ELSEVIER

Learning and Instruction 15 (2005) 173–177

Learning and Instruction

www.elsevier.com/locate/learninstruc

Commentary

Commentary on self-regulation in school contexts

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Abstract

Recent years have witnessed increasing academic self-regulation research. Researchers have compared good with poor self-regulators to determine key processes; examined the relations among self-regulation, motivation, and learning; explored the development of self-regulatory skills; and conducted interventions to improve students' self-regulation. The present articles by Perels et al. and Rozendaal et al. describe interventions that improved students' self-regulation. Perels et al. showed that combining training on self-regulation with problem-solving instruction was especially effective in enhancing self-regulation and achievement. Rozendaal et al. found that teachers who practiced collaborative interactive teaching strategies promoted deep-level cognitive processing in their students. Suggestions for future research in school contexts are provided.

Self-regulation (or *self-regulated learning*) is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000, p. 453). Research on academic self-regulation began as an outgrowth of psychological investigations into self-control among adults and its development in children

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doi:10.1016/j.learninstruc.2005.04.013

(Zimmerman, 2001). Much early self-regulation research was therapeutic in nature, as researchers taught participants to alter aggressive, addictive, and other dysfunctional behaviors.

In recent years self-regulation increasingly has been applied to learning settings involving academic studying and other forms of learning (e.g., cognitive, motor, social skills) (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 2001). A large part of the rationale for studying academic self-regulation came from research showing that learners' skills and abilities did not fully explain their achievement (Zimmerman, 2001), which suggests that other factors such as motivation and self-regulation were important. Applying self-regulation to education also broadened its scope to actual learning beyond the historical emphasis of performance of previously learned actions. Today several theoretical perspectives exist to guide self-regulation research (Zimmerman & Schunk, 2001), and self-regulation is viewed as a process that can help explain achievement differences among students and improve their achievement (Boekaerts et al., 2000).

Research on academic self-regulation—especially studies conducted in school contexts—has addressed various facets of self-regulation (Boekaerts et al., 2000). Several studies have sought to identify key self-regulatory processes, often by comparing good with poor self-regulators. This research has broadened the original focus of self-regulation on overt behaviors to cognitive, motivational, and contextual factors (Pintrich, 2000; Pintrich & Zusho, 2002).

Researchers also have examined the relations between self-regulation, motivation, and learning (Pintrich, 2000). Not surprisingly this research has identified important linkages. Students with better self-regulatory skills tend to be more academically motivated and display better learning (Pintrich, 2003).

A third line of research has examined the development of students' self-regulatory skills. Developmental psychologists have been especially interested in how children's cognitive and emotional capacities change to allow them greater behavioral self-control (Henderson & Cunningham, 1994). They also have explored the development of self-regulatory control of speech (Kopp, 1982).

Another major line of research has investigated the effects of interventions designed to improve students' self-regulatory skills and school achievement. Students often are taught to set goals, use effective task strategies, monitor progress, take notes, organize their studying, establish a productive work environment, and other skills. Interventions typically have shown positive results, transfer beyond the training context, and generalization over time (Schunk & Ertmer, 2000).

Collectively these research foci have improved our understanding of academic self-regulation and have had important implications for school practices. Readers interested in more-complete descriptions of self-regulation theories, research, and interventions should consult other sources (Boekaerts et al., 2000; Schunk & Zimmerman, 1998; Weinstein, Goetz, & Alexander, 1988; Zimmerman & Schunk, 2001).

The articles in the present volume address two critical influences on school achievement—motivation and self-regulation. It is a pleasure to serve as a commentator for this special issue. My remarks focus on the articles addressing

self-regulation, although those by Nurmi and Aunola and by Spinath and Spinath are exceptional pieces investigating the development of motivation.

Perels, Gürtler, and Schmitz describe an intervention designed to enhance German gymnasium (eighth-grade) students' mathematical problem solving and self-regulation. Students completed a self-regulation measure and problem-solving test before and after the intervention, and again four weeks later. The intervention occurred during six, 90-min sessions. Students were assigned to one of four conditions. In the self-regulation condition students received instruction on self-regulation components (goal setting, motivation, volitional strategies, self-efficacy, self-reflection). Students in the problem-solving condition received training on mathematical problem-solving strategies (working forward, working backwards, the principle of invariance). Students in the combined condition received both types of interventions. Control-condition students did not receive training.

Combined-training students showed significant improvements on the self-regulation measure and scored higher than students in the other conditions. Problem-solving training students scored the highest on the problem-solving measure but there were no significant differences between the groups. Training groups scored significantly higher than the control group. Follow-up assessment four weeks following the interventions showed that the effects were maintained.

Only the combined condition led to an increase in self-regulatory competencies. The authors note that to be most effective the use of self-regulation strategies should be embedded in content instruction. Interestingly, self-regulation training alone also enhanced problem solving, which suggests that students may have employed the strategies on their own to learn the mathematical skills.

The results also show that *self-efficacy* (one's perceived capabilities for learning or performing actions at designated levels; Bandura, 1997) benefited from both self-regulation and combined training. Although Perels et al. state that self-efficacy may be more independent from the mathematical context, it is not surprising that self-regulation training would raise self-efficacy for mathematical performance. Students who believe they possess effective strategies that help them learn are apt to feel more efficacious about doing so (Schunk, 1995).

This study has important implications for education. It shows that benefits in self-regulation and problem solving can be derived and maintained from relatively short interventions. Self-regulation often is not stressed by teachers, who tend to focus on skills needed to perform well on standardized assessments. Yet these results show that self-regulation training can have benefits on skills. Teaching self-regulation skills to students during content instruction may have advantages beyond the specific learning involved.

The study by Rozendaal, Minnaert, and Boekaerts was designed to enhance students' cognitive and motivational self-regulation. Participants were students in Dutch secondary vocational colleges. The intervention consisted of the interactive learning group system (ILS). The overall goal is for teachers to restrict instruction time so that students can engage in collaborative interactive learning groups. ILS contains several key principles including, "prepare the students for group assignments by providing prior knowledge," and, "invite students to work in interactive

learning groups.'' At the outset teachers were trained in the use of these principles. The learning groups were formed with students having different learning styles. Assignments included problems that provoked discussion among students. Teachers served as coaches by guiding students to prior knowledge or needed strategies. Teachers summarized the output of groups and provided summative evaluations.

The study explored whether teachers who adhered to the ILS principles influenced students' motivation and deep-level cognitive processing. Teachers judged how often they practiced these principles. Before and after the intervention students assessed their use of deep-level processing strategies and motivational items (e.g., anxiety, interest, persistence). Classes were rated on degree of teacher adherence to ILS principles: strong, ambiguous, or weak.

The results revealed an increase in students' deep-level processing in the strong adherence group and a decrease in the weak adherence group. The ambiguous adherence group increased in anxiety, whereas the weak adherence group showed a decline. Path analyses revealed that task investment (an index of motivation) predicted deep-level processing of students in the strong adherence group.

Like the Perels et al. study this research shows that students' self-regulatory capabilities can be affected by a relatively brief intervention. This study also supports the hypothesized link between cognitive and motivational self-regulation (Pintrich, 2000). Students with teachers who strongly complied with the ILS principles showed greater task investment and better deep processing.

Rozendaal et al. mention two issues to be addressed in future research. One is to determine how these motivational and cognitive self-regulatory strategies affect students' achievement, because this study did not include a measure of achievement. A second is to form groups based on actual observations of teachers to determine how often they implement ILS strategies, rather than based on their self-reports of strategy employment.

These two studies and other self-regulation interventions suggest some directions for future research. Clearly we need more research of the type reported in this special issue; namely, studies aimed at improving students' self-regulatory skills as they are engaged in academic learning. In particular, this type of research will help us understand whether principles of self-regulation generalize across contexts and how contexts affect the amount and type of self-regulation displayed. This type of research would also have practical benefits because it would show whether certain content areas are more constraining than others. Such knowledge would be useful in designing curricula and classrooms that allow for greater self-regulation, and would suggest ways of teaching students to modify strategies to fit different contexts.

We also need research on the development of self-regulatory processes and especially on developmental changes in how the component processes combine to affect self-regulation. There is an extensive literature on cognitive development but far less on the development of motivation as cognitive expertise increases (Pintrich, 2003). Research has shown that motivation often declines with development and advancement in school (Wigfield & Eccles, 2002). This type of research will help us better understand when students are most at risk for failure and factors that may protect motivation and self-regulation.

Finally, there is a clear need for cross-cultural research and research with ethnically diverse populations. The present studies are valuable because they include European student populations, in contrast to the bulk of self-regulation research conducted in North American settings. Research with diverse populations will show how well motivational and self-regulation principles generalize across student populations. More research is needed on how self-regulation may be moderated by ethnicity (Pintrich & Zusho, 2002). This issue has practical benefits, as teachers are increasingly confronted with greater student diversity in their classes.

I commend those involved with this special issue because it highlights the key role played by motivation and self-regulation in learning settings. Future research will undoubtedly help to clarify our understanding of motivational and self-regulatory processes and demonstrate the efficacy of various interventions. Beyond their value in schooling, motivation and self-regulation are critical for lifelong learning, which is a goal that educators hope to promote in students.

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