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Measurement of optimal learning environments: Validation of the parents' attitudes towards self-regulated learning scale

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Abstract

Parents' attitudes towards self-regulated learning and their influence on children's learning behavior have been a rather neglected area of research. One reason for this is very likely the lack of a suitable measurement instrument. We adapted a measurement instrument designed to assess primary teachers' attitudes towards self-regulated learning for use with parents and validated it on a sample of 664 parents and their primary-school children. The instrument measures parents' attitudes towards various cognitive and metacognitive strategies that have been shown to be particularly effective in self-regulated learning processes of primary-school children. In a first step, the factor structure and the theoretical appropriateness of the instrument was verified via a confirmatory factor analysis. In a second step, the validity of the scale was tested with a structural equation model. Parents' attitudes towards self-regulated learning predicted how they facilitated the learning environment of their children; we measured parents' learning-environment facilitation with two scales: parental autonomy support during learning and setting up children's homework workspaces. The path between attitudes towards self-regulated learning and learning-environment facilitation was mediated by parents' self-efficacy regarding learning support. The criterion variable, parents' learning-environment facilitation, then, in turn, predicted students' school achievement as assessed with grades and a standardized test. These initial results suggest that the adapted instrument is useful for assessing parents' attitudes towards self-regulated learning and that these attitudes seem to influence the kind of learning environment parents create.

Keywords: self-regulated learning, attitudes, parents' learning-environment facilitation, parents, learning strategies

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The attitudes that parents hold about school and learning have a large influence on how they create their children's home learning environment. Noack (2004), for instance, showed that maternal values predict the amount of time that mothers spend on academic activities with their children and the mothers' levels of the school involvement. Davis-Kean (2005) found that parents' educational beliefs and expectations for achievement influence the learning environment. Parents who held higher aspirations for their children's scholastic achievement spent, for instance, more time playing with their children and reported more positive parent-child interaction at home.

Despite the existence of a number of findings on the influence of parental attitudes on the learning environment, studies are lacking on parental attitudes towards self-regulated learning and how these influence how parents facilitate their children's learning environments at home. Considering attitudes towards self-regulated learning appears relevant as, to cite one reason, self-regulated learning is a key competency (Council of the European Union, 2002) that has an impact on academic achievement (e.g., Paris & Paris, 2001; Winne, 1995; Zimmerman, 1990) and learning motivation (Pintrich, 1999). Research on teachers indicates that their attitudes towards self-regulated learning influence how they design and set up their students' school learning environments (e.g., Dignath-van Ewijk & van der Werf, 2012; Lombaerts, de Backer, Engels, van Braak, & Athanasou, 2009; Steinbach, Obergriesser, & Stoeger, 2015). We, therefore, assume that parents' attitudes towards self-regulated learning influence how they design and set up their children's home learning environments. We refer to this as parents' *learning-environment facilitation*.

One reason for the lack of research on the relationship between parental attitudes towards self-regulated learning and learning-environment facilitation may be that no measurement instrument exists for assessing the attitudes of parents towards self-regulated learning. The adaptation of an instrument designed to assess teachers' attitudes towards self-regulated learning for use with parents appears not only necessary, but also possible. We identified six instruments that assess teachers' attitudes towards self-regulated learning (Dix, 2009; Lombaerts et al., 2009; Hermans, van Braak, & van Keer, 2006; Steinbach & Stoeger, 2011; Tillema, 2000; Woolley, Benjamin, & Woolley, 2004). For our research question, the instrument by Steinbach and Stoeger (2011) was the most applicable and thus the best choice as a basis for adaptation. It measures primary-school teachers' attitudes towards cognitive and metacognitive aspects of self-regulated learning. It focuses on those strategies that are known to be particularly important for effective learning processes of younger children (cf. Dignath, Buettner, & Langfeldt, 2008; Stoeger, Sontag, & Ziegler, 2014). Younger students are particularly relevant for our research as they are more strongly influenced by their parents than older learners (Buhrmester & Furman, 1987; Eccles, 1999).

Present study

The first aim of our study was to adapt the instrument by Steinbach and Stoeger (2011) for use with parents of primary-school students. The second aim was to verify its factor structure and theoretical appropriateness. The third aim was to validate the instrument in

a structural equation model designed to assess the direct effect of parental attitudes towards self-regulated learning on parents' learning-environment facilitation and the indirect effect of their attitudes on students' scholastic achievement.

Adaptation of the teachers' attitudes towards self-regulated learning scale for use with parents

Steinbach and Stoeger (2011) based their instrument on Zimmerman's model of self-regulated learning (1989), which is itself based on social-cognitive theory (Zimmerman, 2000) and divided into three phases of self-regulated learning: a forethought phase, a performance or volitional-control phase, and a self-reflection phase. We refer to this model as the Zimmerman model. The *forethought phase* encompasses those prerequisite processes that precede actions and learning efforts. The *performance or volitional-control phase* includes processes that are important during learning and influence one's focus and behavior. During the *self-reflection phase*, which begins after learning activities have ceased and concludes the Zimmerman model, learners evaluate the outcome of their learning. Processes occurring during the self-reflection phase influence the next forethought phase. Despite its tripartite macrostructure, each phase of the Zimmerman model includes a variety of cognitive, metacognitive, and motivational aspects and is therefore relatively complex.

Steinbach and Stoeger (2011) based their instrument on a simplified normative model of self-regulated learning that reduces the complexity of the Zimmerman model. The normative model by Ziegler and Stoeger (2005), which we will refer to as the Ziegler – Stoeger model, focuses on those cognitive and metacognitive aspects of self-regulated learning that are particularly effective for primary-school students (cf. Dignath et al., 2008; Stoeger et al., 2014). Considering parents' attitudes towards these aspects is particularly important for the context of our research. The Ziegler-Stoeger model reflects seven of the manifold aspects considered in the Zimmerman model, namely, self-assessment, goal-setting, strategic planning, strategy implementation, strategy monitoring, strategy adjustment, and outcome evaluation. The seven steps are operationalized as a cycle of self-regulated learning and reflect the three phases in the Zimmerman model (cf. Figure 1). The first three steps in the Ziegler-Stoeger model (*self-assessment*, *goal-setting*, and *strategic planning*) reflect selected aspects within the *forethought phase* in the Zimmerman model. The next three steps in the Ziegler-Stoeger model (s*trategy implementation*, *strategy monitoring*, and *strategy adjustment)* reflect selected aspects within the *performance* or *volitional-control phase* of the Zimmerman model, constitute an internal cycle within the Ziegler-Stoeger model, and can be applied to various cognitive strategies (e.g., organizational strategies, rehearsal strategies; cf. Weinstein & Mayer, 1986). By working through these three steps repeatedly, students come to under-stand that a learning strategy is not something one immediately knows how to use effectively, but that strategy use needs to be developed through constant monitoring and, whenever necessary, error recognition and adjustments. The final step in the Ziegler-Stoeger model, *outcome evaluation*, is an aspect taken from the Zimmerman model's third

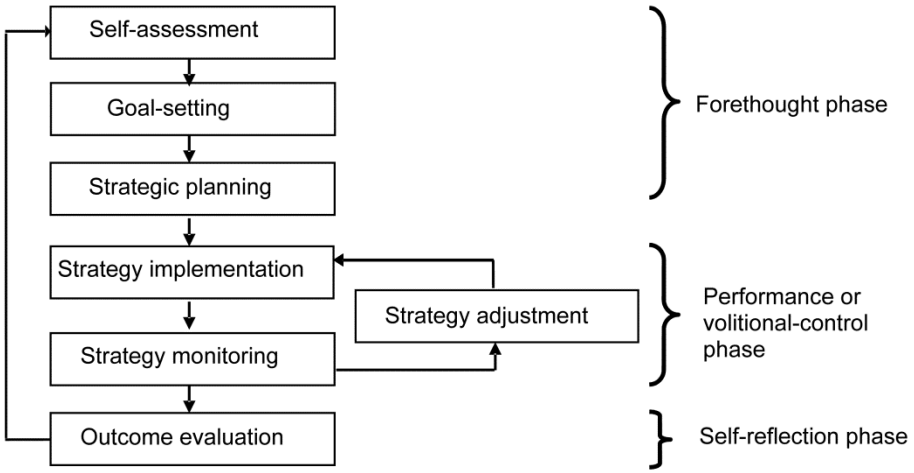

Figure 1:
Seven-step cyclical model by Ziegler & Stoeger (2005) and corresponding phases of Zimmerman's (2000) model.

phase, *self-reflection*. The central concern here is whether strategic learning has helped an individual to achieve a goal. As in the Zimmerman model, the final step in the Ziegler-Stoeger model influences the way students approach future learning processes.

To assess teachers' attitudes towards self-regulated learning, Steinbach and Stoeger (2011) developed four attitude-assessment items for each of the seven cycle steps in the Ziegler-Stoeger model. All items share the same stem ("It is important to me personally that my students …") and are measured on a six-point Likert scale from 1 (*completely disagree*) to 6 (*completely agree*). Thus higher scores are indicative of more positive attitudes towards self-regulated learning.

We adapted the instrument by Steinbach and Stoeger (2011) for use with parents of primary-school students – the first aim of our study – by changing the item stem to read: "It is important to me personally that my *child* …" Table 1 presents one sample item for each of the seven steps in the Ziegler-Stoeger model as they appear in the adapted parental instrument. As in the teacher questionnaire, parents respond to all items on a six-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*).

Factor structure verification of the adapted scale and model comparison

Our second aim was to verify the factor structure of the instrument and its theoretical appropriateness with parents in confirmatory factor analyses as well as to test the theoretical model against three plausible alternative models. In the case of the original teachers' instrument (Steinbach & Stoeger, 2011), a confirmatory factor analysis showed that a

Table 1:
Sample Items for Each Cycle Step

Subscale	Sample Item With the Stem "It is important to me personally that my child …"
Self-assessment	… knows exactly where his/her strengths lie with respect to learning contents.
Goal-setting	… is capable of setting appropriate goals for himself/herself for his/her learning.
Strategic planning	… plans his/her learning and studying step by step.
Strategy implementation	… learns how to properly use learning strategies.
Strategy monitoring	… monitors whether he/she is using learning strategies correctly.
Strategy adjustment	… can optimize his/her learning through adaptation of the strategy he/she is using.
Outcome evaluation	… attributes his/her learning outcomes to his/her learning behavior.

seven-factor structure reflecting the seven cycle steps described in the Ziegler-Stoeger model was the most appropriate factor structure. Steinbach and Stoeger (2015) compared the structure of the Ziegler-Stoeger model with three plausible alternative models. Alternative model 1 was also based on the Ziegler-Stoeger model, but it included a second-order factor representing the attitudes. Alternative model 2 represented a combination of the Ziegler-Stoeger model and the Zimmerman model. A second-order factor was modeled for the first three steps of the Ziegler-Stoger model (*self-assessment*, *goal-setting*, and *strategic planning*), which reflect the Zimmerman's *forethought phase*. For the next three steps in the Ziegler-Stoeger model (s*trategy implementation*, *strategy monitoring*, and *strategy adjustment*), another second-order factor was modeled that represented the *performance* or *volitional-control phase* of the Zimmerman model. Finally, a first-order factor was modeled representing the last step in the Ziegler-Stoeger model, *outcome evaluation*, which reflects the Zimmerman model's self-reflection phase. Alternative model 3 was a unifactorial model postulating a central *g* factor of self-regulated learning. We assessed the theoretical appropriateness of the adapted instrument's seven-factor model with a confirmatory factor analysis and compared it with the three theoretically plausible alternative models described above.

Method

Participants and procedure

Six hundred and sixty-four parents of primary-school children filled out the adapted questionnaire as part of a larger study. The questionnaire instructions were standardized,

and participation was voluntary and anonymous. The fourth-grade children of participating parents attended 43 different schools in Bavaria, in southern Germany. Five hundred and seventy questionnaires (86 %) were answered by the mother and 59 (9 %) by the father. In 28 instances (4 %), the mother and the father completed the questionnaire together, and six questionnaires (1 %) were filled out by another person.

Measures

Parental attitudes towards self-regulated learning were assessed with the adapted instrument developed by Steinbach and Stoeger (2011) and described above. The adapted instrument encompasses 28 items that assess parents' attitudes towards seven aspects of self-regulated learning (self-assessment, goal-setting, strategic planning, strategy implementation, strategy monitoring, strategy adjustment, and outcome evaluation) as described in the model by Ziegler and Stoeger (2005). All items are measured on a six-point Likert scale from 1 (*completely disagree*) to 6 (*completely agree*). Sample items can be found in Table 1.

Data analysis

We ran all models with M*plus* 6.0 (Muthén & Muthén, 1998 – 2010) and estimated all models with the maximum-likelihood (ML) method. We first evaluated our primary model that assumes seven factors, representing the seven cycle steps of self-regulated learning in the Ziegler-Stoeger model. Each factor is represented by four items. We then compared the fit indices of our primary model with the three alternative models described above. Following Brown (2006), we applied several fit indices. As a non-significant chi-square test is not an optimal model-fit indicator on account of its sensitivity to sample size, we evaluated the model with three additional goodness-of-fit measures: the root mean square error of approximation (RMSEA) with its 90 % confidence interval (good fit: RSMEA $\leq .05$, lower bound of the confidence interval: $\leq .05$; acceptable fit: $\leq .08$; lower bound of the confidence interval: $\leq .08$); the standardized root mean square residual (SRMSR) (good fit: SRMR $\leq .05$; acceptable fit: SRMR $\leq .10$); and the comparative fit index (CFI) (good fit: CFI between .97 and 1.00; acceptable fit: CFI between .90 und .97) (Hu & Bentler, 1999; McDonald & Ho, 2002; Schermelleh-Engel, Moosbrugger, & Müller, 2003). For the model comparison we compared the fit indices of our primary model with the indices of the three alternative models. As additional measures, we used the Akaike information criterion (AIC) for model comparisons, for which lower AICs predict a better fit (Schermelleh-Engel et al., 2003). We also ran a chi-square difference test to account for the models being nested.

Results

Confirmatory factor analysis

As only 0.20 % of all data were missing, imputation was not necessary. The assumption of normality was assessed using the estimates of skewness and kurtosis. The means of skewness and kurtosis were – .40 (*SD* = 0.10) and .81 (*SD* = 0.19), respectively. Inter-item correlation ranged from $r = .13$ ($p < .01$) to $r = .91$ ($p < .001$). The mean values for the individual items ranged from 3.47 (*SD* = 1.28) to 5.03 (*SD* = 0.85). The mean of the total scale was 4.49 (*SD* = 0.66).

Our hypothesized model assumes seven factors, which represent the seven cycle steps of self-regulated learning in the Ziegler-Stoeger model. Each factor is represented by four items. A confirmatory factor analysis indicated acceptable fit indices for the model: $\chi^2(329, n = 664) = 1443.73$, $p < .001$, RMSEA = .07 (90 % confidence interval [CI] = .07, .08), SRMR = .05, and CFI = .92. All standardized factor loadings varied between .52 and .97 and were significant at the $p < .001$ level (see Figure 2). Table 2 provides Cronbach's alphas, means, and standard deviations for the seven subscales and the overall attitudes towards self-regulated learning scale.

In a next step, we compared – via confirmatory factor analyses of the data collected in the current study – the fit of the primary model and the three alternative models described above. Table 3 presents all fit index scores for the four models we tested. Fit index values for our primary model and the first two alternative models are better than for alternative model 3. If one only compares the primary model against alternative models 1 and 2, the primary model's fit index values are more convincing. The CFI value of the primary model is the highest (.92). The SRMR value of .05 in the primary model is also better than the SRMR value of .09 in alternative models 1 and 2. The AIC value and the chi-square difference test also confirm the best fit for the primary model. These results indicate a factor structure for the parents' instrument that is comparable to that described for the teachers' instrument by Steinbach and Stoeger (2011).

Validation of the adapted parents' scale via a complex causal model

The third aim of our study was to validate the adapted instrument for assessing parents' attitudes towards self-regulated learning with the help of additional data on the parents and their children. We tested whether parental attitudes towards self-regulated learning influenced – via parents' facilitation of their children's home learning environment – their children's scholastic achievement. We based our validation on a structural equation model that describes the influence of parental attitudes towards self-regulated learning on parents' learning-environment facilitation and the influence of the learning-environment facilitation on children's scholastic achievement. We also added parental self-efficacy regarding learning support as a mediating variable between parental attitudes towards self-regulated learning and learning-environment facilitation (cf. Figure 3).

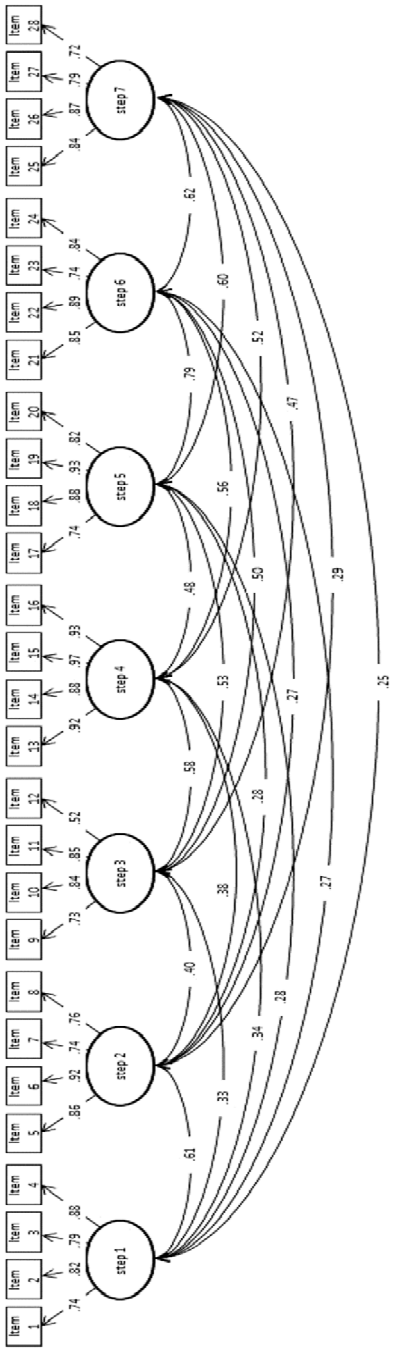

Figure 2:
The seven-factor confirmatory model of the scale and the empirical results (n = 664). Step 1 = self-assessment, step 2 = goal-setting, step 3 = strategic planning, step 4 = strategy implementation, step 5 = strategy monitoring, step 6 = strategy adjustment, step 7 = outcome evaluation. All of the coefficients are statistically significant, $p < .001$.

Table 2:
Reliabilities, Means, and Standard Deviations of the Subscales and the Overall Attitude Scale

Subscales		Cronbach's α	*M*	*SD*
1	Self-assessment	.89	5.02	0.72
2	Goal-setting	.89	4.81	0.85
3	Strategic planning	.82	4.41	0.89
4	Strategy implementation	.96	4.82	0.93
5	Strategy monitoring	.91	3.84	1.09
6	Strategy adjustment	.90	4.10	1.03
7	Outcome evaluation	.88	4.47	0.92
8	Overall attitudes towards self-regulated learning scale	.94	4.49	0.66

Table 3:
Fit Indices for the Four Models

	Description	χ^2	df	RSMEA	RMSEA CI (90%)	SRMR	CFI	AIC	$\Delta\chi^2/\Delta df$
PM	7 factors	1443.73***	329	.07	.07 – .08	.05	.92	39849.09	
AM 1	7 factors + 1 second-order factor	1731.23***	343	.08	.07 – .08	.09	.90	40108.89	287.50 (14)*
AM 2	2 second-order factors and 1 first-order factor	1655.07***	341	.08	.07 – .08	.09	.91	40036.42	211.34 (12)*
AM 3	unifactorial model	9025.39***	354	.19	.19 – .20	.22	.40	47380.75	7581.66 (25)

Note. df = degrees of freedom; RSMEA = the root mean square error of approximation; CI = confidence interval; SRMR = the standardized root mean square residual; CFI = comparative fit index; AIC = Akaike information criterion; PM = primary model; AM = alternative model.
*** $p < .001$.

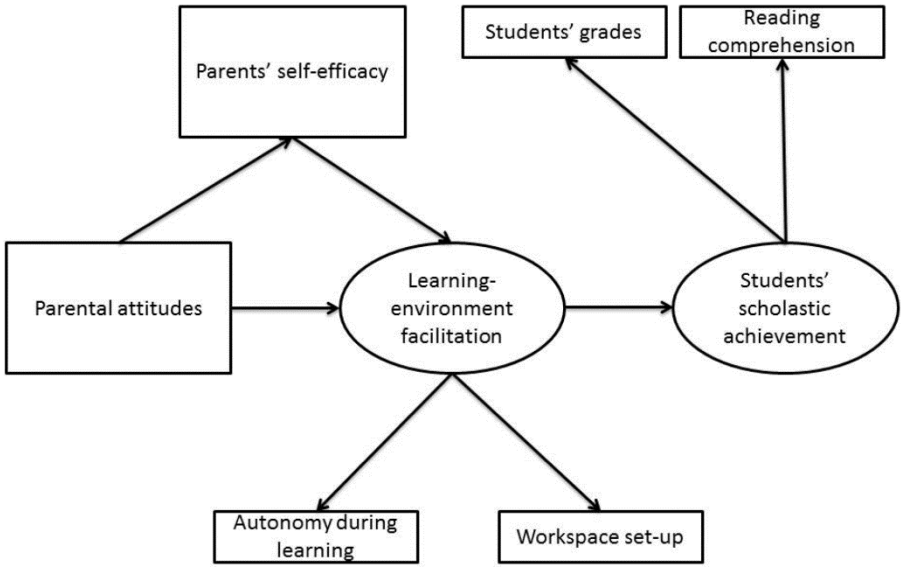

Figure 3:
Model for students' scholastic achievement. Latent constructs are shown in ellipses, and observed variables are shown in rectangles.

Although Steinbach and Stoeger (2011) thoroughly investigated the factor structure of their scale for teachers, they only conducted an initial validation study for their instrument. They demonstrated concurrent validity for their instrument on a sample of 400 preservice teachers with correlations with a scale that measures the degree to which teachers create learning environments that enable students to self-regulate their learning ($r = .18$, $p < .001$). They showed retrospective validity with the same sample by correlating the instrument with participants' past experiences with self-regulated learning ($r = .23$, $p < .01$).

In a second validation study with 46 teachers (Steinbach & Stoeger, 2015), the concurrent validity of the teachers' scale was examined again via the correlation between the teachers' attitude scale and a scale measuring teachers' evaluation of the desirability of different aspects of self-regulated learning in class (desirability of planning, of goal-setting and evaluation, and of strategy implementation), independent of whether they had used these aspects in their own instruction. The correlations ranged between $r = .39$ ($p < .01$) and $r = .54$ ($p < .001$). The authors also examined the predictive ability of the teachers' scale for the same sample with a logistic regression in which the teachers' attitudes towards self-regulated learning predicted their participation in a two-day workshop on self-regulated learning and their implementation, after the workshop, of a seven-week daily training program on self-regulated learning in their own class ($B = 1.80$, $p < .01$) (Steinbach & Stoeger, 2015).

The validation studies described by Steinbach and Stoeger (2015) provide initial indications that the attitudes of teachers towards self-regulated learning influence the degree to which teachers create learning environments that enable students to self-regulate their learning. The study also provides initial evidence that attitudes towards self-regulated learning influence related behavior, namely, teachers' registration for a workshop and their concomitant willingness to implement a training program in their instruction.

It should be noted, however, that the validation described by Steinbach and Stoeger (2015) did not take students' characteristics into account. We, therefore, designed our current study to test (a) the influence of parental attitudes towards self-regulated learning on their facilitation of their children's learning environment and (b) the influence of the learning-environment facilitation on children's scholastic achievement. We view autonomy-granting during homework (Grolnick & Ryan, 1987, 1989) and homework workspace set-up (Wild & Schiefele, 1994; Xu, 2009) as two particularly relevant aspects of parents' learning-environment facilitation. We also included parental self-efficacy regarding learning support as a mediating variable between parental attitudes towards self-regulated learning and parents' learning-environment facilitation, because attitudes and self-efficacy are known to correlate (e.g., DeVries, Dijkstra, & Kuhlman, 1988) and because self-efficacy, in turn, correlates with behavior (Schunk & Pajares, 2002). We present our structural equation model in Figure 3.

For our structural equation model, we used the overall scale for assessing attitudes towards self-regulated learning, rather than its individual components. This is appropriate as the following study does not assess individual aspects of self-regulated learning, but rather parents' overall attitude towards self-regulated learning. We derived the assumptions in our structure equation model from findings in school research: Various studies offer indirect support for the path we assume between attitudes and parental learning-environment facilitation (e.g., Davis-Kean, 2005; Noack, 2004). Research does not document the influence of parental attitudes towards self-regulated learning on learning-environment facilitation. We expect to find the relationship for the home environment, however, as research clearly documents the influence of teachers' attitudes towards self-regulated learning on how they facilitate the school learning environment (e.g., Dignath-van Ewijk & van der Werf, 2012; Steinbach et al., 2015).

To the best of our knowledge, no direct evidence in support of the path between parental attitudes towards self-regulated learning and self-efficacy has been described in the research literature. Research on the relationship between teachers' or students' attitudes towards self-regulated learning and self-efficacy is also lacking. Numerous studies do exist, however, on relationships between attitudes towards learning or subject areas and self-efficacy (e.g., Cera, Mancini, & Antonietti, 2013; Guven & Cabakcor, 2013; Lee & Lee, 2014; Partin & Haney, 2012; Randhawa, Beamer, & Lundberg, 1993). These findings suggest that relationships between parental attitudes towards self-regulated learning and their self-efficacy regarding learning support may exist.

On relationships between parental self-efficacy regarding learning support and parents' learning-environment facilitation numerous studies do exist (e.g., Ferdenzi, 2010; Gonzales, 2005; Green, Walker, Hoover-Dempsey, & Sandler, 2007; Hoover-Dempsey &

Sandler, 1997). Research has shown, for instance, that parental self-efficacy about helping a child succeed in school influences how parents support their children's learning (e.g., Green et al., 2007).

Relationships between parental facilitation of the home learning environment and students' academic achievement have also been documented by numerous studies (e.g., Davis-Kean, 2005; Eccles, 2007; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). In particular, many of these studies provide evidence for relationships between parental autonomy support and children's achievement as well as between the set-up of children's homework workspaces and achievement. Relationships between autonomy support and scholastic achievement via motivation have been documented from the perspective of self-determination theory (Deci & Ryan, 1985, 2000) in various studies (Cooper, Lindsay, & Nye, 2000; Grolnick & Ryan, 1989; Kingir, Tas, Gulsum, & Vural, 2013). The set-up of children's homework workspaces also correlates positively with scholastic achievement (Xu, 2009). Making workspace materials easily accessible and creating a calm working environment are particularly important for learning. Both aspects of workspace set-up help pupils concentrate on learning contents and avoid distraction and thereby facilitate the use of these two important motivational-volitional strategies (Gräsel, 2006; Wild & Schiefele, 1994).

In the following section we will use parent and student data to test the structural equation model described above for validating the measurement instruments that assess parental attitudes towards self-regulated learning. We examine the influence of parental attitudes towards self-regulated learning on learning-environment facilitation and the influence of the parental attitudes (via the facilitation) on children's scholastic achievement. We will also account for a mediation effect of parents' self-efficacy between their attitudes and the learning-environment facilitation.

Method

Participants

The children of the 664 parents described above also participated in this study. All children were in fourth grade and attending 43 different primary schools in southern Germany. Three hundred and sixty-two students (55 %) were girls. The mean age of the students came to 10.28 years (SD = .40, range: 8.00 – 12.08). One hundred and thirty-four (20 %) of the students had a migration background (i.e., either these students themselves or at least one of their parents was born outside of Germany).

Measures

With the exception of students' grades and reading comprehension, all scales were measured on a six-point Likert scale from 1 (*completely disagree*) to 6 (*completely agree*).

Parental attitudes towards self-regulated learning. Parental attitudes towards self-regulated learning were assessed with the adapted 28-item scale described above. Cronbach's α was .94; λ_2 was .95.

Parents' self-efficacy regarding learning support. Parents' self-efficacy regarding learning support was assessed with a scale from Otto (2007). The scale encompasses three items. A sample item is: 'I know what to do to help my child when problems occur during the homework process.' The scale's internal consistency was .86.

Parents' learning-environment facilitation. The home learning environment created by parents for their children comprises parents' levels of autonomy-supportive behavior during learning and their set-up of their children's homework workspaces.

Parental autonomy support during learning. Autonomy-supportive instruction during learning was measured with a scale by Wild, Rammert, and Siegmund (2006). A sample item is: 'When my child gets a bad grade I first calmly listened to how my child plans to deal with the situation.' Cronbach's α was .71.

Setting up children's workspaces. Setting up children's homework workspaces was measured with a six-item scale from Wild and Schiefele (1994). A sample item is: 'The workspace of my child is designed in a way that he/she can find everything quickly.' Cronbach's α was .79.

Students' scholastic achievement. This outcome variable reflects students' grades and their scores on a standardized reading-comprehension test.

Scholastic grades. We calculated the mean of students' grades on their last report card for the subjects of mathematics, German (native language), and basic science. Grades were provided by the teachers. In Germany, the best possible grade is 1 and the poorest grade is 6, with a grade of 5 or greater indicating that the classroom goal was not reached. To facilitate easier interpretation, we inversely scaled grades in the analysis, with 6 indicating the highest possible level of scholastic achievement.

Reading comprehension. Reading comprehension was measured with a standardized test, the Hamburger Lesetest für 3. und 4. Klassen (HAMLET 3 – 4) [Hamburg Reading-Comprehension Test for Grades 3 and 4] by Lehmann, Peek, and Poerschke (2006). Due to time constraints for in-class testing, we used an abbreviated form of the full version (cf. Stoeger et al., 2014), which encompasses six of the 20 texts included in the full version: three expository texts, two functional texts (e.g., recipes and timetables), and one narrative text. In selecting parts of the full version, we considered the difficulty levels indicated in the test manual for all multiple-choice questions. After reading each text, students answered four multiple-choice questions about the text and received one point for each correct answer. We then calculated an overall reading score for each student (range: 0 – 24). Cronbach's α was .73.

Data analysis

As one of the aims of our study was to test the predictive validity of our scale in a structural equation model, we considered a structural equation model that assesses how paren-

tal attitudes affect parents' facilitation of their children's learning environment and how the learning-environment facilitation, in turn, affects pupils' scholastic achievement. We evaluated our structural equation model with the following fit indices: a nonsignificant χ^2; the root mean square error of approximation (RMSEA) with its 90 % confidence interval (good fit: RSMEA ≤ .05, lower bound of the confidence interval: ≤ .05; acceptable fit: ≤ .08; lower bound of the confidence interval: ≤ .08); the standardized root mean square residual (SRMSR) (good fit: SRMR ≤ .05; acceptable fit: SRMR ≤ .10); and the comparative fit index (CFI) (good fit: CFI between .97 and 1.00; acceptable fit: CFI between .90 und .97) (Hu & Bentler, 1999; McDonald & Ho, 2002; Schermelleh-Engel et al., 2003). We ran all models with M*plus* 6.0 (Muthén & Muthén, 1998 – 2010) and estimated them with the maximum-likelihood (ML) method approach.

As a part of our structural equation model, we also tested a mediational effect between parental attitudes towards self-regulated learning and learning-environment facilitation. Following MacKinnon, Lockwood, Hoffman, West, and Sheets (2002), we tested the significance of this indirect effect with the bias-corrected bootstrap method using 95 % confidence intervals instead of with the more traditional and conservative Sobel test. Following the recommendation of Geiser (2010), we used 10,000 bootstrap samples. The effect is considered significant when the confidence interval equals zero. A full mediation effect requires a non-significant direct effect and a significant indirect effect (Zhao, Lynch, & Chen, 2010). The mediation is partial if both the direct and indirect effects are significant and positive or if both effects are negative (Zhao et al., 2010).

Results

Descriptive statistics and zero-order Pearson product-moment correlations for all variables are presented in Table 4. All multi-item constructs were modeled as latent variables. Indicators for the latent variable learning-environment facilitation are (a) granting children autonomy during learning and (b) setting up children's workspaces. Indicators for students' scholastic achievement are (a) students' report-card grades and (b) their scores in a standardized reading-comprehension test. A structural equation model was specified that describes the influence of parental attitudes towards self-regulated learning on learning-environment facilitation and the influence of the learning-environment facilitation on children's scholastic achievement. We added parental self-efficacy regarding learning support as a mediating variable between parental attitudes and learning-environment facilitation (Figure 3).

The model fit the data well. The four fit indices were: χ^2 (7, n = 664) = 20.08, p < .01, RMSEA = .05 (90 % CI = .03, .08), SRMR = .03, and CFI = .97. Figure 4 provides the model with standardized parameter estimates. All standardized factor loadings were significant (p < .001) and ranged between .44 and .84, indicating that the observed variables were good indicators of the latent constructs. Consistent with our model specifications, all paths were positive and significant. First, parental attitudes towards self-regulated learning predicted learning-environment facilitation (β = .26, p < .001) and

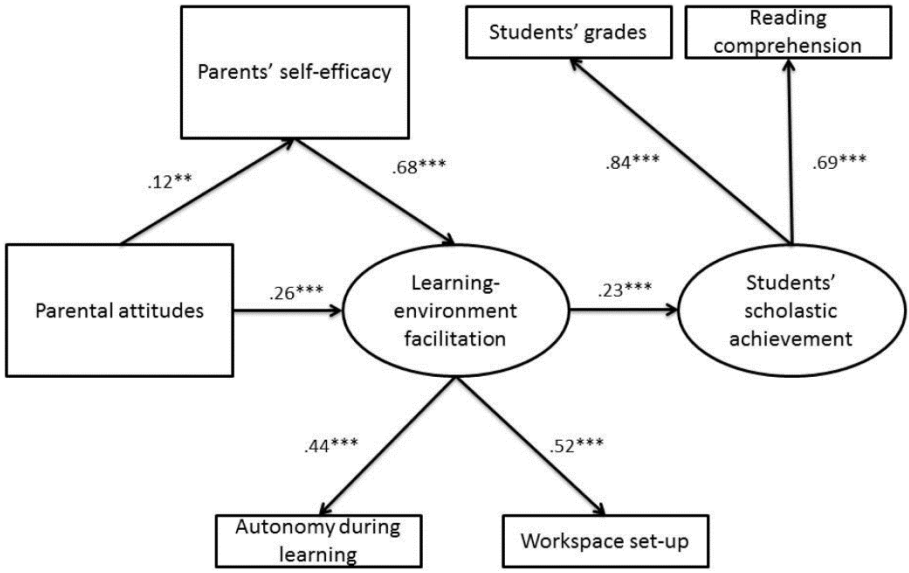

Figure 4:
Standardized coefficients for the model. Latent constructs are shown in ellipses, and observed variables are shown in rectangles.
** $p < .01$. *** $p < .001$.

self-efficacy regarding learning support with a positive correlation ($\beta = .12$, $p < .01$). Second, self-efficacy regarding learning support predicted learning-environment facilitation ($\beta = .68$, $p < .001$). Third, learning-environment facilitation positively predicted students' scholastic achievement ($\beta = .23$, $p < .001$). The standardized indirect effect between parental attitudes towards self-regulated learning and learning-environment facilitation was weak, but significant ($\beta = .08$, with a 95 % bootstrap confidence interval [0.002, 0.166]). As both the direct effect ($\beta = .26$, $p < .001$) and the indirect effect ($\beta = .08$, $p < .05$) are significant and positive, we can conclude that a partial mediator effect is taking place.

Discussion

The aim of the study was to investigate the direct effect of parental attitudes towards self-regulated learning on parents' learning-environment facilitation and the indirect effect of these attitudes on students' scholastic achievement. Therefore, a measurement instrument designed to assess primary teachers' attitudes towards self-regulated learning was adapted for use with parents (Steinbach & Stoeger, 2011). The instrument we chose to adapt focuses on cognitive and metacognitive aspects of self-regulated learning that

are known to be particularly important for effective learning processes of younger children (cf. Dignath et al., 2008; Stoeger et al., 2014). This instrument's focus on younger children made it the most suitable choice for adaptation as parental influence on the learning environment is particularly strong when children are young (e.g., Buhrmester & Furman, 1987).

In a first step, we verified the factor structure and the theoretical appropriateness of the adapted instrument via a confirmatory factor analysis and were able to replicate the factor structure of the original instrument (Steinbach & Stoeger, 2011). Our model comparison with three plausible alternative models showed that the theoretical model provided by Steinbach and Stoeger (2011) was the most appropriate.

In a second step, the validity of the adapted instrument was tested using parent and student data. We based our validation on a structural equation model that describes the influence of parental attitudes towards self-regulated learning on parents' learning-environment facilitation and the influence of these parental attitudes (via the facilitation) on students' scholastic achievement. We added parental self-efficacy regarding learning support as a mediating variable between parental attitudes towards self-regulated learning and learning-environment facilitation.

The structural equation model clearly showed the direct effect of parental attitudes towards self-regulated learning on learning-environment facilitation. While numerous studies have shown that parents' attitudes towards school and learning affect the home learning environments that parents create for their children (e.g., Davis-Kean, 2005; Noack, 2004), our study is, to the best of our knowledge, the first study to demonstrate a direct effect of parental attitudes towards *self-regulated learning* on parents' learning environment facilitation, that is, on the autonomy support parents provide during home learning activities and on how they set up their children's workspaces. As expected, the correlations between attitudes towards self-regulated learning and parental autonomy support during learning were closer than between attitudes towards self-regulated learning and setting up children's workspaces. It should be emphasized that the influence of parental attitudes towards self-regulated learning on learning-environment facilitation was mediated by parents' self-efficacy regarding learning support. This finding suggests that effecting changes in educational behavior depends not only on achieving positive changes in parents' attitudes but also on positive changes in their self-efficacy. In this respect, our finding corroborates related conclusions drawn in numerous other studies (e.g., Green et al., 2007; Partin & Haney, 2012; Randhawa et al., 1993).

For developing optimal learning and achievement behavior, it is worth noting that parental attitudes towards self-regulated learning, mediated via learning-environment facilitation, have a small, but clear effect on students' scholastic achievement. This effect appears to be mediated largely through parental autonomy support during learning. Unfortunately, in our study with achievement, only a relatively distal student variable has been detected. In order to better understand how parental attitudes towards self-regulated learning influence learning-environment facilitation and student behavior, proximal student characteristics such as students' perceived autonomy support and motivation

(e.g., Haggar, Sultan, Hardcastle, & Chatzisarantis, 2015) will need to be examined in future studies.

Limitations and suggestions for future research

A number of limitations should be kept in mind. First, we focused our study on younger children, because parental influence is stronger on younger children than on older children and adolescents (e.g., Buhrmester & Furman, 1987). The results of this study can, therefore, not be transferred without restriction to students of all grades and their parents. To investigate how parents' attitudes towards self-regulated learning influence the learning environments they facilitate for their adolescent and young-adult offspring, the instrument should be adapted for use with those age-groups. The current instrument focuses on those cognitive and metacognitive aspects of self-regulated learning that are particularly important for the self-regulated learning processes of primary-school students (Dignath et al., 2008; Stoeger et al., 2014). For older students, motivational aspects of self-regulated learning are particularly important (Dignath, et al., 2008) and would need to be considered.

Second, we evaluated two theory-derived aspects of how parents facilitate their children's learning environments – parental autonomy support during learning and setting up children's workspaces. Future research will need to consider the extent to which parental attitudes towards self-regulated learning are related to additional aspects of parental learning-environment facilitation. In a specific model proposed and elaborated by Eccles and colleagues (Eccles, 1989; Eccles & Harold, 1993), teaching strategies, for example, are listed as an important aspect of the home environment. This aspect may turn out to be important in the context of attitudes towards self-regulated learning. As such, teaching strategies should be investigated by future studies concerned with parents' attitudes towards self-regulated learning.

Third, our structural equation model examines the impact of parental attitudes towards self-regulated learning, mediated via their learning-environment facilitation, on students' scholastic achievement. Hence, as mentioned above, our study considers the impact of these parental attitudes on a relatively distal student variable. Future research should expand this perspective by also including proximal dimensions such as how children experience autonomy. It would also be helpful to consider how parents' attitudes towards self-regulated learning influence children's actual learning behavior and their use of cognitive and metacognitive learning strategies.

Fourth, readers should keep in mind that we conducted our entire study in Germany. The German school system differs in various respects from other school systems. For example, students traditionally complete extensive homework assignments under parental supervision (Wild & Gerber, 2007). All forms of school-related learning at home are particularly important in Germany during fourth grade, because pupils' fourth-grade marks determine tracking decisions for secondary education, which, in most German states, begins as of fifth grade.

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