.37$, $p = .28$, $\eta^2 = .13$. However, the effect sizes of the mean comparisons (d_z, see Table 4), indicate small effects in the direction expected in Hypothesis 1a. For the two metacognitive strategy types planning and monitoring and evaluation, the MANOVA with repeated measurements showed a significant difference between the two lesson types, $F(2, 18) = 3.93$, $p = .04$, $\eta^2 = .30$. Further analyses revealed that the amount of teaching planning strategies was higher in practice lessons compared to introductory lessons, $F(1, 19) = 7.15$, $p = .02$, $\eta^2 = .27$, while the amount of teaching monitoring and evaluation strategies did not differ between the two lesson types, $F(1, 19) = 0.01$, $p = .90$, $\eta^2 = .001$. Thus, concerning the metacognitive strategies, the results for the planning strategies are in line with Hypothesis 1b.

As a next step, we looked at the stability of teachers' strategy promotion across the two different instructional contexts (Hypothesis 2). Therefore, we tested the correlations between the number of taught strategies in introductory and practice lessons. A significant correlation was found for organization strategies ($r = .46$, $p = .03$, see Table 4). As expected, the more organization strategies a teacher taught in the introductory lessons, the more he or she taught also in the practice lessons. For elaboration and planning strategies, there were non-significant positive relations of moderate height between the two kinds of lessons. Thus, consistency in strategy promotion across different instructional contexts was only found for organization strategies, though a trend was observable for elaboration and planning strategies, which only partly supports our hypothesis.

Table 4: Strategy teaching in introductory compared to practice lessons and correlations between the two lesson types

	Introductory lessons		Practice lessons			
Strategy	M	SD	M	SD	d_z	r
Cognitive						
Elaboration	7.87	3.06	6.90	3.34	.27	.37[+]
Organization	8.28	4.17	6.86	4.86	.30	.46*
Metacognitive						
Planning	0.93	1.08	1.86	1.63	.59	.39[+]
Monitoring and evaluation	1.63	1.05	1.59	1.50	.02	.16

*$p < .05$ **$p < .01$ [+]$p < .10$.

3.3 Promotion of learning strategies and teacher beliefs

Exploring factors that are relevant for teachers' strategy promotion in classrooms we next looked at relations between the teaching of learning strategies and teacher beliefs. First, constructivist beliefs were assumed to be positively related to the promotion of all types of strategies (Hypothesis 3a). As can be seen in Table 3, a

significant correlation was found with the teaching of planning strategies, $r = .53$, $p = .01$, but not for the other strategies. Second, world views of mathematics were predicted to correlate with the teaching of cognitive strategies (Hypothesis 3b). As for the formalist view of mathematics, the more teachers agreed with this view, the less elaboration strategies they taught, $r = -.57$, $p = .01$. This finding is in accordance with our hypothesis, however, for the organization strategies no relation was found. Concerning the application oriented view of mathematics, we did not find any significant correlations with the teaching of cognitive strategies. Third, beliefs about the usefulness of assessment approaches were supposed to correlate with the teaching of monitoring and evaluation strategies (Hypothesis 3c). For the two assessment related beliefs we found significant correlations in the predicted directions. The more teachers emphasized the importance of extrinsic motivation, the less monitoring and evaluation strategies they taught, $r = -.48$, $p = .03$, while a higher emphasis on an individual reference norm went along with more teaching of these strategies, $r = .60$, $p = .01$.

In sum, the results were partly in line with our hypotheses. Interestingly, the scale on the individual reference norm did not only relate to the teaching of monitoring and evaluation strategies. Also, a significant correlation with organization strategies ($r = .50$, $p = .02$) was found, suggesting that this belief is especially relevant in the context of self-regulated learning.

4. Discussion

The aim of this study was to investigate the role of instructional context and teacher beliefs for teachers' promotion of learning strategies in classrooms. Regarding the instructional context we hypothesized that introductory and practice lessons in mathematics differ in the amount of teaching cognitive and metacognitive strategies. We were not able to show a higher amount of teaching cognitive strategies in introductory lessons compared to practice lessons by means of MANOVA. However, this might be due to the small sample size in this study ($N = 20$). The effect sizes for elaboration and organization strategies reveal small effects in the predicted direction. These strategies were, as expected, more often taught in introductory lessons compared to practice lessons. This is in line with suggestions by cognitive psychological research that emphasize the importance of these strategies for knowledge acquisition and suggests that teachers adapt their strategy teaching to varying contexts. Concerning the metacognitive strategies, we found that planning strategies were more often taught in practice lessons compared to introductory lessons, which is in line with our hypothesis. However, this was not true for monitoring and evaluation strategies. It should be noticed that teaching metacognitive strategies was overall very rare in the observed lessons (see means in Table 3), which could limit the conclusions that can be drawn from these results.

When interpreting the results it has to be considered that the two instructional contexts represented by introductory and practice lessons in this study do not only differ in the instructional aim of the lessons but also in several other aspects: in the amount of cooperation, in the amount of self-direction, and in mathematical content (conducting proofs in a geometry unit vs. complex problem solving in algebra). The practice lessons involved working with word problems, which are highly complex tasks. Students are often taught to use specified routines to deal with word problem tasks. Additionally, due to the demand to implement a form of cooperative learning, all teachers realized a group or pair work during the two lessons, even teachers who might not do this regularly. Thus, it is possible that some classes had to cope with cooperative learning in mathematics for the first time. These two aspects, the task complexity and the cooperative learning, could be reasons for teachers to provide their students with planning strategies to guide them through processing the tasks.

It also has to be kept in mind that we compared two kinds of lessons within the same subject, that is, mathematics and focused on different instructional contexts within this subject. Previous studies (Hamman et al., 2000; Moely et al., 1992), however, contrasted different subject matters and came to inconsistent results concerning teachers' strategy promotion. The findings of this study at least suggest that for the promotion of some learning strategies the instructional context can make a difference.

However, we also found a tendency of teachers to be relatively consistent in their strategy promotion across the two kinds of lessons, indicated by a significant correlation between the two contexts for organization strategies and high, though non-significant, relations for elaboration and planning strategies. There might be teachers, who generally emphasize learning strategies and make lots of attempts to make them accessible to their students, while others do not focus as much on strategies. This might be an explanation for these correlations, which, at first glance, seem to contradict the findings on differences between contexts. Teachers can keep a certain level of strategy promotion and still adapt to varying instructional contexts within this level.

We further hypothesized that teachers' promotion of learning strategies in classrooms is related to teacher beliefs. The data show that there are in fact relations between teachers' beliefs and their strategy teaching in the predicted directions. These results are in line with studies that report associations between teachers' pedagogical beliefs and their activities in the classroom (e.g., Dubberke et al., 2008; Klieme & Vieluf, 2009; Pauli et al., 2007; Peterson et al., 1989; Staub & Stern, 2002; Stipek et al., 2001; Vieluf & Klieme, 2011). Positive relations with strategy teaching were found for the progressive teacher beliefs constructivist view of learning and teaching and individual reference norm. Surprisingly, in the present study, constructivist beliefs were only related to the teaching of planning strategies, but not to the other strategy types. Maybe teachers with a very constructivist approach are not as engaged in strategy teaching as we assumed because they perceive strategy instruction as a too directive form of teaching. Another way of

promoting self-regulated learning, which is more indirect, lies in the design of the learning environment. However, in the study of Pauli et al. (2007), teachers' constructivist beliefs had no effect on their self-reported implementation of opportunities for self-regulated learning in the classroom.

Negative relations with strategy teaching were found for the traditional teacher beliefs: formalist view of mathematics and relevance of extrinsic motivation. These results are consistent with those of Stipek et al. (2001). They used a similar measure for the attitude towards extrinsic motivation and a scale for the conception of mathematics as a set of operations, which is comparable to our formalism scale. These two scales were negatively correlated with the observed degree to which teachers encouraged their students to work autonomously (including for example self-evaluation and using resources) and to focus on understanding and mastery (including for example talking about strategy use). To summarize, the present study suggests that teacher beliefs play a role in the context of the promotion of learning strategies and supports the assumption that they could account for teacher differences in the amount of strategy teaching.

A limitation of the present study is certainly the relatively small sample of classes, which is not representative for German schools. Furthermore, as this is not an experimental study, it cannot be figured out which of the features of the two instructional contexts discussed above accounts for differences in strategy teaching or whether a certain combination of features is crucial. It also has to be kept in mind that our observational data revealed that strategy teaching in this sample predominantly consisted in implicit prompting of strategic behavior. Thus, our results only give information about implicit strategy teaching and cannot be generalized to more explicit forms of strategy teaching. Another aspect that should be considered is that the video observation can only cover a temporary sequence of classroom instruction. We see the teacher at a certain point in time and do not know what has happened before. For example, has the class already dealt with a certain strategy extensively and the teacher does not consider it necessary to mention it again? Although researchers claim the need for prolonged training of learning strategies (Veenman, 2011), that is, not only introducing them once but practicing them again and again, we cannot be sure that the observed teachers acted that way. The strengths of the study include the use of systematic video observation to assess teachers' strategy promotion, which contributes to the validity of the data and assesses the intended behavior in the context where it is relevant.

In conclusion, teacher characteristics and, to some extent, context features seem to matter for the teaching of learning strategies in the classroom. The results contribute to the understanding of teacher activities in classrooms and stress the importance of teachers' beliefs for their daily practice regarding the teaching of learning strategies. Especially when looking at teacher education and professional development, the findings can be relevant. Teacher trainings on the promotion of self-regulated learning might remain ineffective if teacher beliefs are neglected. Thus, when we intend to foster self-regulatory skills in students, we could consider trying to shape teacher beliefs as a possible starting point.

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