RUNNING HEAD: Self-regulatory training through homework completion

# Self-regulatory Training through Elementary-School Students' Homework Completion

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*Self-Regulated Learning by Elementary-School Students*

Self-regulated learners have been defined as students who are metacognitively, motivationally, and behaviorally active participants in their acquisition of knowledge and skill (Zimmerman, 1986). A particular challenge for self-regulation researchers is to know at what age these desirable qualities in learning can be enhanced in young children. In this chapter, we initially address three key questions about children's development of self-regulated learning and then describe studies of self-regulated learning and homework as well as a self-regulation instructional program designed for primary-school pupils. This program relies heavily on homework assignments and is an adaptation of a well known instructional program that was modified to teach time and home management in German primary schools. Finally, we will discuss a series of evaluation studies of the program and summarize their practical implications.

*Three Questions about Self-regulated Learning Training*

*Can self-regulation be trained*? In an edited book on instructional applications of self-regulation (Schunk & Zimmerman, 1998), successful applications of self-regulation training were reported in numerous academic content areas, such as reading, writing, mathematics, and self-directed speech. In a more recent edited text (Boekaerts, Pintrich, & Zeidner, 2000), additional successful interventions were reported in both academic and nonacademic learning areas (e.g. clinical psychology, chronic illness). There is now extensive evidence that self-regulatory processes can be taught to students, but at what age?

*From what age should there be training in self-regulated learning?* Most intervention studies conducted to date have involved post-secondary and college students (cf. also Hattie, Biggs, & Purdie, 1996), and studies on self-regulated learning with elementary-school pupils have been quite rare (Perry, Phillips, & Dowler, 2004). Developmental psychology

investigations have reported evidence of self-regulated learning in younger children (e.g. Bronson, 2000; Schneider & Lockl, 2002). Meta-analyses of self-regulation training studies have even shown that younger children could profit more from training measures in single components of self-regulated learning (e.g. Dignath & Buettner, 2008; Hattie et al., 1996). While the age differences found are to be interpreted with caution because of the heterogeneity of effect sizes (cf. Shadish & Haddock, 1994), the advantages of training students in self-regulation in the early grades could be significant (Hattie et al., 1996).

*What are suitable settings for training programs?* It is well recognized that self-regulation interventions are best implemented in real-life settings (Weinstein & Meyer, 1994). To maximize students' self-regulated learning, it is important to carry out training in home settings as well as in regular classrooms. When self-regulation training occurs in both of these places, it increases the likelihood of transfer (Salomon & Perkins, 1989; Schunk & Zimmerman, 1998; Weinstein, Husman, & Dierking, 2000). An important aspect of homework assignments is that they involve parents, and home environment influences as well as classroom influences.

*Prior Studies of Self-Regulated Learning and Homework*

To date, relatively few studies have dealt with students' use of self-regulation processes during homework completion (Keith, Diamond-Hallam, & Fine, 2004). Research papers on the effectiveness of homework assignments have focused mainly on the significance of time variables, such as the quantity and quality of homework time. However, a few studies have reported a relation between homework and self-regulated learning. For example, Perels, Löb, Schmitz, and Haberstroh (2006) investigated whether Schmitz's (2001) process model of self-regulated learning is also applicable to school-external learning and homework completion. The model is based on social cognitive theory, and divides self-regulation processes into three

phases: pre-action, action and post-action. A sample of 249 eighth-grade pupils was studied through daily self-observations made during homework. The pupils kept a diary for seven weeks during and after completing their homework. Time-series analyses revealed that pre-action phase processes influenced the action phase processes as well as the post-action processes. The latter influenced further the pre-action phase processes of the next learning cycle. The results were viewed as an indication of the applicability of the basic self-regulation model to school-external learning processes.

Other researchers (e.g., Trautwein, Lüdtke, Schnyder, & Niggli, 2006; Zimmerman & Kitsantas, 2005) have also established connections between self-regulated learning and homework completion. Path analyses revealed that external regulation by parents during homework periods increased ninth-grade pupils' perception of helplessness. This perception in turn mediated time-use for homework and test-preparation (Trautwein & Köller, 2003). In studies with college students, path analyses also showed that the quality of homework positively affected self-regulated learning (Zimmerman & Kitsantas, 2005). There are thus definite indications that homework quality is significantly related to better study habits and self-regulated learning.

One limitation of these studies is that they were conducted with older students. It is therefore not clear whether the results would also apply to elementary school pupils. To guide such application, Zimmerman, Bonner, and Kovach (1996) introduced a systematic instructional approach for self-regulation composed of five training modules that are based on social cognitive theory. We describe this approach and its theoretical background next along with its application and evaluation.

*A Need for an Integrative Training Approach to Self-regulated Learning in Elementary Schools*

We find it problematic that, in most self-regulatory training programs, only a few processes have been systematically taught (for an overview cf. Boekaerts et al., 2000; Dignath & Buettner, 2008; Hattie et al., 1996). From a researcher's perspective, the fewer the self-regulatory processes that are taught, the greater is the experimental control. However, this fragmentation may circumscribe the effectiveness of the interventions. In this chapter, self-regulatory training is focused on an integrated pattern of self-regulatory processes over repeated learning cycles, and we contend that this methodology could provide a more comprehensive self-regulated learning intervention.

Even when training in self-regulated learning takes place in realistic settings (e.g., regular classrooms), it is often carried out by researchers instead of actual schoolteachers (cf. Boekaerts et al., 2000; Dignath & Buettner, 2008). Meta-analyses show that the size of self-regulation training effects is greater when conducted by researchers instead of regular teachers (Dignath & Buettner, 2008), and this indicates a lack of transfer of teacher training to regular classrooms.

*Teaching Self-Regulated Learning during Regular Instruction and Homework*

Zimmerman et al. (1996) introduced a training program to develop self-regulated learners using five modules: time management, comprehension and summarization, note taking, test-preparation skills and writing skills. These training modules require the learner to practice key self-regulated learning processes (i.e., self-evaluation and monitoring, planning and goal setting, strategy implementation and monitoring, outcome monitoring and strategy refinement) in each of the five distinct content areas. The modules are designed to build sequentially upon prior modules. They are designed to produce successful learning at home that is directly relevant in class.

The theoretical background model of the training modules is social cognitive. Zimmerman (2000) subdivides the self-regulatory process into three successive phases: a forethought phase, a performance or volitional control phase and a self-reflection phase. The forethought phase refers to processes which take place in advance of actions and efforts associated with learning, and it establishes their prerequisites. The performance phase refers to those processes which are of importance during the execution of an action and influences both attention level and concentration. The self-reflection phase contains processes which come into play following the execution of an action. It entails the assessment of the action´s results and thereby influences later forethought phases, thus completing the cycle.

Each of these three phases is divided into subcategories listed in Table 1. Although the model is designed to be comprehensive, only those categories that are of particular importance to the training modules developed by Zimmerman et al. (1996) will be discussed. These categories are italicized in the table. (For a precise description of the remaining categories see Zimmerman, 2000.)

At the core of these training modules are daily achievement measurements and systematic feedback. Each of the training modules lasts five weeks. In the first week the training aims to improve a key phase three self-reflection process: *self-evaluation*. Because the model is cyclical, there are advantages to beginning training with phase three processes with novice learners who are unaware of advantageous forethought processes, such as setting goals or planning strategies. The monitoring and self-evaluation conducted at the outset of training with the assistance of standardized forms serves to help pupils become actively aware of their strengths and weaknesses (see Figure 1). This experience provides them with the means to be able to set appropriate *goals* for the improvement of their learning and performance. There is research

showing that the goal systems of highly self-regulated individuals are organized hierarchically, such that process goals operate as proximal regulators of more distal outcome goals (Zimmerman, 2000). For this reason, teachers support pupils in setting intermediate goals that are specific, challenging, and proximal in time (cf. Bandura, 1998; McClelland, 1985). Goals for the following week, jointly developed by teachers and pupils, are also documented on a standardized self-recording sheet for the second training week.

In order to find the best method to attain their goals, students are instructed in how to use *strategic planning* (see Table 1). This means that the pupils decide to select or alter their self-regulatory strategies (cf. e.g. Bandura, 1982; Zimmerman, 1989). The important aspect here is that the methods of learning are chosen to be appropriate to the task and setting. Teachers also play a supporting role in this process in that they present students with appropriate strategies for each new task, or consult with students as to whether the strategies they may have already decided on are applicable to the tasks at hand. Since each and every strategy is not equally appropriate to each and every pupil, and the personal, behavioral and environmental components are in a constant state of change, cyclical adjustments are also necessary to strategic planning as well as the selection of strategies to be applied over the course of the training.

After goals have been set and strategic planning completed, the strategies are implemented. Performance or volitional control, which is primarily ensured through self-control processes (e.g. self-instruction, imagery, attention focusing) and self-observation processes (e.g. self-recording, self-experimentation) (for details see Zimmerman, 2000) play an important role here. In the modules developed by Zimmerman et al. (1996) self-control is primarily assured through *attention focusing*. This serves to increase concentration among the pupils and to eliminate potential disruptions to the learning process, which should in turn lead to

improvements in strategy application and learning behavior (Corno, 1993). Since the application of strategies takes place primarily while a student is completing homework assignments, topics such as the proper organization of a workplace and the avoidance of distraction by television, etc. are addressed.

Self-observation of strategy implementation is established as a result of *self-recording* of learning and performance behavior introduced in the first week. As a method, self-observation has been particularly positively evaluated in research literature, in that it contributes to increases in the proximity (Kazdin, 1974), informativeness (Ericsson & Lehman, 1996), accuracy (Ellis, 1995) and valence (Kirschenbaum & Karoly, 1977) of strategy feedback. On the basis of their self-recordings, which are discussed regularly with their teachers, students become able to recognize strengths and weaknesses in the strategies they apply, and thereby make adaptations repeatedly.

At the end of the week, time is taken for self-reflection or strategic outcome monitoring. Students establish a link between their learning outcomes and the strategic processes they used in order to be able to discern the effectiveness of the strategic processes they chose and continuously adapted over the course of the previous week. To this end a systematic comparison is made, with the help of the teachers, using the self-compiled records of learning behavior and performance results produced each day. At the beginning of self-reflection, *self-evaluation* is primary (see Table 1), whereby self-monitored information is compared with a standard or goal. In the modules developed by Zimmerman et al. (1996), mastery and previous performance (see Bandura, 1991) are primarily used as evaluation criteria. These criteria have been assessed by Covington and Roberts (1994) as particularly advantageous because they allow persons to observe their personal learning progress. In response to the results of their self-evaluations,

pupils experience either *satisfaction or dissatisfaction*. Since learners should give preference to those behaviors which lead to satisfaction and positive affect (Bandura, 1991), the training insures that, should dissatisfaction surface, teachers are to offer constructive feedback and concrete possibilities for potential actions. Self-evaluation leads the students to make *adaptive or defensive inferences*, that is, to come to conclusions as to how they need to alter their self-regulatory approaches. Adaptive inferences guide learners to new and potentially better forms of performance self-regulation, such as shifting goals hierarchically and adapting or choosing a more effective strategy (Zimmerman & Martinez-Pons, 1992). Defensive inferences, by contrast, merely safeguard individuals from future dissatisfaction and aversive affects, and undermine appropriate adaptations. For this reason, in the training modules attempts are made through appropriate feedback and support in self-evaluation to inspire above all adaptive inferences and thereby encourage advantageous forms of self-reactions.

These self-reactions lead to adaptations in learning behavior and thus affect forethought processes cyclically. In a new execution of the cycle in the following week, pupils are able to use their self-reflections to adapt their goals and strategies. A major advantage of the training modules developed by Zimmerman et al. (1996) is that the cycle of self-regulated learning is repeated several times over the course of the five-week training period, and that pupils thereby subject their self-regulation processes to constant monitoring, improvement and intensive practice.

A further advantage of the training is that the *perception of self-efficacy* held by pupils (forethought phase) is actively promoted. This is particularly advantageous since perception of self-efficacy is counted among the keys to self-motivational beliefs (see Table 1) which induce self-regulated learning (Schunk, 1986; Zimmerman, 1986). Various research studies have been

able to demonstrate that schoolchildren who perceive high self-efficacy set more challenging goals for themselves (Zimmerman & Bandura, 1994), use more effective learning strategies (Zimmerman & Martinez-Pons, 1990), monitor their learning and the results of their learning more closely (Bouffard-Bouchard, Parent, & Larivee, 1991) and are more motivated to self-regulate their performance (Bandura, 1997; Pajares & Miller, 1994).

In order to improve their perceptions of self-efficacy, children make daily predictions on how well they expect to perform on the homework exercises and record these estimates as well as actual accomplishments on the standardized forms. These performance estimates pertain to different subject matter in different training modules. After the exercises have been completed and graded, self-estimates are compared with the actual performance results. At the end of the week a graphic representation of the anticipated and actual performances for the entire week is compiled and the accuracy of self-estimates is opened for discussion by the teacher with the entire class. This procedure is retained for the entire course of the five-week training.

To summarize, the modules developed by Zimmerman et al. (1996) are based on a cyclic model of self-regulation incorporating the most important microprocesses of self-regulation (goal-setting, strategic planning, monitoring, self-evaluation, etc.). In addition, environmental factors and peripheral personality variables such as self-efficacy are taken into consideration and subjected to directed improvement. The individual strategies are practiced over a long time and optimized gradually.

*A Training Module for Time Management and Homework Skills in Elementary Schools*

Whereas Zimmerman and colleagues' first training module was oriented exclusively to improving time management, in our training program, besides time management, we included several additional skills associated with homework (e.g., setting up a study place or dealing with

distractions). Thus, the purpose of our module should be envisioned as training in homework completion with a focus on time management (Stoeger & Ziegler, 2006).

In order to teach self-regulated learning processes together with concrete subject matter content (Weinstein et al., 2000), the training module was implemented within the framework of fourth-grade elementary-school mathematics instruction. The training program was carried out by the regular teaching staff who received several days of training conducted by the authors. In this training, basic knowledge about self-regulated learning was communicated and the training materials were introduced and discussed. For teachers' at-home review and support during the program, a handbook (Ziegler & Stoeger, 2005) was made available containing all the training material and the theoretical background. Before the actual program began, evening meetings were held for parents of all participating classes, where parents received an introduction into the principles and purposes of the training program.

*The Training Procedure*

The training program lasted six weeks and took place during regular mathematics instruction and homework periods. It began with an *information week* (week 1 of the training program),[1] followed by a *self-observation week* (week 2), and by four *learning cycle weeks* (weeks 3 to 6). In the following we give an overview of the content and training materials used in each of the weeks.

*Information week (week 1).* The information week begins with a general introduction to the training. The pupils are informed that the training program lasts six weeks in total, that the results are to be followed but that their performance during the program is not graded. In this way the focus is directed away from performance and towards learning behavior. So that all the materials may be available for later discussion, the pupils have a loose-leaf binder for all the

program materials. The focus in this week is an introduction to the topics of self-regulated learning and useful homework habits.

As an introduction to a cyclical concept of self-regulatory training, Zimmerman et al. (1996) developed a four-step cycle (cf. Figure 1). This training cycle differs somewhat from the three theoretical phases of the self-regulation model. Step 1 of the training cycle begins with a self-reflection phase process (self-evaluation) to help students appraise their current levels of functioning before deciding how to proceed with forethought phase processes (goal-setting and strategic planning). During Step 2, students analyze the learning tasks at hand, set specific learning goals, and decide which strategies they will engage to make the learning goals attainable. Step 3 involves two performance phase processes (strategy implementation and monitoring). During this step, students put these strategies into operation and monitor their application. In some cases, adjustments may need to be made in order to implement the strategy properly. In step 4 of training, students shift from monitoring and controlling strategic processes to monitoring performance phase outcomes in order to assess the effectiveness of a strategy. This completes the cycle, and the students return to Step 1 of the training cycle to re-evaluate their changes in their level of performance.

A child-friendly picture of the four-step training cycle (the so called “learning circle”) was used with children to enable them to understand self-regulated learning and as an illustration for them of the various steps in the learning process. In addition to the cyclical figure, short stories developed to serve as models (cf. Schunk, Hanson, & Cox, 1987) were used to make children conscious of why and how they are to carry out each step. Because studies show that making students aware of the theoretical background model (cf. Salomon & Perkins, 1989) assists in increasing the transferability of outcomes to other domains (Schunk & Zimmerman,

1998; Weinstein et al., 2000), the four-step cycle was applied to different learning content during the information week. In the teachers' discussion of the "learning circle" they focused attention on using different forms of instruction, such as group work, discussions during instruction, worksheets, etc. Because the "learning circle" is also mentioned repeatedly during subsequent training weeks, it was hung as a poster in the classroom and in the children's rooms at home to enable them to check on their step in the learning circle at a given time.

The second topic of the information week is the value of good homework habits and time management. The information is presented as part of daily learning units. The acquisition of these competences was meant to facilitate strategy planning during Step 2 in the cycle of self-regulated learning.

To allow the pupils to choose from a fairly broad repertoire of homework skills, they receive five handout sheets with study tips during the information week. These tips deal with topics such as: avoiding distractions, correct use of break-taking during study, the best succession of study und assignment periods, suitable times for study, and how to create a good workplace. Each of the handouts has several study tips on a specific topic. Each day in the information week, one of these handouts with study tips is discussed. In the learning-cycle weeks the handouts are used by the children for their strategy planning. For this reason the handouts are also put up in the classroom as posters and in the children's study rooms at home, printed on colorful paper.

*Self-observation week (week 2).* The self-observation week is dedicated to self-evaluation (Step 1 of the self-regulated training cycle: self-evaluation and monitoring), in which the children get to know their own strengths and weaknesses. The self-evaluation is done for two areas: mathematics skills and homework behavior.

To support pupils in self-evaluation of their math skills, during the self-observation week four homework sheets and a quiz sheet are handed out for completion. To make the self-evaluation easier, all handouts are constructed identically and have a similar level of difficulty. They encompass ten tasks: addition, subtraction, multiplication, division, word problems, calculating measurement units and riddle-type problems (e.g., continuation of series). The four homework sheets are completed at home from Monday to Thursday, and the quiz on Friday in class. Before pupils do the homework sheets and the quiz, they judge whether they think they can solve each problem. After correcting the homework and quiz sheets, they judge whether they have solved it correctly. A support feature on each sheet is a box and a circle next to each problem. If, before working on the sheets, pupils judge that they can solve particular problems, they fill in the boxes beside the problems with green. If they think they can't solve some problems, those boxes are filled in with red. The pupils are allowed enough time to judge all the problems and fill in the boxes. Each homework sheet thus prepared is taken home to be completed there. The next day the problems are corrected together in class, and the children have time after the discussion of each problem to fill in the circles beside each problem – in green if they have solved it correctly, and in red if their solution was incorrect. A daily comparison of the boxes and circles, that is, the expected and the actual correctly solved problems, enables pupils to form a more and more accurate and differentiated picture of their mathematical skills and thus contributes to their increased perception of self-efficacy. In addition, pupils can recognize those problem types that are easier for them and those they still have difficulty with, as well as whether or not they are judging themselves correctly.

While the homework and quiz sheets are meant to support pupils in their self-evaluation in math, they also receive a self-observation list to assist them to self-evaluate their strengths and

weaknesses in homework behavior. This is constructed like a learning diary, in which the pupils enter daily the times they begin and end the current homework sheet and the length of any interruptions. Further they indicate any interruptions or distractions, the location where the homework sheet was completed and whether during that time another person was present in the room. The entries on the self-observation sheet are made directly during or after working on the homework sheets. During the training program, the entries in the observation sheet are discussed daily with the children, so that they gradually recognize which behaviors are advantageous and which are disadvantageous during homework. Here the handouts with learning tips, as mentioned above, can be consulted.

These materials were intended to help the pupils monitor and self-evaluate their strengths and weaknesses in math abilities (math handouts and quiz) and homework behavior (self-observation sheet). An overview sheet handed out at the end of the week is a further support. It serves to confirm systematically and additionally the strengths and weaknesses in the two areas in question (math skills and homework behavior) and to make any connections between the two visible. The overview sheet consists of three parts: In the first, the filled-in green boxes and circles on the four homework sheets and the quiz sheets are transcribed. This enables the children to compare once more their self-evaluation for the entire week systematically with their actual attainments. Through the graphic presentation of their self-evaluations and their actual math scores they can see whether and how often they correctly evaluated themselves, respond how often and by how much they over- and/or underestimated themselves und whether their self-evaluations improved over the week.

The second part of the overview sheet also refers to pupils' math scores, and the third to their homework behavior. To fill out the second and third parts of the overview sheet, pupils

place the self-observation list, the homework sheet for the whole week, and the quiz sheet together side-by-side. With the help of these items, they first indicate how difficult or easy the particular problem types were on the homework sheets and the quiz sheet. Then they look at their weekly plan and judge the entries on the single lines (i.e., distraction, study times, study environment, etc.) for the whole week. Entries on the overview sheet are extensively discussed with the children and the individual days are checked to see whether favorable/unfavorable study habits accompany better/worse scores on the homework sheets.

On the basis of the weaknesses determined at the end of the self-observation week, children formulate two goals for the next week. One of the goals should deal with their math skills (e.g., "Next week I'll practice subtraction above all"), and the second, with homework behavior (e.g., "During homework next week I won't listen to the radio at the same time"). A goal-setting sheet, on which examples of possible math and homework goals are proposed, can, if necessary, be called upon as a support measure. The two goals decided upon after the self-evaluation are entered on the self-observation sheet for the coming week. This sheet is identical to the observation sheet in the self-observation week except for the special section where the goals are entered.

*Learning cycle weeks (weeks 3 to 6).* Weeks 3 to 6 of the training program proceed approximately like the self-observation week. Each week, pupils again receive four homework sheets and a quiz sheet, as well as the self-observation sheet, on which they enter their daily homework behavior. The materials are constructed as in the self-observation week, but goals attained the previous week are already entered on the self-observation sheet. The three-part overview sheet is also done at the end of each week.

The difference between the learning cycle weeks and the self-observation week is that pupils do not just observe and evaluate themselves, but in each of the learning cycle weeks they go through one full "learning circle". However, each learning cycle week does not begin with self-evaluation and monitoring (Step 1 of the cycle), since these took place at the end of the previous week and can be referred back to. Also the goals (Step 2 of the cycle: goal setting) were already entered into the weekly plan during the previous week.

On the Monday of each week, therefore, a brief look back at the previous week, the self-evaluation made, as well as the goals derived from it takes place first. Pupils recall what personal strengths and weaknesses in math and learning behavior they determined during the previous week, and what goals they set for the current week. Then together they consider how the goals of individual pupils can best be reached. This indicates strategic planning (Step 2 of the cycle) and can be supported by the study tips from the information sheets. The strategy pupils choose to reach their goal is applied in the corresponding week (step 3 of the cycle: strategy implementation). For example, a pupil could one week practice additional subtraction assignments and concentrate especially on shutting out all distractions. To recognize whether the chosen strategies have been successful, in the remaining weeks of the program pupils also systematically record their math scores on the homework sheets and the quiz and enter their study behavior on the self-observation sheet. By comparing math scores and study habits they can always see whether the strategy they choose leads to better attainment (Step 3 in the cycle: monitoring). If this isn't the case, they undertake modifications in their strategy. This modification was not included explicitly by Zimmerman et al. (1996) in the cycle of self-regulated learning, but was explicitly discussed in the framework of the training. Here it is important that pupils at all steps be supported by teaching staff. Regular lessons should take

place in which progress and problems are discussed and how the latter can be dealt with. This is best done with the help of various methods (group work, discussions etc.) and training materials (e.g., the stories provided during the training in which correct study habits are modeled, for details cf. Ziegler & Stoeger, 2005).

At the end of the week there is a weekly review and evaluation of the learning outcome with the help of the overview sheet (Step 4 in the cycle: strategic outcome monitoring). Pupils reflect on how well chosen learning goals have been reached with the strategies employed. This evaluation of results for each week affects pupils´ self-evaluation and goal-setting for the subsequent week and, with that, the next cycle of self-regulated learning.

During the cycle weeks the learning circle is discussed repeatedly and pupils always know their current step on the "circle." To help students achieve "situated learning" (for an overview cf. Klauer, 2001), in the training, the following procedure is recommended. First, teaching staff show and comment on self-regulated learning as a procedure. For support, pupils receive an information sheet in which a model solves the exercise sheets and works with the self-observation sheet; and thereby runs through the "learning circle" for the areas mentioned. Practice of the learning skills and the single cycle steps by the pupils is accompanied by advice and support of the teaching staff ("coaching" and "scaffolding"), that in the course of the training is 'faded.' Of particular importance during this process is reflecting on learning together and exchange between teaching staff and pupils. Parents too can be involved when their children tell them about the training program and its various materials.

*Empirical Studies of the Effectiveness of the Training Module*

The effectiveness of the training with fourth-grade elementary-school pupils was examined in four empirical evaluation studies (Stoeger & Ziegler, 2005, 2006, 2008, 2010). In

all the studies the above-described training module was carried out by teaching staff during regular instruction and homework periods. All teaching staff members were given a two-day training course. In Evaluation Study 1, the effectiveness of Zimmerman's first training module in its original version (Zimmerman et al., 1996) was investigated generally and as dependent on the motivational orientation of the pupils. In Evaluation Study 2, the training module which we had broadened and revised was evaluated. Among other things, pupils' score development over the course of the training weeks was modeled with the help of "growth curves." In Evaluation Study 3, the effectiveness of the broadened training program was examined as a function of the participants´ cognitive abilities. The central research question in the fourth Evaluation Study was whether the broadened training program is effective for highly gifted underachievers, that is, for pupils whose scholastic achievements lie markedly below their cognitive abilities as measured by intelligence tests.

*Training-Program Evaluation Study 1.* In the first training-program evaluation study (Stoeger & Ziegler, 2006) Zimmerman et al.'s (1996) training module was used in a form approximating the original module (without the previously described modifications). The study involved 393 pupils from 20 fourth-grade elementary school classes. The participating classes were randomly assigned to a training or control group. Through a pre- and post-test design the effectiveness of the training was examined.

Particular emphasis was put on students' motivational orientations (Pintrich, 2000a, b). In the research literature, there is evidence that a learning goal orientation is an important condition for the acquisition of self-regulatory competences (e.g. Pintrich, 2000a; Schunk & Ertmer, 2000). However, because studies also indicate that individuals will vary in their motivational orientations based on the situation, the entire ensemble of motivational orientations needs to be

taken into consideration (see the reviews by Pintrich, 2000b). In a cluster analysis of various motivation items to assess learning-goal orientation, performance-approach goal orientation, and performance-avoidance goal orientation (Ziegler, Dresel, & Stoeger, 2008), three clusters of motivational orientation were identified.

Self-regulation training produced significantly greater time management, self-regulated learning skills, and scholastic performance than observed with untrained teachers. A moderator effect due to motivational orientation was demonstrated with regard to the expectation of success and confidence in one's own mathematics abilities. Particularly interesting was that no training effects were found for pupils in the cluster labeled as learning-goal oriented. However, the training instilled a realistic mode of self-appraisal among these pupils. The results indicate students' goal orientation played an important role in their self-regulation of learning.

*Evaluation study 2.* In Evaluation Study 2 (Stoeger & Ziegler, 2008), the training program we had enhanced (with the information week worksheets on the learning circle, stories about self-regulated learning, handouts on homework skills, broadened overview sheet at the end of the week, etc.) was carried out with 219 pupils from 17 classes and evaluated on three fronts. First, the effectiveness of the revised training was examined in a way comparable to Evaluation Study 1. Second, possible learning increases were analyzed with the help of hierarchical linear models. Third, it was of interest to see which variables could explain inter-individual differences in learning increases.

The results of Evaluation Study 2 showed that time-management and study skills, as well as various self-regulatory and metacognitive competencies, improved in the training condition in comparison to the control condition. Also pupils' perception of self-efficacy – purposefully encouraged by daily comparisons of self-appraisals with actual success rates on the math

handouts – increased during the training program. Further, the program developed pupils' motivation: Their willingness to make an effort, their interest and their learning-goal orientation increased during the program, and by contrast, helplessness diminished. Also, in terms of math attainments, significant effects of the program were visible.

An analysis using hierarchical linear models of the score increases on the daily homework handouts revealed a number of improvements due to the program. Rates of correct problem solutions on the homework sheets increased linearly during the training program by almost one problem weekly. This increase diminished near the end of the program. Although the achievement increases were relatively homogeneous, pupils differed significantly in their average weekly rates of correct solutions and their score increases. Those pupils whose self-efficacy perception, learning-goal orientation and time-management skills were more strongly expressed profited from the training at an above-average rate.

*Evaluation Study 3.* Self-regulated learning apparently requires complex, demanding cognitive control processes. These may not yet be present in sufficient amount in all elementary school pupils. The main concern in Evaluation Study 3 (Stoeger & Ziegler, 2010) was to examine whether the enhanced training program is effective in the same way for pupils of differing cognitive abilities. Since the training program represented in Evaluation Study 2 requires relatively high metacognitive competencies, it is conceivable that pupils of below-average cognitive ability might be over-challenged and their self-efficacy perception even diminished by the training program. For pupils of above-average cognitive ability, on the other hand, it could happen that, with the daily repetition and similar math problems, boredom might set in and motivation be diminished.

In this study, 201 pupils from 16 fourth-grade elementary school classes took part. They, again, were randomly assigned to a training or control group. Before the training program began, all pupils took a cognitive ability test, on the basis of which they were divided into four ability-level groups. In a pre-post-test design all the training group pupils showed positive training effects on homework skills (improved distraction avoidance and homework organization), self-efficacy perception, metacognition, various motivational variables, and performance scores. The notion that some ability-level groups could be disadvantaged was not borne out. The training module presented thus seems to be a good possibility for promoting self-regulation in all pupils equally regardless of individual ability level.

*Evaluation Study 4.* It is now widely accepted that underachievement is a serious problem for gifted pupils. Self-regulated learning appears, however, to offer possibilities for intervention that focus on *several* of the central causes of underachievement, such as lack of motivation and unfavorable study habits (for reviews see McCoach & Siegle, 2003). Evaluation Study 4 (Stoeger & Ziegler, 2005) therefore investigated whether training in self-regulated learning is also effective for gifted underachievers.

A total of 36 highly gifted underachievers identified in a sample of 1,200 pupils took part in the study. They were randomly assigned to the self-regulation training or control group. Very clear improvements due to the training were identified for each of the already described target variables (e.g. time management and strategic learning). In particular the motivation of the underachievers – one of the central causes of underachievement in the consideration of many researchers (McCoach & Siegle, 2003) – was positively influenced by the training. There were also significant increases in scholastic achievement – the ultimate goal of the training – due to self-regulatory training.

### *Critique and Perspective on Future Research*

The results of these self-regulated learning evaluation studies confirm the hypotheses that both the original training module of Zimmerman et al. (1996), as well as the adapted version, were effective for fourth-grade pupils. However, various issues can be raised about the evaluation studies presented. For example, follow-up measurements were not possible in the four studies due to school policy. Also, the lack of a placebo group was a limitation. In future research, therefore, an evaluation of the self-regulation training module presented should include follow-up measures and placebo groups. We are already conducting such research (cf. Stoeger, Sontag, & Ziegler, 2009). A more exact analysis of the learning diaries (cf. Schmitz & Wiese, 1999) and interviews with pupils should make possible more comprehensive understanding of pupils' learning processes (Sontag & Stoeger, in preparation).

To enhance transfer of self-regulatory processes acquired through self-regulated learning training, it is important that the learner be metacognitively aware that the information being learned has potential current and future applications outside of the original learning context (Salomon & Perkins, 1989; Weinstein et al., 2000). For this reason teaching staff were advised to remind the children repeatedly during the six weeks' training and afterward of its application beyond the program, and to point out during regular instruction as many of the skills-transfer opportunities as possible. To date, however, the transfer to other learning content and skills has not received much empirical examination. In future research, therefore, the effectiveness of single training modules as well as their combined application should be tested (for an evaluation of the module *comprehension and summarization skills,* see Stoeger, Sontag, & Ziegler, 2009).

### *Implications for Practice*

Three questions were posed in our introduction – whether self-regulated learning can be trained, from what age it can be trained, and in what setting training should occur. From a theoretical perspective, training in self-regulated learning processes should be possible and even desirable with students as young as elementary school age. Our evaluations of the multi-step self-regulation training module revealed positive effects from regular instruction and homework assignments with students as early as elementary school. It must be considered especially advantageous that several self-regulated learning processes can be simultaneously taught and applied to various learning contents and skills. This teaching and the application of self-regulation competencies in real learning settings facilitate their transfer to other learning contents and subject matters (Schunk & Zimmerman, 1998). The repeated learning cycle also ensures proceduralisation of the learning skills.

As our evaluation studies show, regular teaching staff can be trained to provide successful self-regulated learning content. Interestingly, those pupils who already had better skills in self-regulated learning profited more from the training modules. This finding seems to suggest that the training probably can and should be carried out before the fourth grade of elementary school.

Our studies were facilitated by the fact that the self-regulation training was initiated by the school authorities together with the authors. In some cases schools decided to participate after the evaluation studies showed that self-regulated learning was advantageous for their students. After using single subject matter training modules sequentially at the fourth-year level, these teachers developed additional modules for the other age-levels. These extensions followed key self-regulated learning principles. For example, self-regulated learning was always practiced in connection with concrete content and learning skills. This fulfilled an important condition for the realization of sustained self-regulated learning.

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Footnote

[1]The training program is a modification we made of training devised by Zimmerman et al. (1996). Since theirs was not specifically developed for primary school pupils, we had to include in our training various supports for this target group. The two most important differences were the inclusion of an introductory, child-friendly information week on the topic of self-regulated learning and various supplemental materials (stories about self-regulated learning, handouts on homework habits and the training program procedure, etc.).

Table 1:

*Phase structure and subprocesses of self-regulation (from Zimmerman, 2000).*

| Cyclical self-regulatory processes | | |
|---|---|---|
| Forethought | Performance/Volitional control | Self-reflection |
| Task analysis | Self-control | Self-judgment |
| - *goal setting* | - self-instruction | - *self-evaluation* |
| - *strategic planning* | - imagery | - causal attribution |
| | - *attention focusing* | |
| | - task strategies | |
| Self-motivation beliefs | Self-observation | Self-reaction |
| - *self-efficacy* | - *self-recording* | - *self-satisfaction/affect* |
| - outcome expectations | - self-experimentation | - *adaptive-defensive* |
| - intrinsic interest/value | | *inferences* |
| - goal orientation | | |

Figure Caption

*Figure 1*. Cycle of self-regulated learning Training Steps (after Zimmerman, Bonner & Kovach, 1996).


Self-Evaluation
and Monitoring
Goal-Setting and
Strategic Planning
Strategy Implementation
and Monitoring
Strategic Outcome
Monitoring