The Promotion of Self-regulated Learning by Kindergarten Teachers: Differential Effects of an Indirect Intervention

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Abstract

The early promotion of self-regulated learning (SRL) has aroused increased interest since it has been highlighted as the key competence for lifelong learning (E.U. Council, 2002). To meet the demand for early support, an intervention for kindergarten teachers to foster SRL in five to six-year-old children was developed (Venitz & Perels, 2018). In the present study, different SRL promotion strategy profiles of kindergarten teachers were investigated by using latent profile analyses and the effectiveness of the developed intervention was evaluated under consideration of the found profiles. The results of latent profile analysis (n= 134 kindergarten teachers) displayed specific profiles that differ regarding the degree of self-reported knowledge concerning strategies to promote SRL in children. Using a sample of n= 76 kindergarten teachers who participated on a three-week training which was focused on the reflection of the own SRL as well as the promotion of SRL, differential effects of the found profiles were investigated. The results indicate that an adaption of the intervention according to the different SRL promotion strategy profiles would be meaningful, because kindergarten teachers with high and low SRL promotion strategy profiles differed significantly concerning their repertoire of supportive strategies and their SRL behavior.

Keywords: Differential Effects, Self-Regulated Learning, Kindergarten Teachers, Training, Latent Profile Analysis

Introduction

Against the background of social change processes that contribute to a growing relevance of lifelong learning processes, self-regulated learning (SRL) is increasing in importance (see Fthenakis et al., 2007; Lüftenegger et al., 2012). Therefore, the promotion of independent, self-directed forms of learning is one of the most important aims of the German early education system (KMK, 2004) and should begin as soon as possible (Secretariat of the Standing Conference of Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, 2015). An early promotion of SRL has an advantage over later support as learning behaviors are still malleable, increasing the positive influence of the SRL processes (Dignath, Büttner, & Langfeldt, 2008; Perels & Otto, 2009). In addition, "relatively small self-regulatory differences in early childhood can be magnified to progressively larger differences over time" (Baron, Evangelou, Malmberg, & Melendez-Torres, 2015, p. 1). Thus, early promotion of SRL can play a preventive role. In this context, kindergarten teachers are encouraged to continuously develop their knowledge and competence concerning the promotion of children (e.g., Lindeboom, & Buiskool, 2013; Secretariat of the Standing Conference of Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, 2015), so SRL is also a highly relevant competence for early childhood educators. In addition, the demand on teachers to "be familiar with the factors that influence a learner's ability to self-regulate and the strategies they can use to identify and promote self-regulated learning (SRL) in their classrooms" (Zumbrunn, Tadlock, & Roberts, 2011, p. 4) can also be transferred to the kindergarten context. Empirical findings provide hints that relevant skills or methods to foster SRL of kindergarten children can be effectively mediated by professional programs (e.g., Perels, et al., 2009). Hence, an intervention to promote the SRL behavior of kindergarten teachers as well as their knowledge about strategies to foster SRL in children, appears useful. Therefore, in a further

study by Venitz & Perels (2018), an indirect intervention for kindergarten teachers which focuses on the SRL promotion of five to six-year-old children, was developed. As research on SRL of educational staff in school contexts indicates that there are individual differences in the support of SRL (Moos & Ringdal, 2014), an investigation of differences with regard to early childhood educators' knowledge about SRL promotion strategies seems to be of special importance. That is why the present study seeks to investigate different profiles with regard to knowledge about SRL promotion strategies within a sample of 134 German kindergarten teachers, following a person-centered approach (Niemivirta, 2002). According to the Aptitude-Treatment-Interaction approach (Snow, Corno, & Jackson, 1996), differential effects of SRL profiles on an indirect SRL promotion strategy training were investigated via repeated measurement analyses.

SRL and its Relevance for Kindergarten Teachers

After the E.U.-Council (2002) report was issued, "self-regulated learning has been highly praised as the key competence to initiate and maintain lifelong learning" (Dignath et al., 2008, p. 102). Because of an increasingly faster alteration of knowledge in a highly technically developed society, an independent acquisition and continuous extension of knowledge is required, which can be facilitated through recourse to SRL strategies. Therefore, SRL, or the ability to initiate (learning) action processes autonomously, to adapt them continuously on the basis of self-observations and to reflect upon them (Zimmerman, 2000), has become one of the most important aims of the German education system and is of growing interest for researchers (e.g., Dignath, Büttner, & Langfeldt, 2008; Wigfield, Klauda, & Cambria, 2011; Perry et al., 2010). As the theoretical foundation of the intervention that was used as the database for the investigation of differential training effects, the social-cognitive process model of Zimmerman (2000) was chosen, which distinguishes three central learning phases (forethought phase, performance

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phase, and self-reflection phase). The model offers an in-dept explanation of SRL processes and related strategies, so it offers a solid knowledge base for kindergarten teachers and can be used for the (further) development of knowledge concerning strategies to foster SRL in children. In the first phase of the model (forethought phase), the focus is on planning the action, including analysis of the task, clarification of the challenges of the task and motivational processes. The second phase (performance phase) places pivotal importance on competencies like self-control and self-monitoring, meaning the conscious perception and analysis of inner experience and behavior. Here, the learning action is implemented while maintaining a focus on the planned aims. Central elements of the third phase (self-reflection phase) are self-evaluation and self-reaction, meaning that the task that was completed is compared with the aims set forth at the beginning of the task and evaluated in terms of its success (self-evaluation). As a consequence of the self-evaluation, a self-reaction takes place. If learners are displeased with the result of their work, they should adapt either their original aim or the strategies used in future learning actions. Zimmerman (2000) described a model consisting of several processes that are subjected to continuous adaptation and, therefore, an optimization of the learning behavior, so it offers suitable points of reference for an intervention study. However, abilities linked to the monitoring and the evaluation of one's own behavior in children of kindergarten age are doubted by some authors (e.g., Veenman, Van Hout-Wolters, & Afflerbach, 2006). Certainly, results by other researchers like Bronson (2000), Whitebread et al. (2009) or Hoyle & Dent (2018) assume that there already is a notable difference in metacognitive abilities, such as monitoring behaviors, the control of attention, and the adaption of strategies on the basis of self-evaluation, in comparison with infants and toddlers.

Thus, SRL is seen as an ability that can already be promoted in children kindergarten age by an increased number of researchers. These findings suggest that children seem to possess basic abilities to learn self-regulation, which can be further developed by additional support through interactions with competent educational staff and a structured learning environment (see Bruder, 2006). As it describes single learning processes, in which kindergarten teachers can orient themselves in their support of SRL, the social-cognitive process model by Zimmerman (2000) offers a suitable theoretical foundation for an intervention for children of kindergarten age and their reference persons. To date, SRL and its promotion has been mainly investigated in a school context (e.g., Cleary, Platten, & Nelson, 2008; Fuchs et al., 2003; Leidinger & Perels, 2016; Perels, Gürtler, & Schmitz, 2005; Rosário et al., 2007), but not often in a kindergarten context, so there is a lack of research concerning the SRL of kindergarten teachers and its promotion, although it can be expected to have significant implications for their daily work (e.g., Chatzistimatiou et al., 2014). Research in a school context suggests, "that if teachers become self-regulated in their own learning, their experience in self-regulatory processes can help them to develop strategies for teaching self-regulation to their students" (Senler & Sungur-Vural, 2014, p. 552). Because the work of kindergarten teachers is marked by a "rapidly changing environment" (Peeters et al., 2014, p. 1964), an ongoing adaption and extension of their knowledge of how to support children is required (Lindenboom & Buiskool, 2013). Thus, it can be stated that SRL also holds importance for early education staff. In a school context, it is stated that teacher first "need to be self-regulated learners themselves due to ever-changing curricular revisions, which require innovation and adaptability" (Moos & Ringdaal, 2012, p. 3) to continuously regulate their own learning and that they have to support the development of SRL behavior of the children they teach. This assumption should also be

transferable to the early education context. Although the theoretical assumptions demonstrate the importance of a teachers' knowledge of SRL promotion strategies, findings from Perry, VandeKamp, Mercer and Nordby (2002) in a school context indicate that teachers recognize the importance of SRL and are willing to help students build beneficial SRL behavior. However, they are "unsure of the tasks and practices that support it" (Serratore, 2015, p. 8). Transferring the findings to a kindergarten context, a reinforcement of kindergarten teachers' knowledge of strategies to promote SRL in children and a reflection on their own SRL seem to be of particular importance. Therefore, the presented training (Venitz & Perels, 2018) pursued two essential key goals: First, the reflection of the own SRL behavior as a basis to get able to act as a positive role model who demonstrates SRL behavior (Bandura, 1977), and second the development of knowledge concerning the support of SRL in kindergarten children.

Promotion of SRL

To conceptualize an adequate training for kindergarten teachers to improve SRL in children of kindergarten age, psychological-developmental requirements have to be considered. It is still unclear if and how many (meta-)cognitive conditions for SRL have already been developed by five to six-year-old children. While some authors like Veenmann, Van Hout-Wolters and Afflerbach (2006) postulate that metacognitive abilities that are necessary for SRL are not developed until school age (about eight years), others assume that basic abilities for controlling and regulating one's own cognitive processes already exist by preschool age (see Bronson, 2000; Hoyle & Dent, 2018; Larkin, 2010; Whitebread et al., 2009). By the means of extensive observational studies, Bronson (2000) could show that children of preschool age increasingly acquire capacity for information processing that enables them to adequately understand task demands. In addition, the capacity of working memory which facilitates the remembrance of instructions and therefore serves as a useful help to pursue defined goals, already increases in childhood (Hoyle & Dent 2018). Furthermore, at kindergarten age, intrinsic motivation is still highly developed, which contributes to a facilitation of the maintenance of learning-action (Carlton & Winsler, 1998). In addition, five to six-year-old children already possess the basic abilities to monitor and execute volitional control over their learning actions, which are necessary to finish a task in accordance with the initially established aims (Zimmerman, 2000). Furthermore, the ability to inhibit impulsive responses in favor of goal-directed responses, named effortful control, has already been developed at the age of three (Hoyle & Dent, 2018). These results indicate that at least basic developmental-psychological abilities to learn self-regulation already exist, making a targeted promotion of SRL at the end of kindergarten possible and meaningful. Certainly, essential reference persons such as parents or early childhood educators can mainly support the learning processes of children in this age group and therefore have an important role in terms of the development of SRL (see Hoyle & Dent, 2018; Pino-Pasternak & Whitebread, 2010). Concrete strategies to promote SRL in children were formulated within the parental Inducement of Self-Regulation-model (PIASR) by Martinez-Pons (1996), which formed the theoretical basis of the intervention concerning strategies to promote SRL. This model seemed suitable as it had already been successfully implemented in a previous study concerning the promotion of SRL in younger children through an intervention for kindergarten teachers (Perels et al., 2009). The model was originally conceptualized with regard to supporting behaviors of parents, but in the study of Perels et al. (2009), it was assumed that the model can also be transferred to kindergarten teachers because they take on the education-

al task while also acting as a positive role model. Therefore, it is to be expected that the SRL promotion strategies based on the PIASR model of Martinez-Pons (1996) can be used by kindergarten teachers, too. The model is defined by four central dimensions (modeling, encouragement, facilitation and rewarding). These dimensions represent strategies that adults can use to support the SRL of children and were mediated and practiced in the present indirect intervention. Based on the assumptions of Bandura (1977), the dimension of modeling comprises behaviors of adults who display positive examples of SRL and which are hypothesized to be imitated by children if they witness them regularly in everyday life (see Martinez-Pons, 1996). Encouragement means the ability to strengthen the child's efforts to imitate the observed behaviors adequately. Ongoing encouragement is assumed to lead to higher motivation and thus an improved persistence while task processing as well as more frequent mastery of the task. The dimension of facilitation in Martinez-Pons' model represents parental behaviors that contribute to mastery of a task by offering little encouragement such as targeted steering of attention to the essential dimensions of the task (Martinez-Pons, 1996). Finally, the dimension of rewarding contains parental behaviors that are intended to influence the children's behavior by providing rewards if the children show SRL strategies. In behavioristic terms (e.g., Skinner, 1974), it is likely that a behavior which is rewarded will be displayed more often. The model provides a basis for the procurement of knowledge of strategies that early childhood educators can use in their everyday working life to foster SRL in children.

Interventions to Promote SRL and SRL Promotion Strategies

Several studies confirm the effectiveness of direct interventions, meaning interventions that are directly attached to the target group, (e.g. Glaser & Brunstein, 2007; Perels, Gürtler, & Schmitz, 2005) as well as indirect interventions (De Jager, Jansen, & Reezigt, 2005; Perels et al., 2009; Souvignier & Mokhlesgerami, 2006), meaning interventions that focus on the environment of the target group. In their meta-analyses, Dignath, Buettner and Langfeldt (2008) examined 48 SRL programs in the primary school context in regard to their effectiveness. The results showed positive effects on academic performance (d= .62; $S.E$= .05), cognitive and metacognitive strategy use (d= .73; $S.E$= .04) and motivation (d= .76; $S.E$= .09). Therefore, especially the promotion of strategy use and motivation seems to be fruitful in primary school age (Dignath, Buettner, & Langfeldt, 2008). Studies in a school context were often developed with the aim to offer teachers material that they can use in their classes to support the SRL of their students (e.g., DeCorte, Verschaffel, & Van de Ven, 2001; Fuchs et al., 2003; Perels, Dignath, & Schmitz, 2009). Some interventions are conceptualized as professional development programs for teachers on the subject of SRL and revealed positive effects for the students (e.g., De Jager, Jansen, & Reetzig, 2005; Rozendaal, Mineart, & Boekaerts, 2006). In combination with an intervention for children of primary school age, Otto (2007) developed an indirect intervention concerning the promotion of SRL by teachers and parents. As part of the indirect intervention, knowledge about SRL processes and strategies concerning the promotion of SRL in class and in homework situations were mediated. The results of the study revealed significant improvements in terms of SRL on the level of the children, particularly in the training conditions where children took part in the intervention instead of only the teachers and/or parents. In elementary context, direct as well as indirect interventions are still rare (Perels et al., 2009), but first approaches have been launched in the recent years that have proven to be effective. One example of a direct intervention in a pre-

school context was developed by Perels and colleagues (2009). The intervention aimed to support the development of SRL strategies in preschoolers by practicing them together on the basis of various playful and creative tasks.

In kindergarten context, indirect interventions, meaning interventions that are aligned to the environment of the target group (e.g. parents or educators of children) seem to be of special interest because essential reference persons like parents or kindergarten teachers still have a formative influence on the behavior of the target age group (Bruder, 2006). Indirect interventions also offer the advantage of increased efficiency because kindergarten teachers in particular can operate as multipliers of the mediation of SRL skills (Bruder, 2006). Despite these obvious benefits of training essential reference persons in a kindergarten context, there is still a lack of research concerning SRL promotion interventions that are explicitly aimed at essential reference persons of children at the end of kindergarten time. One of the rare indirect intervention studies concerning the promotion of SRL in a preschool context was developed by Perels et al. (2009). Besides promotion of the preschoolers' SRL within the direct intervention (described above), the study aimed at imparting opportunities for the targeted promotion of SRL by preschoolers and a self-reflective conceptualization of SRL in a three-weekly training. Results were obtained for the preschool teachers as well as the children. On the level of the preschool teachers, significant improvements concerning their own SRL were revealed. The children showed significant benefits of the training in terms of their SRL.

The EMIL-project represents another example of a successfully evaluated study with the subject of an indirect promotion of executive functions in preschoolers (a construct nearly related to SRL) by providing a further education program for early childhood educators (Walk, Evers, Quante, & Hille, 2018). The training program includes a total of eight sessions in which knowledge about executive functions is mediated and ways to support it in preschoolers in the daily routines of the preschools are developed and discussed. The evaluation of the intervention yielded significant benefits of the training on the level of the preschool children with regard to three of seven executive function tests, namely behavioral inhibition, visual-spatial working memory, and combined executive function (working memory, inhibitory control, and cognitive flexibility). Results of the evaluation of the training on the level of the educators are not known so far.

Although it is becoming apparent that the promotion of self-regulation in kindergarten is gaining importance in both contexts, research and practice, there is a lack of interventions that include kindergarten teachers and parents together although the highest effect on the SRL of preschoolers can be expected if both reference groups are trained. By training parents and early childhood educator together, a consistent promotion at home and in kindergarten – the two most important learning contexts of kindergarten-age children – is ensured (El Nokali, Bachmann, & Votruba-Drzal, 2010).

SRL Promotion Strategies and Teachers' SRL Behavior

In terms of the importance of the SRL behavior of teachers for the implementation of SRL promotion strategies, empirical research seems to provide consistent results. In his study, Randi (2004) concluded that "teachers advance their knowledge and are enabled to recognize more opportunities to foster self-regulation in a diversity of settings" (Randi, 2004, p. 1966), if they are given opportunities to improve their own SRL. Following this assumption, teach-

ers first need to be conscious of their own SRL behavior before they can transfer adequate strategies to children. On the basis of their research, Peeters et al. (2014) also highlighted the "teacher's own self-regulatory competencies as a critical determinant of SRL implementation in primary school" (Peeters et al., 2014, p. 1963). In accordance with the assumptions of Peeters et al. (2014), Kramarski (2018) also supposes a dual teacher role in the context of SRL in his theoretical model, namely the learner's role and the teacher's role. Considering this dual role of teachers, the kindergarten teacher training that built the empirical basis for the investigation of differential effects, followed a two-level approach. In each session, methods to reflect and optimize the SRL behavior of the kindergarten teachers themselves were mediated while at the same time strategies to support the development of SRL in kindergarten children were presented and discussed within the training. Due to these conceptual thoughts and empirical findings, the present study also wanted to examine differential effects in terms of the SRL behavior of the participants.

Differential Effects When Fostering SRL Promotion Strategies

When evaluating interventions in real-life settings, the consideration of differential effects plays an important role because "the evaluator cannot influence the general set-up" (Lapka, Wagner, Schober, Gradinger, & Spiel, 2011), meaning that often a natural heterogeneity of the training group is given that is beyond the control of the evaluator. Therefore, within a training sample, it can be assumed that there are individual differences, such as regarding different starting levels concerning the main teaching subject, which can lead to different benefits of a training (Lapka et al., 2011). By using a variable-oriented approach, these individual differences are neglected, and only global effects of the training can be revealed. However, with the help of a person-centered approach, as implemented in the present study, changes through the training in relation to special subgroups can be analyzed. In this way, one can identify the need for the development of adaptive trainings that consider claims and needs of different subgroups. Thus, research on differential training effects can contribute to a profound foundation of individual trainings. In a study by Dörrenbächer and Perels (2016), SRL profiles of college students that differed qualitatively with regard to motivational subcomponents were examined to determine the effectiveness of a training to improve SRL skills. The results revealed that students within the profile with moderate SRL benefited from the intervention, whereas students with low SRL and moderate motivation as well as students with high SRL and high motivation did not show significant change. Another example of an investigation of differential effects of a training concerning the knowledge and usage of SRL strategies is a study by González-Pienda, Fernández, Bernardo, Núñez and Rosário (2014) that considered different pre-training SRL levels within the evaluation of their training. The results of their study illustrated that students with low baseline levels profited, whereas students with moderate and high baseline levels did not benefit noticeably. One explanation for this compensation effect is that students who already possess a high level of SRL skills have little room for improvement, whereas students with low levels of SRL skills can take the opportunity to expand their knowledge and practice the newly learned strategies through training. Results from other studies (e.g., Alexander, Carr, & Schwanenfluegel, 1995) indicate a contrary effect, named the Matthew effect (Walberg & Tsai, 1983), meaning that participants who already start with a high level of knowledge profit more from an intervention. This increased gain is explained by their superiority in controlling cognitions, which leads to a facilitated learning and application process. In a meta-analysis by Donker, Boer, Kostons, Dignath van Ewijk and van der Werf (2014), a to-

tal of 58 studies on learning strategy instructions in primary and secondary education with a focus on improving SRL were examined with the aim to reveal the strategies that can best contribute to an improvement in academic achievement. They also investigated differential effects of learning strategy instructions in reference to different types of students (regular students, children from low SES background, children with learning disabilities and needs and gifted children from higher SES backgrounds). In contrast to the studies described above, which suggested either a compensation effect or Matthew effect, the results of the analysis by Donker et al. (2014) did not reveal any significant differences between the individual types of students in regard to their gains from strategy instruction.

To summarize, the current research literature offers inconsistent findings concerning the benefit of a SRL (strategy) training for different groups of participants. In addition, analyses of the differential effects of interventions with the focus on SRL promotion strategies in a kindergarten context are very rare, so the present study can provide new insights into this field of research. Considering the preceding theoretical and empirical findings, a suitable training can only be provided, if different competencies and prior levels of knowledge are taken into consideration. This is why the present study aimed to evaluate a SRL training for kindergarten teachers, using different promotion strategy profiles. Given that the present study is most similar to the González-Pienda et al. (2014) study, it was hypothesized that kindergarten teachers with a low SRL promotion strategy profile would benefit more from the intervention than kindergarten teachers with a high SRL promotion strategy profile, indicating a compensation effect.

The Current Study

The preceding explanations show gaps in the research, the present study hopes to fill. First, there is a large amount of research concerning the promotion of SRL in a school context, referring to teachers, but the extent of knowledge and the usage of concrete strategies to foster SRL of educational staff in kindergarten have been largely neglected thus far. As a consequence of the increased recognition of early education processes and their support by kindergarten teachers, the conceptualization and evaluation of a specific SRL promotion training for this professional group, is of great significance. This was the starting point for the development and evaluation of a study for kindergarten teachers which aimed to improve their knowledge and competencies in regard to the promotion of SRL in children of kindergarten age (Venitz & Perels, 2018; further described in section 2.2). The results of the quasi-experimental control-group study with repeated measures showed a significant increasement in terms of the strategies that were used by the participants to promote the SRL in children of kindergarten age (Venitz & Perels, 2018). However, an investigation of differential effects is still pending, although it has been shown that the analysis of effects in dependence of different participant groups, offers a deeper insight into the evaluation of an intervention (Lapka, et al., 2011). In conclusion, this is why the present study now aims to investigate whether kindergarten teachers with specific SRL promotion strategy profiles displayed differential training effects. Consequently, the first aim of the present study was to investigate different profiles concerning SRL promotion strategies within the group of kindergarten teachers (Research question 1). Second, the training effects of a previously developed intervention for kindergarten teachers on the subject of promoting SRL in children of kindergarten age (Venitz & Perels, 2018) in relation to the different SRL promotion strategy outbound profiles were investigated (Research question 2).

Methods

Sample

Data from the present study were collected as part of a study supported by the German Research Foundation in the period from September 2014 to August 2015.

Sample for Research Question 1

In all, 134 German kindergarten teachers (96.6% female) took part in the test consisting of a questionnaire to assess SRL and strategies to promote SRL. This data formed the basis for the conduction of latent profile analyses on SRL promotion strategies. Of the kindergarten teachers, 11.5% were under 25 years, 17.5% were 25-29 years old, 13.5% were 30-39 years, 18.8% were 40-49 years, 33.3% were 50-59 years and 5.2% were over 60 years old. They had been employed in their roles for 17.5 years on average (SD = 13.76). Because we used this sample to conduct latent profile analysis, it was named the cluster sample.

Sample for Research Question 2 (Differential Training Effects)

For the analysis of differential training effects, n = 76 kindergarten teachers (100% female) were recruited. They participated in a SRL promotion training for children at the age of five to six years (see below) and had completed both a pretest and posttest. Of the kindergarten teachers, 13.5% were under 25 years, 21.2% were aged 25-29 years, 11.5% were 30-39 years, 19.2% were 40-49 years, 28.8% were 50-59 years and 5.8% were over 60 years old. They have been teaching for an average of 16.01 years (SD = 12.84 years). This sample was used to analyze individual effects of the SRL promotion strategy profiles with regard to the SRL intervention and thus termed the training sample.

Intervention to Promote SRL and SRL Promotion Strategies of Kindergarten Teachers

As a special feature of the training for kindergarten teachers, which was analyzed concerning differential effects in the present study, we used a two-level-approach that has been shown to be effective in previous indirect trainings in a school context (e.g., Bruder, Perels, & Schmitz, 2004). In order to transfer teachers' knowledge to children in kindergarten parallel to the intervention, the training pursued two essential aims: First, kindergarten teachers should be sensitized to the process of SRL in order to optimize their own SRL and therefore, to act as a positive role model (Bandura, 1977) for the children. Second, they should learn which methods they can use to support the development of SRL in kindergarten-age children (in reference to Martinez-Pons' PIASR-model, 1996). The data of the intervention study were collected in the period between September 2014 and August 2015 in several German kindergartens in a circuit of the responsible university. For the adult sample, 37 kindergarten teachers in the training groups and 10 kindergarten teachers in the control group participated in the study. Participation was voluntary, and data were collected anonymously. A unique assignment of the children to the parents and the kindergarten teachers was made possible by the procurement of individual codes. For the analyses on the child level, 53 children between five and six years were included. The training was comprised of three weekly sessions lasting about 90 minutes each and was conducted by two skilled trainers (see Venitz & Perels, 2018 for extended training description). To ensure standardized implementation, a schedule for each session was developed. All the sessions were structured in a similar way. At the beginning of each training session, the participants were greeted and made familiar with the contents of the day's training. After a theoretical lecture, the participants were offered the opportunity to practice parts of the learned content based on different exercises. After the exercises, they were encouraged to exchange experiences and examples of appropriate situations in their everyday life. At the end of each session, a transfer assignment was given to gain (further) experience either on the reflection of their own SRL or the teaching of self-regulatory strategies in their kindergarten classes until the next session. These experiences and related questions were renewed at the next training session. During every session, they also received a folder with materials for further exercises and an overview of the essential points of the training. The theoretical contents of the interventions propose a cyclical process, which can be divided into forethought, performance, and self-reflection phase (Zimmerman, 2000). In each of the three sessions, one phase and its central components and strategies were elaborated upon and heightened by exercises. Specific contents of the single sessions are displayed in Table 1.

Table 1. *Contents of the first, the second and the third training session*

First Training Session	Overview of the training units by means of a short theoretical input (the model of self-regulation by Zimmerman (2000) and PI-ASR-model by Martinez-Pons (1996)
	Forethought Phase
	Relevance of adequate goal formulation (theoretical input, interactive group exercise
Second Training Session	Performance Phase
	Strategies to support task processing, e.g. support in handling distractions (theoretical input, self-reflection exercise)
	Importance of children's self-talk while task managing and the method of metacognitive dialog (Pramling, 1988)
Third Training Session	Self-reflection Phase
	Relevance of attributing styles for the development of children's attitudes towards learning (theoretical input, self-reflection exercise)
	Importance of supporting beneficial reference standard (theoretical input, group exercise)
	Mistakes as an opportunity for the further development of learning processes (theoretical input)

Measures

To assess kindergarten teachers' self-reported knowledge about SRL promotion strategies and their perception of their own SRL behavior, a questionnaire was used, consisting of 146 items. The 4-point Likert-type scale ranged from 1 ("I don't agree at all") to 4 ("I agree completely"). In terms of the knowledge about SRL promotion strategies, the questionnaire comprises four subscales (modeling, facilitation, encouragement and rewarding) based on the PI-ASR-model (Martinez-Pons, 1996). They all showed acceptable internal consistency values for the two measurement points (see Table 1). To assess the kindergarten teachers' perceptions of their own SRL, three subscales (forethought phase, performance phase and self-reflection phase) in reference to Zimmerman's model of self-regulated learning (2000) were used, which showed satisfying Cronbach's alpha values (see Table 1). The scores Self-regulated learning behavior overall and SRL promotion strategies overall were used for the investigation of differential training effects and revealed good internal consistencies for both measurement points (see Table 2).

Table 2. *Scales, item examples, and reliabilities of the questionnaire*

| Scale | Subscale | Cronbach's alpha | |
		T1	T2
SRL behavior	Forethought phase: e.g., "Before I start a task, I am setting concrete targets." (36)	.90	.91
	Performance phase: e.g., "While I am working, I am thinking of my set aims, to check if I made progress." (19)	.73	.76
	Self-reflection phase: e.g., "Errors show me, what I can do differently." (17)	.79	.75
SRL promotion strategies	Modeling: e.g., "If I am excited about something, it automatically promotes the motivation of the children." (10)	.73	.69
	Facilitation: e.g., "If the children have difficulty solving a task, I try to encourage them to find their own solutions." (15)	.77	.81
	Encouragement: e.g., "If the children are afraid of a task, I encourage them." (10)	.77	.82
	Rewarding: e.g., "I praise the children for tracing failures to changeable things." (5)	.72	.52
Self-regulated learning behavior overall		.92	.93
SRL promotion strategies overall		.86	.74

Data Analysis

To answer Research Question 1, we wanted to analyze individual differences in the self-reported knowledge about SRL promotion strategies of kindergarten teachers. With the help of latent profile analyses (see Vermunt & Magidson, 2002) of the cluster sample of 134 kindergarten teachers using the SRL promotion strategy subscales (see Martinez-Pons, 1996) as indicators, we grouped them into homogenous classes. We choose latent profile analyses because they can be used with continuous variables and they contribute to the identification of latent classes on the basis of the relationships of the indicator variables. Thus, participants with similar characteristics in terms of the indicator variable are grouped together and are defined by the other groups from which they differ in regard to the variable of interest. As the research suggests that teachers differ in terms of the level of strategies they use to promote SRL in children, we could expect different SRL promotion strategy profiles for kindergarten teachers

but did not know how many profiles existed. Therefore, we conducted an exploratory analysis by investigating models from 1 to 7 classes in MPlus7 (Muthén & Muthén, 2012), which uses the robust maximum-likelihood estimation approach (MLR). The number of initial stage random starts was set to 500 with a maximum of 50 iterations of the stages of the optimization. To handle missing data, MPlus uses the Full Information Maximum Likelihood algorithm. In order to determine the number of classes that best conformed to the data, several model fit criteria were considered. Following the recommendations by Marsh, Lüdtke, Trautwein and Morin (2009), Bayesian Information Criterion (BIC), entropy and the Lo-Mendel-Rubin Likelihood Ratio Test (LMRT) were used for model selection. A low BIC can be interpreted as an indication for a good model fit, whereas high entropy values suggest a better model fit. A significant p-value for the LMRT indicates that the estimated model with k-classes fits the data better than the model with k – 1 classes. In addition to goodness of fit indices, theory or previous research should be considered to help decide upon the best model (see Marsh, Lüdtke, Trautwein, & Morin, 2009).

To answer Research Question 2, the kindergarten teachers who took part in the SRL promotion strategy training were selected as the training sample. Based on this data, the aim was to identify differential training effects in dependence of SRL promotion strategy profiles. In accordance with the central aims of the intervention, repeated measurement analyses were conducted using overall SRL promotion strategy (mean of all item scores) and overall SRL behavior as dependent variables and the profile classification as the independent variable. We did not have to replace missing values, since for the cluster sample as well as for the training sample, they were completely random (Little's MCAR test revealed no significant results). In accordance with previous research (González-Pienda et al., 2014), we predicted that kindergarten teachers would differ in how their mean scores changed from pre- to posttest, namely that teachers with low SRL promotion strategy profiles would have a greater benefit from the SRL intervention than teachers with moderate or high SRL promotion strategy profiles. To test this hypothesis, additional theory-driven single group comparisons were conducted using contrast analyses.

Results

Research Question 1: Latent Profile Analyses

With the aim of grouping homogenous classes, we conducted latent profile analyses (LPA) with the SRL promotion strategy subscales as indicators using the cluster sample (*n*= 134).

The fit indices of the analyses for the 2-7 cluster group solutions are displayed in Table 3.

The latent profile analyses for kindergarten teachers' perceptions of their SRL promotion strategy knowledge resulted in a three-cluster solution, which is consistent with the results of the study by González-Pienda et al. (2014). The three-cluster shows the lowest BIC, good entropy and a significant p-value for the LMRT. In addition, the distribution of the classes is balanced (profile 1= 40; profile 2= 51; profile 3= 43). Although a two-class solution showed higher entropy and a significant p-value for the LMRT, it has a much higher BIC and the distribution of the teachers to the classes is less balanced, making a three-class solution preferable. Following the recommendations of Marsh et al. (2009), we investigated solutions using different numbers of groups, deciding to use the one "that makes most sense in relation to theory, previous research, the nature of the groups, and interpretation of the results" (Marsh et

al., 2009, p. 194). We considered these points in addition to goodness of fit indices. The fit indices, as shown above, support a three-class solution. In addition, the same number of classes was used in the study of González-Pienda et al. (2014), again supporting a three-class solution. Means and standard deviations of the SRL promotion strategy indicators (modeling, facilitation, encouragement, rewarding) as well as of the overall variable SRL promotion strategies are displayed in Table 4.

**Table 3.** *Fit statistics for latent profile analyses*

Cluster	BIC	E	LMRT
2	365.00	.82	.00
3	354.62	.80	.01
4	367.26	.79	.79
5	380.93	.80	.43
6	395.46	.83	.25
7	408.32	.81	.36

Note. *BIC*= Bayesian information criteria, *E*= entropy, *LRMT*= p-value for Lo-Mendell-Rubin test. The selected cluster solution is typed in boldface.

Table 4. *Means and standard deviations of the tested variables in dependence of the SRL promotion strategy profile*

Groups	n	M (SD) MDL	M (SD) FCL	M (SD) ENC	M (SD) REW	M (SD) SRL_PS
Low SRL promotion strategy Profile	40	3.06 (.28)	3.04 (.18)	3.18 (.14)	3.00 (.37)	3.07 (.12)
Moderate SRL promotion strategy profile	51	3.21 (.39)	3.14 (.23)	3.62 (.14)	3.14 (.44)	3.31 (.14)
High SRL promotion strategy profile	43	3.61 (.31)	3.61 (.17)	3.85 (.12)	3.63 (.37)	3.70 (.10)

The profile plot (Figure 1) illustrates specific characteristics of the SRL promotion strategy profiles. The differences in the means of the subscales were significantly different for all groups ($p < .00$).
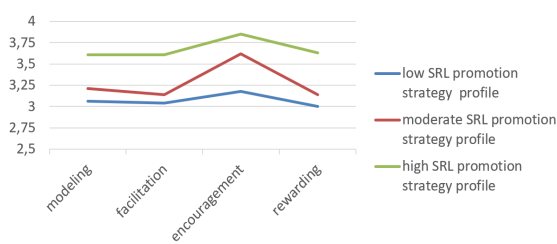
Figure 1. Profiles of SRL promotion strategies for Group 1 (low SRL profile), Group 2 (moderate SRL profile) and Group 3 (high SRL profile)

The means of the SRL promotion strategy subscales are all located in the upper third of the graph (*M*= 3.03-3.85, scale from 1 "I don't agree at all" to 4 "I agree completely"), meaning we can conclude that all kindergarten teachers already had some knowledge of SRL prior to the intervention. In addition, all profiles show a similar distribution in terms of the subscales, indicating they all had the highest scores for the subscale encouragement and lower values for the subscales modeling, facilitation and rewarding. It can be concluded that the classes do not differ obviously in terms of the distribution of the values on the subscales but rather in regard to their height. Class 1 had the lowest scores for all subscales, so it was named "low SRL promotion strategy profile" (blue line). Class 2 had moderate

scores and therefore was termed the "moderate SRL promotion strategy profile" (orange line), and Class 3 showed the highest scores for all subscales of the SRL promotion strategies, so we named it the "high SRL promotion strategy profile" (grey line).

Research Question 2: Differential Training Effects

To ensure that the cluster and the training group shared the same baseline, the distribution of the detected SRL promotion strategy profiles in the cluster and the training group was checked for uniformity. Next, we again conducted a latent profile analysis with Mplus (Muthén & Muthén, 2012) within the training group (*n*= 76 kindergarten teachers). Table 5 displays the fit indices of the analyses for the 2-7 training group solution.

Table 5. *Fit statistics for latent profile analyses*

Cluster	BIC	E	LMRT
2	143.45	.83	.00
3	**130.42**	**.85**	**.04**
4	139.49	.89	.10
5	143.20	.91	.05
6	154.79	.90	.48
7	164.24	.92	.10

Note. *BIC*= Bayesian information criteria, *E*= entropy, *LRMT*= p-value for Lo-Mendell-Rubin test. The selected cluster solution is typed in boldface.

In this case, the LPA for the training group also resulted in a three-cluster solution showing the lowest BIC, good entropy and a significant p-value for the LMRT. Participants were distributed into the classes as follows: Profile 1= 31; Profile 2= 27; Profile 3= 18.

To investigate how the different profile groups' knowledge concerning SRL promotion strategies changed through the intervention, a repeated-measurement ANOVA with overall SRL promotion strategies (mean of all item scores) as dependent variable (pretest/posttest) and profile groups as independent variable was performed. We wanted to detect interaction effects of profile groups with time. Due to the small sample size, we conducted Kolmogorov-Smirnov-tests for overall SRL strategy profiles (T1, T2) of all three groups. The results showed no significant deviation from normal distributions that would prohibit conducting an ANOVA. With the help of a 2 x 3 (time x SRL promotion strategy profile) repeated-measurement ANOVA, we found a significant interaction ($F(2,73)= 3.16$, $p < .05$, $\eta_p^2= .08$), indicating differential effects in terms of the SRL promotion strategies with regard to SRL promotion strategy profiles. The changes in terms of the SRL promotion strategies between the two measured time points are displayed in Fig 2.
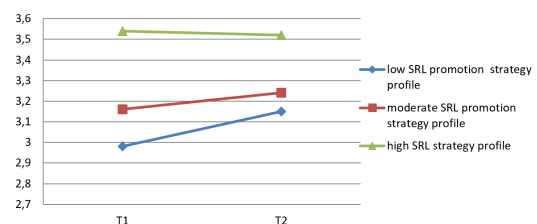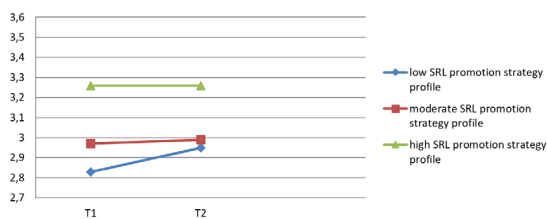

Figure 2. Differential training effects in terms of teacher self-regulated learning behavior in dependence on SRL promotion strategy profile group. Scale from 1 [not true at all] to 4 [totally true]

Differential Effects in terms of SRL behavior

We also ran a repeated-measurement ANOVA with overall SRL behavior (mean of all item scores) as the dependent variable (pretest/posttest) and profile groups as the independent variable to investigate whether there were significant interaction effects of profile groups with time.

Additionally, we again conducted Kolmogorov-Smirnov tests for overall SRL behavior profiles (T1, T2) of all three groups to account for the small sample size. The results showed no significant deviation from normal distributions that would contraindicate the use of ANOVA. The results of the 2 x 3 (time x SRL behavior) repeated measurement ANOVA showed a significant interaction, $F(2,73)= 3.20$, $p< .05$, $\eta_p^2= .08$, indicating differential effects in terms of teacher SRL behavior with regard to SRL promotion strategy profiles. The changes in terms of the teacher SRL behavior between T1 and T2 are displayed in Fig 3.

Figure 3. Differential training effects in terms of teacher self-regulated learning behavior in dependence on SRL promotion strategy profile group. Scale from 1 [not true at all] to 4 [totally true]

Low versus high SRL promotion strategy profile

To test the hypothesis that kindergarten teachers with a low SRL promotion strategy profile benefit more from training than teachers with a high SRL promotion strategy profile (high SRL promotion strategy profile > low SRL promotion strategy profile), we ran theory-driven single-group comparisons by the means of contrast analyses. The values of the second measurement of the dependent variable were considered for the analyses. As a measure of the effect size, Cohen's d was used. Following Cohen (1988), effect sizes of $d\geq .25$ are considered small, $d\geq .50$ medium, and $d\geq .80$ a large effect.

The results of the contrast analyses in terms of the SRL promotion strategies (overall value) were significant ($t(2,73) = 4.82$, $p< .001$, $d= 1.51$). In terms of the teachers' SRL behavior, contrast analyses also revealed significant results ($t(2,73)= 4.53$, $p< .001$, $d= 1.22$).

According to Cohen (1988), the determined effects can be interpreted as large effects.

Discussion

Following a person-centered approach, we had two essential aims: First, we wanted to examine whether there are different profiles among kindergarten teachers in regard to their self-reported knowledge of SRL promotion strategies. Secondly, we investigated differential training effects by testing the hypothesis that kindergarten teachers who possess only a low knowledge level of SRL promotion strategies benefit more from a SRL training than kindergarten teachers who already have greater knowledge about SRL promotion strategies before the intervention. The latent profile analyses revealed the presence of three profiles of SRL promotion strategies, characterized as low, moderate and high level. The first profile, "low SRL promotion strategy profile" (29.85%) represented the smallest group of the three. Most kindergarten teachers in this study belonged to the second profile: "moderate SRL promotion strategy profile" (38.81%). 31.34 % of the participants were assigned to the "high SRL promotion strategy profile". Overall, all groups showed rather high values on the subscale encouragement, indicating that they already had a sense of the importance of positive reinforcement for child learning and already used this strategy in their daily work in kindergarten. However, the recognition of the importance of rewarding and facilitation was rated rather low by the participants. One explanation for the poor recognition of rewarding as a strategy to improve SRL in children might be that it has a somewhat negative connotation in society because it is often stated that rewarding leads to spoiling. Nevertheless, rewarding, in form of the recognition of successful learning actions and behaviors by adults, is an essential motivational factor for children and therefore can help to improve SRL. This assumption is supported by several empirical findings (e.g., Henderlong & Lepper, 2002). In Henderlong and Lepper's 2002 review of the effects of praise on children's motivation, they showed that praise can have different effects on intrinsic motivation depending on a series of variables. In their synthesis, they conclude that, when praise is insincere, related to ability or perceived as controlling, it diminishes children's intrinsic motivation. In contrast, sincere praise contributes to positive performance attributions and therefore increased intrinsic motivation and effort. Concerning the lower scores for facilitation, it can be assumed that the kindergarten teachers did not recognize the importance of this strategy as much as with regard to encouragement. However, facilitation is probably one of the most effective strategies for promoting children's SRL as it is an integral aim of theoretical approaches like for example the model of Martinez-Pons (1996), the metacognitive dialogue of Pramling (1988) or the sustained shared thinking by Siraj-Blatchford et al. (2002). With regard to research aim 1, the results revealed that kindergarten teacher significantly differ in terms of their knowledge about SRL promotion strategies. In reference of the aptitude-treatment-interaction approach (Snow, Corno, & Jackson, 1996), it can be assumed that the detected subgroups of participants have different needs and wishes in regards to the training. Therefore, the intervention might not be equally fruitful for all participants which was tested by Research Question 2.

In terms of this second Research Question, the present study revealed that kindergarten teachers with low SRL promotion strategy profiles benefited significantly of the indirect intervention, whereas kindergarten teachers with high SRL promotion strategy profiles did not. The findings suggest a compensation effect, which was also found in the study by González-Pienda et al. (2014). The fact that only kindergarten teachers with a low SRL promotion strategy benefited from the intervention indicates that a SRL promotion strategy training may not be equally effective for all kindergarten teachers. Prior knowledge has to be considered because they can influence the effects of instructional designs (Lapka et al., 2011). Consequently, adaptive trainings that are tailored to the different needs of the detected classes are required. Considering the high SRL promotion strategy profile, the training should be revised. The results illustrate that the teachers already possess a high level of knowledge of SRL promotion strategies, so it would be useful to shift the focus from a mediation of basic knowledge to a more practical approach which focusses on minimally guided problem-solving (Kalyuga, 2007). Building on Fyfe, Rittle-Johnson and De-Caro (2012) who investigated effects of different levels of guidance during exploratory mathematical problem solving for children, it can be assumed that the participants with a high SRL level prior to the intervention benefit more from independent learning methods that they can adapt

to their unique learning needs. However, participants with less knowledge need more intensive instructional support in order to improve (Kalyuga, 2007).

Limitations and Implications for Future Research and Practice

Although the study offers differential insight into the promotion of SRL from the perspective of kindergarten teachers, several aspects should be optimized in future studies. One obvious limitation of the study is that all variables have been assessed by means of self-report even though research on the assessment of SRL has shown that what people report doing or thinking does not always correspond to their actual behavior (see Veenmann, 2005). In our study, this means that participants may indicate that already know many SRL promotion strategies (e.g., because of social desirability) although they do not use them in daily practice, thus distorting the results of our analyses. Therefore, in future studies, questionnaires based on self-report should be complemented by online measures such as think-aloud protocols or systematic observation. A suitable possibility for supplementing self-reports seems to be the observation instrument ATES (Assessing How Teachers Enhance Self-regulated Learning; Dignath-van Ewijk, Dickhäuser, & Büttner, 2013) which assesses teachers' promotion of SRL in capturing their instruction of SRL strategies.

Another limitation of the study is the small sample size, particularly of the training sample. To obtain valid conclusions for different training effect sizes, further studies with larger sample sizes would be meaningful. In addition, an investigation of the long-term effects would be interesting to make causal inferences possible.

Generally, the study contributed to a more in-depth insight into the knowledge of kindergarten teachers concerning the promotion of SRL, a theme which has been neglected for some time despite the increasing interest in the SRL of students (Dignath-van Ewijk, 2016). The evaluation of the training through a person-oriented approach showed that kindergarten teachers who belonged to the high SRL promotion strategy profile did not benefit from the intervention, leading to two essential implications for future research and practice. First, differential effects have to be further investigated by integrating additional variables. Here, the consideration of motivational aspects seems to be useful since motivation can impact the effectiveness of a training (Chiaburu & Tekleab, 2005; Jaeggi et al., 2011; Scaduto, Lindsay, & Chiaburu, 2008). Therefore, it could be assumed that the high SRL promotion strategy group benefits less because they already possess much of the knowledge shared during the intervention and therefore were less motivated to pay attention. A decrease in motivation and related attention to presented material could have hampered the absorption of new knowledge. Second, based on the findings referring to differential effects of the intervention, an adaption of future trainings is required. The results indicate that kindergarten teachers with high and with low prior knowledge concerning SRL promotion strategies do not benefit equally from the training. Taking these differences into account, trainers will be able to adapt their teaching methods and to select materials that are tailored to the requirements of the subgroups. Whereas kindergarten teachers with a poorer knowledge of SRL promotion strategies seem to need more instructional support, for participants with higher knowledge the focus should be placed on more independent learning methods and a more practical and problem-solving oriented approach.

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