19

SELF-REGULATION AND ACADEMIC LEARNING

SELF-EFFICACY ENHANCING INTERVENTIONS

DALE H. SCHUNK AND PEGGY A. ERTMER

Purdue University, West Lafayette, Indiana

I. INTRODUCTION

How well students learn and perform in school depends on diverse personal, social, familial, instructional, and environmental factors (Berliner & Biddle, 1997; Steinberg, Brown, & Dornbusch, 1996; Thompson, Detterman, & Plomin, 1991). Included in this list are self-regulatory processes, which investigators believe contribute to academic motivation and learning (Meece & Courtney, 1992; Newman, 1994; Pintrich & Garcia, 1991; Schunk, 1994; Zimmerman & Martinez-Pons, 1990).

Self-regulation (or *self-regulated learning*) refers to self-generated thoughts, feelings, and actions, that are planned and systematically adapted as needed to affect one's learning and motivation (Schunk, 1994; Zimmerman, 1989, 1990, 2000, Zimmerman & Kitsantas, 1996). Self-regulation comprises such processes as setting goals for learning, attending to and concentrating on instruction, using effective strategies to organize, code, and rehearse information to be remembered, establishing a productive work environment, using resources effectively, monitoring performance, managing time effectively, seeking assistance when needed, holding positive beliefs about one's capabilities, the value of learning, the factors influencing learning, and the anticipated outcomes of actions, and experiencing pride and satisfaction with one's efforts (McCombs, 1989; Pintrich & De Groot, 1990; Weinstein & Mayer, 1986; Zimmerman, 1994).

Self-regulation is not an all-or-none phenomenon: Rather, it refers to the degree that students are metacognitively, motivationally, and behaviorally active in their learning (Zimmerman, 1986). Students may self-regulate different dimensions of learning, including their motives for learning, the methods they employ, the performance outcomes they strive for, and the social and environmental resources they use (Zimmerman, 1994). Thus, self-regulation has both qualitative and quantitative aspects because it involves which processes students use, how frequently they use them, and how well they employ them. The hallmarks of self-regulation are choice and control: Students cannot self-regulate unless they have options available for learning and can control essential dimensions of learning (Zimmerman, 1994). Students have little opportunity for self-regulation when teachers dictate what students do, when and where they do it, and how they accomplish it.

The importance of self-regulation is underscored by research showing that self-regulated students are mentally active during learning, rather than being passive recipients of information, and exert control over setting and attaining learning goals (Pintrich & Schrauben, 1992; Schunk, 1990). In contrast, many students—including some high achievers—do not engage in effective self-regulation during learning (Weinstein & Mayer, 1986; Zimmerman & Martinez-Pons, 1990).

Students may display deficiencies in the area of self-regulation: motives (e.g., avoid activities or quit readily), methods (use ineffective strategies), outcomes (set easy goals that are not challenging), resources (not seek help when needed). These problems can arise when students lack knowledge of effective self-regulatory processes or believe that their own approaches work well enough (Fabricius & Hagan, 1984; Pressley et al., 1990). Further, training is often not given in schools due to inadequate time, space, or funding, the need for parental consent, and the widespread belief that students do not require self-regulation because achievement test scores are high (Schunk & Zimmerman, 1998a).

We believe that all students who are mentally capable of learning also are capable of self-regulating their motivation and learning. As the chapters in this volume and others make clear (e.g., Schunk & Zimmerman, 1998b), self-regulation training can be successfully implemented with diverse learners in various settings.

In this chapter, we discuss several interventions that were designed to affect students' motivation and self-regulated learning. This research focuses on influencing a key self-regulatory motive: *perceived self-efficacy*, or learners' beliefs about their capabilities to learn or perform behaviors at designated levels (Bandura, 1986, 1993, 1997). Effective self-regulation depends on students developing a sense of self-efficacy for learning and performing well (Schunk, 1994). Compared with students who doubt their learning capabilities, those with high self-efficacy are more likely to choose

to engage in activities, work harder, persist longer when they encounter difficulties, use effective learning strategies, and demonstrate higher achievement (Schunk, 1994; Zimmerman & Martinez-Pons, 1990).

We initially provide an overview of a social cognitive theoretical perspective on self-regulation that highlights the role of self-efficacy. We then present nonintervention research evidence that supports theoretical predictions, after which we describe the intervention projects. We conclude with a section on future directions for self-regulation research.

II. THEORETICAL FRAMEWORK

A. SOCIAL COGNITIVE THEORY OF SELF-REGULATION

Social cognitive theory emphasizes the interaction of personal, behavioral, and environmental factors (Bandura, 1986; Zimmerman, 1994, 2000). Self-regulation is a cyclical process because these factors typically change during learning and must be monitored. Such monitoring leads to changes in an individual's strategies, cognitions, affects, and behaviors.

This cyclical nature is captured in Zimmerman's (1998, 2000) three-phase self-regulation model. The *forethought phase* precedes actual performance and refers to processes that set the stage for action. The *performance (volitional) control phase* involves processes that occur during learning and affect attention and action. During the *self-reflection phase*, which occurs after performance, individuals respond to their efforts.

B. SELF-EFFICACY AND SELF-REGULATION

Effective self-regulation depends on feeling self-efficacious for using skills to achieve mastery (Bandura, 1986, 1993; Bouffard-Bouchard, Parent, & Larivee, 1991; Schunk, 1996; Zimmerman, 1994). Learners obtain information about their self-efficacy from their performances, vicarious (observational) experiences, forms of persuasion, and physiological reactions. Students' own performances offer reliable guides for assessing self-efficacy. Successes raise efficacy and failures lower it (Zimmerman & Ringle, 1981). Students acquire efficacy information by socially comparing their performances with those of others. Similar others offer a valid basis for comparison (Schunk, 1987). Observing similar peers succeed (fail) at a task may raise (lower) observers' efficacy. Learners often receive persuasive information from teachers, parents, and others, suggesting that they are capable of performing a task (e.g., "You can do this."). Such information may raise efficacy, but can be negated by subsequent performance failure (Bandura, 1993). Students also acquire efficacy information from physiological reactions (e.g., sweating, heart rate). Symptoms that signal

anxiety may convey that one lacks skill; lower anxiety may be construed as a sign of competence.

As shown in Table 1, self-efficacy operates during all phases of self-regulation. Skillful self-regulators enter learning situations with specific goals and a strong sense of self-efficacy for attaining them. As they work on tasks, they monitor their performances and compare their attainments with their goals to determine progress. Self-perceptions of progress enhance self-efficacy, motivation, and continued use of effective strategies (Ertmer, Newby, & MacDougall, 1996; Schunk, 1996). During periods of self-reflection they evaluate their progress and decide whether adaptations in self-regulatory processes are necessary. In Zimmerman's (2000) three-phase recursive model, comprising forethought, performance, and self-reflection, high self-efficacy for learning in the forethought phase becomes realized as self-efficacy for continued progress in the performance phase and self-efficacy for achievement in the self-reflection phase. The latter also sets the stage for modifying goals or setting new ones.

C. OTHER INFLUENTIAL PROCESSES

Table 1 shows that self-efficacy is not the only influence on achievement. During the forethought phase, goals, outcome expectations, and perceived value affect motivation and task engagement. *Goals* refer to what students are consciously attempting to accomplish. Goals are critical for self-regulation because they provide standards against which to gauge progress and motivate students to exert effort, persist, focus on relevant task features, and use effective strategies (Bandura, 1988; Locke & Latham, 1990; Schunk, 1990). Learners who make a commitment to pursue a goal are likely to compare their performances with their goal as they work. Positive self-evaluations of progress enhance self-efficacy and motivation (Bandura, 1988).

Of particular importance are the goal properties of specificity, proximity, and difficulty (Schunk, 1990). Motivation, learning, and self-regulation are enhanced when goals have specific performance standards, can be attained in a short time, and are of moderate difficulty. Goals that are

TABLE 1 Self-Efficacy during Phases of Self-Regulation

Forethought (pretask)	Performance (during task)	Self-reflection (posttask)
Self-efficacy	Self-efficacy	Self-efficacy
Goals	Self-monitoring	Goals
Outcome expectations	Self-perceptions of progress	Self-evaluations
Perceived value	Strategy use	Adaptations of self-regulatory processes
	Motivation	

general (e.g., do your best), distant in time, or overly easy or difficult do not motivate as well. Although long-term goals are common (e.g., read a book in 2 weeks), students benefit when they subdivide them into shorter term objectives.

Goal effects also may depend on whether the goal denotes a learning or performance outcome (Ames, 1992; Meece, 1991). A *learning goal* refers to what knowledge and skills students are to acquire; a *performance goal* denotes what task students are to complete (Dweck & Leggett, 1988; Stipek, 1996). Learning and performance goals may affect self-regulation and achievement differently, even when their properties are similar. Learning goals focus students' attention on processes and strategies that help them acquire competencies (Ames, 1992). Students who pursue a learning goal are apt to experience a sense of efficacy for attaining it and be motivated to engage in task-appropriate activities (Schunk, 1996). Efficacy is substantiated as they note task progress. In contrast, performance goals focus attention on completing tasks. Such goals may not highlight the importance of the processes and strategies underlying task completion or raise efficacy for learning. Students may not compare present and past performances to determine progress, but instead may socially compare their work with that of others. Such comparisons can lower efficacy among students who lag behind.

Outcome expectations, or the anticipated consequences of actions, are influential because students engage in activities they believe will lead to positive outcomes (Shell, Murphy, & Bruning, 1989). *Perceived value,* or students' beliefs about the incentives or purposes for learning, affects behavior because learners show little interest in activities they do not value.

Other influential processes during the performance control phase are self-monitoring, self-perceptions of progress, strategy use, and motivation. *Self-monitoring* (or *self-observation*) refers to deliberate attention to specific aspects of one's behavior. Researchers recommend assessing behaviors on such dimensions as quantity, quality, rate, and originality (Bandura, 1986; Mace, Belfiore, & Shea, 1989). Self-observation that results in self-perceptions of progress can motivate one to improve (Schunk, 1989). Self-observation is supported by self-recording, where instances of behavior are recorded along with their time, place, and frequency of occurrence (Mace et al., 1989; Zimmerman, Bonner, & Kovach, 1996).

Effective self-regulators engage in skillful strategy use during learning (Ertmer et al., 1996). Research shows that students can be taught effective strategies and that strategy use raises achievement (Pressley et al., 1990; Zimmerman & Martinez-Pons, 1990). Unfortunately, teaching a strategy does not guarantee that students will continue to use it, especially if they believe that the strategy is not as important for success as other factors (e.g., time available; Borkowski, Johnston, & Reid, 1987). Feedback about

the value of the strategy and how well students are applying it can raise efficacy and motivate students to continue using it (Schunk & Swartz, 1993a). Strategy feedback promotes achievement and self-regulatory strategy use better than instruction alone (Borkowski, Weyhing, & Carr, 1988; Kurtz & Borkowski, 1987).

Motivation comes into play during performance control through the benefits of goals and self-efficacy (Meece, 1994), but in other ways as well. An important motivational factor involves students' attributions (perceived causes) of their successes and difficulties. Research supports the notion that effective self-regulators form attributions that sustain self-efficacy, effort, persistence, and learning (Schunk, 1994). Whether goal progress is deemed acceptable depends on its attribution. Students who attribute success to factors over which they have little control (e.g., luck, task ease) may hold low self-efficacy if they believe they cannot succeed on their own. If they believe they lack ability to perform well, they may judge learning progress as deficient and be unmotivated to work harder. Students who attribute success to ability, skill, effort, and effective use of strategies should experience higher self-efficacy and maintain motivation (Schunk, 1994).

During self-reflection, students engage in self-evaluation and adapt strategies as needed. Self-evaluations of learning progress and achievement substantiate students' self-efficacy and motivate them to continue to work diligently (Schunk, 1996). Low self-evaluations will not necessarily diminish self-efficacy or motivation if students believe they are capable of learning and can do so through *adaptations of self-regulatory processes*. For example, they may decide to switch to a different strategy, seek assistance, modify their goals, or make adjustments in their work environments. The recursive nature of the model is apparent when students' self-reflections on past performance lead to setting new goals and forethought about future actions (Zimmerman, 2000).

III. RESEARCH EVIDENCE

The focus of this chapter is on interventions designed to affect students' self-efficacy and self-regulation. Initially, however, we provide a brief overview of some nonintervention research that supports the hypothesized relationship of self-efficacy to self-regulation. These studies provide correlational support for the interventions that follow.

Zimmerman and Martinez-Pons (1990) explored how verbal and mathematical self-efficacy related to self-regulated learning strategies among normally achieving and gifted students in Grades 5, 8, and 11. The verbal efficacy items assessed students' perceptions of correctly defining words; mathematical efficacy examined perceived problem-solving competence.

Students read scenarios describing learning contexts and indicated the self-regulated learning methods they would use to learn. Verbal and mathematical self-efficacy correlated positively with the use of effective learning strategies (e.g., self-evaluating, goal setting and planning, keeping records, and monitoring). Gifted students displayed higher self-efficacy and strategy use than did normally achieving students; older students made greater use of self-regulated learning strategies.

Pintrich and De Groot (1990) examined relationships among self-regulation (use of metacognitive and effort management strategies), cognitive strategy use (rehearsal, elaboration, and organizational strategies), and self-efficacy for learning and performing well in class, among seventh graders in science and English. Self-efficacy, self-regulation, and cognitive strategy use were positively intercorrelated and predicted achievement.

Using high school students, Pokay and Blumenfeld (1990) explored relationships among expectancies for success (analogous to self-efficacy) in geometry, use of learning strategies (metacognitive, cognitive, and effort management), and achievement. Early in the semester, expectancies for success predicted strategy use and achievement; later on, perceived value of the learning was the best predictor of strategy use. Expectancies for success correlated positively with effort management.

The relationship of self-efficacy and self-regulation during verbal concept formation tasks among high school students was examined by Bouffard-Bouchard et al. (1991). Students with high self-efficacy for successful problem solving displayed greater performance monitoring and persisted longer than students lower in efficacy. Self-efficacy correlated positively with performance.

Zimmerman and Bandura (1994) studied the relationships among self-efficacy, goals, and self-regulation of writing among college students. Self-efficacy for writing correlated positively with students' goals for course achievement, self-evaluative standards (satisfaction with potential grades), and actual achievement. Results of a path analysis showed that self-efficacy affected achievement directly and indirectly through its influence on goals.

Tuckman and Sexton (1990) studied college students in an educational psychology course. The self-regulated learning task involved writing test items based on course lectures and text material. For each of 10 weeks, students with high self-efficacy for writing test items chose to engage in significantly more item writing than students lower in self-efficacy.

Chapman and Tunmer (1995) explored the relationship of perceptions of competence (analogous to self-efficacy) in reading and use of self-regulatory reading (e.g., letter and word identification) and comprehension strategies among children ages 5 to 7. Perceptions of competence correlated positively with comprehension strategies among older children; for

younger children, perceptions of task difficulty correlated significantly with reading strategies.

Ertmer et al. (1996) examined how freshmen veterinary students with different levels of self-regulation approached learning from case-based instruction. The study employed intensive interviews designed to determine differences between high and low self-regulators.

Students enrolled in a biochemistry laboratory course that used case-based instruction were classified as high or low self-regulators. Interview data gathered on three occasions during the semester assessed students' lab goals, strategies for analyzing case studies, and perceptions of performance and progress. Motivation and self-efficacy for completing case analyses also were measured.

Students' approaches to case-based instruction were shaped by the value placed on the use of cases, types of goals and evaluation criteria used to focus learning, and ability, motivation, and self-efficacy for using self-regulatory monitoring strategies on difficult cases. High self-regulators valued case-based instruction, perceived it relevant to their needs, and felt efficacious for learning. They focused on mastering the analysis process and used self-regulatory strategies (e.g., positive self-talk, self-checking) on difficult cases.

In contrast, low self-regulators fluctuated in their perceptions of the value of the case method, as well as in self-efficacy for learning from cases. They focused on learning facts and being correct, and had difficulty adapting or inventing new strategies to meet case demands. Students acted automatically, employing habitual learning strategies (e.g., underlining, highlighting) that were not appropriate or effective on cases.

IV. INTERVENTIONS TO ENHANCE SELF-EFFICACY AND SELF-REGULATION

The preceding correlational results indicate strong support for the interrelationship of self-efficacy and self-regulation. Against this background, we now describe some research projects that were designed to enhance self-efficacy and self-regulation.

We make no attempt to discuss all intervention research relevant to our model in Table 1. Rather, we focus on how goals (forethought phase), self-monitoring and self-perceptions of progress (performance control phase), and self-evaluations of progress (self-reflection phase) affect self-efficacy and self-regulated learning. Furthermore, most of the projects we describe represent research involving situational manipulations rather than long-term interventions with program evaluation. Readers interested in

the impact of other types of interventions should consult additional sources (Bandura, 1997; Schunk & Zimmerman, 1994, 1998b).

A. GOALS

Wood, Bandura, and Bailey (1990) varied task complexity and goal instructions with graduate business students during a simulated decision-making task (assigning employees to different production tasks to complete work assignments within an optimal period). Subjects were assigned to low or high task-complexity conditions based on the number of employees supervised and the degree of match between skills and job requirements. They received either a general (do your best) goal or a specific goal of raising productivity by at least 25%. They judged efficacy for attaining performance levels ranging from 30% better to 40% worse. Other measures were self-regulation (effectiveness of their managerial strategies) and performance (number of hours to complete the simulated task).

The specific goal enhanced performance in the low complexity condition, but not in the high complexity condition. During the early trials, high complexity and the specific goal produced the highest self-efficacy. Path analysis showed that self-efficacy raised performance directly and indirectly through its effect on self-regulation; the latter directly affected performance. Self-efficacy also influenced personal goal setting (the goals that subjects were striving for regardless of the assigned goal). In a related study using a similar methodology (Bandura & Jourden, 1991), self-efficacy directly affected performance and self-regulation, and had an indirect effect on performance through its effect on self-regulation. Feedback indicating progressive mastery promoted self-efficacy, high goal setting, and performance.

Zimmerman and Kitsantas (1996, 1997) found that providing process (learning) goals raised self-efficacy and self-regulation during dart throwing. Ninth- and tenth-grade girls were assigned to a process-goal condition and advised to focus on the steps in dart throwing; others were assigned to a product-goal condition and told to concentrate on their scores. Some girls engaged in self-recording (a self-monitoring strategy) by writing down after each throw the steps they accomplished properly or their throw's outcome.

In the first study (Zimmerman & Kitsantas, 1996), process-goal girls attained higher self-efficacy and performance than did product-goal girls; self-recording also enhanced these measures. These results were replicated in the second study (Zimmerman & Kitsantas, 1997); however, a shifting-goal condition was included where girls pursued a process goal, but once they could perform the steps automatically they switched to a product goal

of attaining high scores. The shifting goal led to the highest self-efficacy and performance.

B. SELF-MONITORING AND PERCEPTIONS OF PROGRESS

To investigate the influence of self-monitoring on motivation and self-regulated learning, Schunk (1983) provided subtraction instruction to elementary-school children who had failed to master subtraction operations in their classes. One group (self-monitoring) reviewed their work at the end of each session and recorded the number of workbook pages they had completed. To control for the effects of monitoring generally, Schunk included a second group (external monitoring) who had their work reviewed at the end of each session by an adult who recorded the number of pages completed. In a third condition (no monitoring), children received the instructional program, but were not monitored and did not receive instructions to monitor their work.

The self- and external-monitoring conditions led to higher self-efficacy, persistence, and achievement, compared with the no-monitoring condition. The two progress-monitoring conditions did not differ on any measure. The benefits of monitoring did not depend on children's performances during the instructional sessions, because the three treatment conditions did not differ in amount of work completed. Monitoring of progress, rather than the agent, enhanced children's perceptions of their learning progress and self-efficacy for continued progress. Without monitoring, children may be less certain about how well they are learning.

Studies by Schunk and Swartz (1993a, 1993b) investigated the influence of providing students with feedback to instill perceptions of progress. Fourth- and fifth-grade children received writing instruction over 20 days that covered four types of paragraphs: descriptive (e.g., describe a bird), informative (e.g., write about something you like to do after school), narrative story (e.g., tell a story about visiting a friend or relative), and narrative descriptive (e.g., describe how to play your favorite game). During each session, children received modeled writing strategy instruction, after which they engaged in self-regulated practice. Before and after the intervention, students' self-efficacy for writing effective paragraphs and writing achievement were assessed.

There were four goal conditions: learning goal, learning goal plus progress feedback, performance goal, and general goal. The model asked learning-goal and learning-goal-plus-feedback children to pursue a goal of learning to use the strategy to write paragraphs. Performance-goal students were asked to adopt a goal of writing paragraphs; general-goal students were advised to do their best. Progress feedback was delivered periodically to individual students during the sessions. It linked strategy

use with improved writing performance (e.g., "You're doing well because you followed the steps in order"). At the end of the project, all children self-evaluated their progress in using the strategy.

Across the studies, providing students with a learning goal and progress feedback led to the highest self-efficacy, motivated strategy use, and achievement. There were some benefits of providing only a learning goal. Gains were maintained after 6 weeks and generalized to types of paragraphs on which children received no instruction. Learning-goal-plus-feedback students evaluated their progress in strategy use greater than did students in the other conditions. Schunk and Swartz also found that learning-goal-plus-feedback students, compared with children in the other conditions, reported the highest writing strategy use, employed the strategy more often, and judged the strategy to be of greater value. Providing a learning goal without feedback yielded some benefits on these measures.

C. SELF-EVALUATIONS

Schunk (1996) conducted two projects in which average-achieving children received modeled explanations and demonstrations of fraction solution strategies and practice opportunities. Children judged self-efficacy for correctly solving different types of fraction problems and were tested on fractions performance before and after the intervention. Students worked under conditions involving either a learning goal (learning how to solve problems) or a performance goal (solving problems). In the first project, half of the students in each goal condition engaged in daily self-evaluation of their problem-solving capabilities. The learning goal with or without self-evaluation and the performance goal with self-evaluation conditions demonstrated higher self-efficacy, self-regulated motivation, achievement, and task orientation (desire to independently master and understand academic work), and lower ego orientation (desire to perform well to please the teacher and avoid trouble) than did the performance goal without self-evaluation condition.

In the second project, all students self-evaluated their learning progress once during the instructional program. The learning goal led to higher self-efficacy, self-regulated motivation, achievement, and task orientation, and lower ego orientation than did the performance goal. These results suggest that frequent self-evaluation of progress or competence is powerful and can override the effects of learning goals. When self-evaluation occurs less frequently, it may complement learning goals better than performance goals and exert desirable effects on self-efficacy and self-regulated learning.

Schunk and Ertmer (in press) investigated the influence of self-evaluation and goals on college students' self-efficacy, achievement, and self-reported use of self-regulation strategies. Students were pretested on

Hypercard (a computer application) self-efficacy and achievement, and on how well (competence) and how often (frequency) they performed various strategies while learning computer skills. These strategies tapped four dimensions of self-regulation (Zimmerman, 1994): motives (e.g., find ways to motivate myself to finish a lab project even when it holds little interest for me), methods (e.g., locate and use appropriate manuals when I need to accomplish an unfamiliar computer task), performance outcomes (e.g., set specific goals for myself in this course), and social/environmental resources (e.g., find peers who will give critical feedback on early versions of my projects).

All students were enrolled in a computer applications course; Hypercard was one of the units. For this study, students were assigned to one of four conditions: learning goal with self-evaluation, performance goal with self-evaluation, learning goal without self-evaluation, and performance goal without self-evaluation. At the start of each of three laboratory sessions, learning-goal students were provided with a goal of learning to perform various Hypercard tasks, which coincided with the unit objectives; performance-goal students were advised to do their work and try their best. At the end of the second session, students assigned to the self-evaluation conditions evaluated their progress in acquiring Hypercard skills. All students were posttested at the end of the project.

Providing learning goals—with or without self-evaluation—led to higher self-efficacy and strategy competence and frequency than did providing performance goals and no self-evaluation. Students who received learning goals and self-evaluation judged self-efficacy higher than did learning-goal students who did not receive self-evaluation and performance-goal students who self-evaluated. Students given learning goals without self-evaluation judged self-efficacy higher than did students given performance goals and self-evaluation. Among the self-evaluation conditions, students who pursued learning goals evaluated their learning progress greater than those who received performance goals. These results corroborate those of Schunk (1996) in showing that infrequent self-evaluation is more beneficial for self-efficacy and self-regulation in the presence of learning goals.

V. FUTURE RESEARCH ON SELF-REGULATION

The studies in the preceding section have the dual purpose of enhancing students' self-efficacy for learning and facilitating use of self-regulatory strategies. We see these ends to be complementary, although researchers need not attempt to influence both processes at once. Strictly speaking, one can address the development of self-efficacy and self-regulatory com-

petence separately. Building efficacy requires providing students with mastery experiences, exposing them to successful models, and delivering positive feedback. Self-regulatory competence can be developed through strategy instruction, exposure to social models, or providing students with opportunities to construct strategies and test their usefulness.

Although these objectives can be addressed in isolation, we believe that because self-efficacy and self-regulation exert reciprocal effects, training programs should address both aspects. Students who possess self-regulatory skills are not apt to use them proficiently if they have doubts about their learning capabilities. Furthermore, high self-efficacy will not produce skillful self-regulation among students who lack knowledge of skills or believe that self-regulation is not beneficial. Thus, we recommend that programs designed to teach self-regulation include components to enhance students' self-efficacy for learning and implementing self-regulation skills.

Research on self-regulation has advanced tremendously in the past few years, and we expect this trend to continue. We believe that the following suggestions for research will help to further our understanding of the operation of self-regulatory processes and help to link self-regulation with educational practices.

A. INSTRUCTIONAL COMPONENTS

The studies in the preceding section primarily used social models to explain and demonstrate operations. Models are an important means of transmitting skills and strategies (Bandura, 1986; Rosenthal & Zimmerman, 1978). Models also are frequently employed in strategy instruction (Graham & Harris, 1989a, 1989b; Schunk & Swartz, 1993a, 1993b).

Alternatively, strategy instruction can be less formally structured such that teachers provide support and assistance while students construct their own strategies. This approach has been used successfully in training studies (Butler, 1998; Winne & Stockley, 1998). Forcing students to take greater responsibility for their own learning fits well with other instructional models, such as reciprocal teaching (Palincsar & Brown, 1984) and collaborative peer learning groups (Cohen, 1994; Slavin, 1995).

Research should explore the relative effectiveness of modeling and self-constructions, and especially the factors that may influence their success. For example, we might predict that strategy modeling would be more effective during initial learning when individuals' ability to construct strategies is limited, but that as students develop competence they are better able to construct effective self-regulatory sequences. There also may be developmental differences such that younger students benefit more from modeled demonstrations, but older students are able to formulate their own methods.

B. SELF-REGULATION IN CONTENT AREAS

A second suggestion is to conduct research on self-regulation in the context of content-area learning. When self-regulatory processes are linked with academic content, students learn how to apply them in a learning context. It is worthwhile to teach students how to set goals, organize their schedules, rehearse information to be remembered, and so forth, but such instruction may not generalize beyond the context in which it is provided.

We recommend that researchers conduct studies in academic settings where students are taught self-regulatory activities and how to modify them to fit different situations. These studies have the added benefit of showing students the value of self-regulation. Students who learn strategies, but feel they are not particularly useful, are not likely to use them. Linking self-regulation to actual content helps to raise the perception of value as students compare their performances with prior ones that did not have the benefit of self-regulation.

C. TRANSFER OF SELF-REGULATION PROCESSES

Embedding self-regulation processes within specific content areas brings up the issue of transfer. Although students' perceptions of the value of self-regulation strategies may increase when these strategies are integrated within regular disciplinary courses (e.g., biology, history), it is unclear whether students will then transfer these skills to other disciplinary courses (Hofer, Yu, & Pintrich, 1998). It has been argued that students' transfer of self-regulation skills across contexts, content areas, and types of academic tasks, depends on at least three factors (Pressley et al., 1990): knowing how to self-regulate, believing that self-regulation is beneficial, and possessing the skills necessary to make appropriate modifications in self-regulation processes such that they match the current situation. Research is needed to determine the extent that explicit instruction and practice in each area improves transfer.

Whether self-regulation skills are taught within a content area or as part of an adjunct course, the issue of transfer is relevant. In one case, students must transfer skills to a new content area; in the other case, transfer must occur between a "content-free" course and any number of specific content courses. What is unclear is whether one approach is more effective than the other, and if so, how specific features of the approach facilitate transfer. We recommend that researchers conduct process-oriented studies designed to determine how students think about and employ strategies they learn in one context to another setting. Researchers should consider the use of qualitative methods that involve in-depth analysis of

students as they attempt to use the strategies in different courses (Hofer et al., 1998).

As the amount of information available to learners continues to increase, instructors must decide how much is reasonable to provide in any course. Instructors are beginning to seek out ways to equip their students with strategies that will enable them to locate, access, and evaluate relevant information in a self-directed manner. The question is how to balance students' need for information with the need to develop strategies to find and use information. Content-area interventions, in which instructors teach skills and embed information about the transferability to other domains, have been found to be highly beneficial for learning and transfer (Schunk & Zimmerman, 1998b).

D. SELF-REFLECTIVE PRACTICE

Finally, we recommend greater research attention be paid to self-reflective practice. This is a critical component of self-regulated learning, but to date little effort has been made to link it systematically with interventions. Self-reflective practice ought to allow students to evaluate their progress toward learning goals, alter their approach as needed, and adjust social and environmental factors to provide a setting highly conducive to learning.

Researchers might examine whether the effectiveness of self-reflection varies as a function of setting. Self-reflective practice may be more important where external evaluation is infrequent or when students encounter difficulties learning. The need for self-reflection may decline where assessment is straightforward and progress indicators are clear. Researchers also might determine ways to motivate students to engage in self-reflection on their own, such as by teaching students to treat self-reflection as any other academic task that must be planned. Such research will help us to realize the full potential of this central component of self-regulation.

VI. CONCLUSION

In this chapter we have argued that students' self-regulatory competence can be enhanced through systematic interventions that are designed to teach skills and raise students' self-efficacy for learning. We have focused on interventions involving goals, self-monitoring and perceptions of progress, and self-evaluations of progress and capabilities. We believe that research on self-regulation will enhance our understanding of achievement processes and have important implications for teaching and learning in and out of school.

REFERENCES

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*, 261–271.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1988). Self-regulation of motivation and action through goal systems. In V. Hamilton, G. H. Bower, & N. H. Frijda (Eds.), *Cognitive perspectives on emotion and motivation* (pp. 37–61). Dordrecht, The Netherlands: Kluwer.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*, 117–148.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bandura, A., & Jourden, F. J. (1991). Self-regulatory mechanisms governing the impact of social comparison on complex decision making. *Journal of Personality and Social Psychology, 60*, 941–951.

Berliner, D. C., & Biddle, B. J. (1997). *The manufactured crisis.* New York: Longman.

Borkowski, J. G., Johnston, M. B., & Reid, M. K. (1987). Metacognition, motivation, and controlled performance. In S. J. Ceci (Ed.), *Handbook of cognitive, social, and neuropsychological aspects of learning disabilities* (Vol. 2, pp. 147–173). Hillsdale, NJ: Erlbaum.

Borkowski, J. G., Weyhing, R. S., & Carr, M. (1988). Effects of attributional retraining on strategy-based reading comprehension of learning-disabled students. *Journal of Educational Psychology, 80*, 46–53.

Bouffard-Bouchard, T., Parent, S., & Larivee, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high-school age students. *International Journal of Behavioural Development, 14*, 153–164.

Butler, D. L. (1998). A strategic content learning approach to promoting self-regulated learning by students with learning disabilities. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 160–183). New York: Guilford.

Chapman, J. W., & Tunmer, W. E. (1995). Development of young children's reading self-concepts: An examination of emerging subcomponents and their relationship with reading achievement. *Journal of Educational Psychology, 87*, 154–167.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64*, 1–35.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256–273.

Ertmer, P. A., Newby, T. J., & MacDougall, M. (1996). Students' responses and approaches to case-based instruction: The role of reflective self-regulation. *American Educational Research Journal, 33*, 719–752.

Fabricius, W. V., & Hagen, J. W. (1984). Use of causal attributions about recall performance to assess metamemory and predict strategic memory behavior in young children. *Developmental Psychology, 20*, 975–987.

Graham, S., & Harris, K. R. (1989a). Components analysis of cognitive strategy instruction: Effects on learning disabled students' compositions and self-efficacy. *Journal of Educational Psychology, 81*, 353–361.

Graham, S., & Harris, K. R. (1989b). Improving learning disabled students' skills at composing essays: Self-instructional strategy training. *Exceptional Children, 56*, 201–214.

Hofer, B. K., Yu, S. L., & Pintrich, P. R. (1998). Teaching college students to be self-regulated learners. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 57–85). New York: Guilford.

Kurtz, B. E., & Borkowski, J. G. (1987). Development of strategic skills in impulsive and reflective children: A longitudinal study of metacognition. *Journal of Experimental Child Psychology, 43*, 129–148.

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance.* Englewood Cliffs, NJ: Prentice-Hall.

Mace, F. C., Belfiore, P. J., & Shea, M. C. (1989). Operant theory and research on self-regulation. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theory, research, and practice* (pp. 27–50). New York: Springer.

McCombs, B. L. (1989). Self-regulated learning and academic achievement: A phenomenological view. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theory, research, and practice* (pp. 51–82). New York: Springer.

Meece, J. L. (1991). The classroom context and students' motivational goals. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 7, pp. 261–285). Greenwich, CT: JAI Press.

Meece, J. L. (1994). The role of motivation in self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 25–44). Hillsdale, NJ: Erlbaum.

Meece, J. L., & Courtney, D. P. (1992). Gender differences in students' perceptions: Consequences for achievement-related choices. In D. H. Schunk & J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 209–228). Hillsdale, NJ: Erlbaum.

Newman, R. S. (1994). Adaptive help seeking: A strategy of self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 283–301). Hillsdale, NJ: Erlbaum.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117–175.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*, 33–40.

Pintrich, P. R., & Garcia, T. (1991). Student goal orientation and self-regulation in the college classroom. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 7, pp. 371–402). Greenwich, CT: JAI Press.

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic tasks. In D. H. Schunk & J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 149–183). Hillsdale, NJ: Erlbaum.

Pokay, P., & Blumenfeld, P. C. (1990). Predicting achievement early and late in the semester: The role of motivation and use of learning strategies. *Journal of Educational Psychology, 82*, 41–50.

Pressley, M., Woloshyn, V., Lysynchuk, L. M., Martin, V., Wood, E., & Willoughby, T. (1990). A primer of research on cognitive strategy instruction: The important issues and how to address them. *Educational Psychology Review, 2*, 1–58.

Rosenthal, T. L., & Zimmerman, B. J. (1978). *Social learning and cognition.* New York: Academic Press.

Schunk, D. H. (1983). Progress self-monitoring: Effects on children's self-efficacy and achievement. *Journal of Experimental Education, 51*, 89–93.

Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57*, 149–174.

Schunk, D. H. (1989). Self-efficacy and achievement behaviors. *Educational Psychology Review, 1*, 173–208.

Schunk, D. H. (1990). Goal setting and self-efficacy during self-regulated learning. *Educational Psychologist, 26*, 207–231.

Schunk, D. H. (1994). Self-regulation of self-efficacy and attributions in academic settings. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 75–99). Hillsdale, NJ: Erlbaum.

Schunk, D. H. (1996). Goal and self-evaluative influences during children's cognitive skill learning. *American Educational Research Journal, 33*, 359–382.

Schunk, D. H., & Ertmer, P. A. (in press). Self-regulatory processes during computer skill acquisition: Goal and self-evaluative influences. *Journal of Educational Psychology.*

Schunk, D. H., & Swartz, C. W. (1993a). Goals and progress feedback: Effects on self-efficacy and writing achievement. *Contemporary Educational Psychology, 18*, 337–354.

Schunk, D. H., & Swartz, C. W. (1993b). Writing strategy instruction with gifted students: Effects of goals and feedback on self-efficacy and skills. *Roeper Review, 15*, 225–230.

Schunk, D. H., & Zimmerman, B. J. (1998a). Conclusions and future directions for academic interventions. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 225–235). New York: Guilford.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1998b). *Self-regulated learning: From teaching to self-reflective practice.* New York: Guilford.

Shell, D. F., Murphy, C. C., & Bruning, R. H. (1989). Self-efficacy and outcome expectancy mechanisms in reading and writing achievement. *Journal of Educational Psychology, 81*, 91–100.

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice* (2nd ed.). Boston: Allyn and Bacon.

Steinberg, L., Brown, B. B., & Dornbusch, S. M. (1996). *Beyond the classroom: Why school reform has failed and what parents need to do.* New York: Simon and Schuster.

Stipek, D. J. (1996). Motivation and instruction. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 85–113). New York: Macmillan.

Thompson, L., Detterman, D., & Plomin, R. (1991). Associations between cognitive abilities and scholastic achievement: Genetic overlap but environmental differences. *Psychological Science, 2*, 158–165.

Tuckman, B. W., & Sexton, T. L. (1990). The relation between self-beliefs and self-regulated performance. *Journal of Social Behavior and Personality, 5*, 465–472.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 315–327). New York: Macmillan.

Winne, P. H., & Stockley, D. B. (1998). Computing technologies as sites for developing self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 106–136). New York: Guilford.

Wood, R., Bandura, A., & Bailey, T. (1990). Mechanisms governing organizational performance in complex decision-making environments. *Organizational Behavior and Human Decision Processes, 46*, 181–201.

Zimmerman, B. J. (1986). Development of self-regulated learning: Which are the key subprocesses? *Contemporary Educational Psychology, 11*, 307–313.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*, 329–339.

Zimmerman, B. J. (1990). Self-regulating academic learning and achievement: The emergence of a social cognitive perspective. *Educational Psychology Review, 2*, 173–201.

Zimmerman, B. J. (1994). Dimensions of academic self-regulation: A conceptual framework for education. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 3–21). Hillsdale, NJ: Erlbaum.

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 1–19). New York: Guilford.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, and M. Zeidner (Eds.), *Handbook of self-regulation* (Chap. 2). San Diego, CA: Academic Press (this volume).

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31*, 845–862.

Zimmerman, B. J., Bonner, S., & Kovach, R. (1996). *Developing self-regulated learners: Beyond achievement to self-efficacy*, Washington, DC: American Psychological Association.

Zimmerman, B. J., & Kitsantas, A. (1996). Self-regulated learning of a motoric skill: The role of goal setting and self-monitoring. *Journal of Applied Sport Psychology, 8*, 60–75.

Zimmerman, B. J., & Kitsantas, A. (1997). Developmental phases in self-regulation: Shifting from process goals to outcome goals. *Journal of Educational Psychology, 89*, 29–36.

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology, 82*, 51–59.

Zimmerman, B. J., & Ringle, J. (1981). Effects of model persistence and statements of confidence on children's self-efficacy and problem solving. *Journal of Educational Psychology, 73*, 485–493.