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Academic Studying and the Development of Personal Skill: A Self-Regulatory Perspective

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Although the topic of academic studying has been neglected historically, researchers interested in academic self-regulation have undertaken a program of research with important implications for understanding how academic studying can be optimized. In this article, I present a conceptualization of this topic in terms of 6 underlying dimensions that students can self-regulate using specific processes. Extensive anecdotal evidence is described indicating that similar self-regulatory processes are used by experts in such diverse disciplines as music, sports, and professional writing. These descriptions reveal that self-regulatory processes are not only important during initial development of a skill but also during subsequent performance of it in naturalistic settings. Finally, research on the beneficial effects of self-regulated studying is recounted on academic motivation as well as achievement, and a cyclical self-regulatory model for study skill instruction in regular classrooms is presented.

> "Studying is the principal means of self-education throughout life." (Rohwer, 1984, p. 1)

In a seminal article in 1984, Rohwer noted that one of the most neglected topics in the field of education was academic studying. Although teachers assign homework to induce studying and expect their students to prepare outside class to participate fully within it, they have historically devoted little attention to teaching needed study skills, such as time management, note taking, or test preparation. Students were expected to develop these skills on their own from completion of assigned homework and preparation for in-class tests. Before Rohwer's article, educational psychologists had also neglected academic studying processes—preferring instead to focus on learning under more proscribed conditions, including during teaching and other forms of in-class instruction. Undoubtedly, the reasons that both teachers and educational psychologists had neglected this topic can be traced to its occurrence outside formal learning contexts and the fact that it is largely self-directed. In these naturalistic contexts, students' failure to learn may have been due to factors other than their learning ability, such as insufficient motivation, lack of home support, or the presence of distractions. The meager research that had been conducted on academic studying before 1984 was heterogeneous and fragmented in form, and as a result, Rohwer called for the development of a coherent psychology of studying that could offer insight regarding not only qualitative differences in study processes used by students but also the underlying psychological processes.

Since Rohwer's (1984) article, research on academic studying has made significant strides on a number of fronts, and I would like to discuss efforts associated with models that focus on *self-regulatory processes*. Self-regulation can be defined as self-generated thoughts, feelings, and actions for attaining academic goals. Although academic self-regulation models are not limited to explaining academic studying, they do address this topic and have important properties that are especially compatible with it (Winne & Hadwin, 1997). For example, research on academic self-regulation grew out of efforts to explain proactive efforts of students to learn on their own—their personal initiative, resourcefulness, persistence, and sense of responsibility. For these proactive properties to emerge, self-motivation is necessary as well as self-directed learning competence, and as a result, most self-regulated learning models have incorporated motivational variables as central features, such as goal setting, self-beliefs, and intrinsic interest (e.g., Corno, 1993; Garcia & Pintrich, 1994; McCombs, 1989; Schunk, 1994). Insufficient self-motivation

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is an important problem with academic studying. For example, the National Assessment of Educational Progress Report (1990) indicated that 71% of the 12th graders studied no more than 1 hr per day, and 25% did not study at all. Among the self-regulatory processes affecting students' motivation to study, time management skill and perceived competence play a key role (Britton & Tesser, 1991; Zimmerman, Greenberg, & Weinstein, 1994). Because self-regulation models include self-motivation as well as metacognition and behavior performance (Pintrich & De Groot, 1990; Zimmerman, 1995b), they are well suited for explaining academic studying.

Self-regulatory models are also distinctive because they seek to understand academic studying from a student's perspective, especially his or her self-image as a learner. These self-beliefs are assumed to both influence students' proactive efforts to self-regulate studying and be influenced reciprocally by the results of those efforts (Zimmerman, 1989). Unfortunately, students' beliefs about themselves as learners had been measured in a nontask-specific way before the mid-1970s, and as a result, their impact was greatly underestimated (Wylie, 1968). During the last 2 decades, research on academic self-beliefs has improved in both methodology and results. Domain-specific or task-specific self-image or identity measures have been found to be closely associated with indexes of academic motivation and achievement (Marsh, 1990; Pajares & Miller, 1994; Zimmerman, 1995a). In this article, I will describe key dimensions of self-regulation, the types of self-regulatory processes exemplary students as well as other experts use, the role of self-regulatory processes and self-efficacy during academic studying, and a cyclical self-regulatory model for study skill instruction.

DIMENSIONS OF SELF-REGULATION

Early views of academic self-regulation as unitary personality trait, ability, or stage of development have been supplanted in recent years by multidimensional conceptions that envision it as acquired interdependent processes. Self-regulation is no longer viewed as a fixed characteristic of students but rather as context-specific processes that are selectively used to succeed in school (Zimmerman, 1989, 1994, 1995b). The degree and quality of self-regulatory processes that students can exercise during academic studying depends on several key psychological dimensions of functioning, such as motivation, method, and time (see column 2 of Table 1). Associated with each dimension is an essential scientific question for understanding academic studying as well as other forms of self-directed learning (see column 1 of Table 1).

For example, the question "why" addresses students' motivation to self-regulate their studying. To be able to self-regulate this dimension, students must be free to and capable of choosing whether and how much to study (see column 3 of row 1 in Table 1). This is usually the case with studying outside of the classroom. Although teachers often constrain outside studying by assigning and grading homework, students still have choice regarding the length of their studying as well as engaging in additional forms of it. Students who self-initiate studying are labeled typically as self-motivated by their parents or teachers (see column 4 in row 1 of Table 1). There is extensive evidence that this motivational attribute, which is also called *intrinsic motivation*, is highly associated with academic achievement (e.g., Bandura & Schunk, 1981; Zimmerman & Martinez-Pons, 1988). Researchers studying the causes of students' self-motivation have identified a number of key self-beliefs and processes, such as goal setting, self-efficacy perceptions, academic values, and attributions (see column 5 in row 1 of Table 1). To help a student become more self-motivated, teachers and parents must understand the role of these underlying processes and beliefs, be able to assess their presence, and know how they can be taught. Thus, row 1 of Table 1 provides a framework for understanding how motivation for academic studying can become self-regulated. Subsequent rows provide parallel frameworks for analyzing five other dimensions of academic studying.

For example, the method dimension of self-regulation (in row 2 of Table 1) focuses attention on questions regarding "how" to study and on the essential condition of allowing students to choose or adapt their own way to study (in column 3 of Table 1), such as using an imaginal or a verbal strategy to memorize the names of American presidents. Students who self-regulate this dimension will be perceived as highly planful in the way they approach a learning task, such as outlining a paper before beginning to write it (in column 4 of Table 1). As students become more adept and their studying becomes routine, they can mentally organize the information without needing to create a formal outline. A key underlying process when self-regulating one's studying method is the use of learning strategies (in column 5 of Table 1). For more than 2 decades, the range and power of such strategies have been demonstrated, and there have been systematic efforts to teach them to students, especially those at risk for academic failure (Graham & Harris, 1994; Pressley & Woloshyn, 1995; Weinstein & Mayer, 1986; Weinstein & McCombs, in press).

The third question of "when" refers to the time dimension of studying (in row 3 of Table 1). Self-regulated students plan their use of time more effectively than unregulated students (Zimmerman et al., 1994). Most teachers give students greater autonomy regarding academic study time as they advance in age and grade level, which is an essential condition for this form of self-regulation. For example, study time in elementary schools is usually organized and monitored very closely by their teachers, whereas study time at the collegiate level is relegated to students to manage on their own. In terms of their studying attributes, self-regulated students are prompt and consistent in their completion of homework (Zimmerman & Martinez-Pons, 1988). Several key processes are associated with students' effective use of time—namely, time planning, management, and self-beliefs.

TABLE 1
Dimensions of Academic Self-Regulation

Scientific Questions	*Psychological Dimensions*	*Task Conditions*	*Self-Regulatory Attributes*	*Self-Regulatory Processes*
Why?	Motive	Choose to participate	Self-motivated	Goal setting and self-efficacy
How?	Method	Choose method	Planned or routinized	Task strategies, imagery, and self-instruction
When?	Time	Choose time limits	Timely and efficient	Time management
What?	Behavior	Choose outcome behavior	Self-aware of performance	Self-monitoring, self-evaluation, self-consequences
Where?	Physical environment	Choose setting	Environmentally sensitive and resourceful	Environmental structuring
With whom?	Social	Choose partner, model, or teacher	Socially sensitive and resourceful	Selective help seeking

Note. From "Dimensions of academic self-regulation: A conceptual framework for education" (p. 8), by B. J. Zimmerman, in *Self-Regulation of Learning and Performance: Issues and Educational Applications,* D. H. Schunk and B. J. Zimmerman (Eds.), 1994. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

The question "what" refers to students' overt behavioral performance (in row 4 of Table 1). To self-regulate their studying, learners must be able to choose, modify, and adapt their form of response particularly from the feedback it produces. This essential condition is often lacking in formal instructional settings. For example, when reading an assigned text, students must vary the form of notes they might be taking on the basis of how well the initial attempt captures the information (e.g., merely listing key terms vs. outlining material that is more difficult to recall). In terms of their characteristics, self-regulated students can be identified by their awareness of their academic effectiveness and by their optimal adjustment of their studying to changing conditions. For example, these students are more aware than classmates of how well they have captured the meaning of the text assignments (Zimmerman & Martinez-Pons, 1988). Some key studying processes that influence performance proficiency are self-monitoring, self-reactions, self-instruction, and volition (Zimmerman, 1998).

The fifth question refers to the way that students regulate their physical environment (in row 5 of Table 1), such as the places "where" they study or the use of self-instructional supports (e.g., computers and recording devices). Unfortunately, some students have little control over the settings where they often study because of crowding, noise, television, or lack of instructional resources. Self-regulated students can be identified by their awareness of surrounding conditions on their academic concentration, such as the influence of distracting sounds and sights. Regulatory control over these environmental conditions can be gained through self-selecting and structuring activities, for example, by studying at a library in which reference books are readily available or by disconnecting the phone from the jack while studying at home.

The scientific question "with whom" concerns the social dimension of studying (in row 6 of Table 1). Socially self-regulated students are aware of how study partners, coaches, or instructors can help or hinder their learning, and they can be readily identified by their sensitivity and resourcefulness in seeking help. Students who self-regulate use several key social processes, such as model selection and teacher or peer help-seeking (Nelson-Le Gal & Jones, 1985; Newman, 1994). These learners can be distinguished from socially dependent classmates by the confident and selective way they initiate and respond to social support. By contrast, nonself-regulated learners are reluctant to ask for assistance because they are unsure what to ask and afraid of how they might appear (Newman, 1994).

Thus, self-regulation of studying is not a singular aspect of students. Rather, it is multidimensional in scope, contextual in its application, and dependent on perceived outcomes. Because personal studying processes interact with performance outcomes and social-environmental events, they must be constantly adjusted. Students' interpretations of their behavioral effectiveness in each setting are as important to their success as their initial strategic skill. Their interpretation and efforts are influenced by their self-image, goals, and other sources of self-motivation. To optimize their studying, students should self-regulate all major dimensions of their functioning (Zimmerman, in press). We now consider the issue of how experts accomplish this.

COMPARING EXPERTS' METHODS OF SELF-REGULATION ACROSS DISCIPLINES

Some of the most widely studied methods of self-regulation are listed in Table 2. It is important to note that each of these techniques has been used to acquire knowledge and skill outside the field of academic functioning as well as within it, and there is extensive anecdotal as well as experimental evidence of the effectiveness of each technique. Some creative personal adaptations of these techniques will be described from the biographies, autobiographies, and instructional texts

TABLE 2
Self-Regulatory Processes of Professional Writers, Athletes, Musicians, and Students

Self-Regulatory Processes	*Area of Expertise*			
	Writers	*Athletes*	*Musicians*	*Students*
Goal setting	Setting daily word or page goals	Setting specific and quantifiable daily goals for training	Setting daily practice session goals	Making lists to accomplish during studying
Task strategies	Creating outcomes or generative cue	Knowing how and what to practice, for example, taking periodic breaks and slow execution	Playing a piece slowly and softly	Creating mnemonics to remember facts
Imagery	Imagining a plot in visual detail	Visualizing yourself successfully making the shot	Imagining the presence of an audience	Imagining the consequences of failing to study
Self-instruction	Saying aloud what will be written	Self-verbalizing confidence statements, for example, "let's go!"	Verbally praising or prompting oneself	Rehearsing steps in solving a math problem
Time management	Scheduling daily writing, especially time in the morning	Setting up regular practice times, eating times, and relaxation and preparation periods	Scheduling daily practice to avoid extremes	Scheduling daily studying and homework time
Self-monitoring	Keeping records of literary production	Keeping a daily record of goal accomplishment or filming matches for replay	Keeping daily records of performance, for example, stress levels	Keeping records of completed assignments
Self-evaluation	Putting off text self-judgments during creation	Breaking game into components and evaluating yourself after each performance	Listening to self-recording, setting realistic standards	Checking work before handing it in to teacher
Self-consequences	Putting off pleasurable events until writing is completed	Grade yourself after every match	Refusing to end practice until passage is played flawlessly	Making TV or telephoning contingent on homework completion
Environmental structuring	Controlling writing setting and conditions	Building practice facility designed to develop weak part of one's game	Performing with specific tools or instruments, i.e., a metronome	Studying in a secluded place
Help seeking	Obtaining literary advice or feedback from colleague	Returning to teacher when flaws develop in one's game	Returning to teachers when techniques slip	Using a study partner

of successful writers, athletes, and musicians as well as from expert students' protocols. What is evident from these naturalistic accounts of learning and performance is that self-regulatory techniques are not merely methods to acquire and use knowledge in formal learning settings. Once mastered, they are also used throughout life to function effectively in informal contexts, such as at home. These techniques are used on diverse tasks—ranging from mundane daily work or practice tasks to acclaimed performances in the arts, sports, and writing.

The first self-regulatory process, *goal setting*, refers to specifying intended actions or outcomes. In Table 2, notice the similarity in goals set by writers, athletes, musicians, and students across these disparate areas of expertise, such as their specificity and proximity in time, as well as some of the interesting task-related variations in these processes. With regard to writing, before the British novelist Anthony Trollop (1946) began a book, he set specific writing goals to attain each week. He believed goals focused his daily activities and functioned as implicit standards for self-evaluation. In similar fashion, James Loehr (1991), a sports psychologist at the Nick Bolletieri Tennis Academy, trained champions such as Monica Selles and Andre Agassi to set specific rather than general goals and to make short-term goals more important than long-term ones. Specific short-term goals provide greater direction and more opportunities for feedback (Schunk, 1994). The concert pianist Misha Dichter approached technically problematic music pieces by singling out musical passages that are the most awkward technically and by turning them into daily exercise goals to work on them as intensely as possible (Mach, 1991). Interviews with self-regulated students reveal they often reported creating lists of specific study topics to accomplish during a particular study session (Zimmerman & Martinez-Pons, 1986).

The process of self-regulating *task strategies* refers to analyzing tasks and identifying specific, advantageous methods for learning. There is considerable variation in the types of task strategies that were used across the four areas of expertise, ranging from outlines to mnemonics, to structure one's thinking and performance. For example, Irving

Wallace (1971) prepared extensive notes and outlines before he began writing.

> On each new novel, I have always written many outlines for myself, developing scenes, and characters, underlying story problems that need further thought. I work the novel out in chronological sequence, over many weeks, in my head and then roughly on paper before beginning it. (pp. 51–52)

Other writing strategies were smaller in scope but no less important. For example, Hemingway purposely stopped writing each day in midsentence because he found this strategy enabled him to begin writing without delay on the following day (Plimpton, 1965). The coach of the U.S. Davis Cup tennis team Tom Gullikson found that a breathing strategy helped him stay relaxed and execute his strokes better. "Breathing out at contact point and taking deep breaths between points helped to keep the tension down. As soon as I started becoming more relaxed in my play, I started doing better" (Loehr, 1991, p. 78). To increase his attentional control, the pianist Youri Egorov used the practice strategy of playing very slowly and very softly (Mach, 1991). The pianist Alicia De Larrocha also used this form of concentration training and describes its benefits in the following way:

> Slowness not only aides memory, it helps to check note accuracy and phrasing because when you play in slow motion just as in viewing a movie run slowly, you see every detail and at the same time reinforce the memory. (Mach, 1991, p. 59)

Self-regulated students report the use of approximately 15 to 20 common forms of strategies during their efforts to study (Weinstein & Mayer, 1986; Zimmerman & Martinez-Pons, 1986). A successful medical student (Evensen, in press) describes her studying as shifting between a strategy to reduce text to key notes and a strategy to "explode" the terms and concepts to include details and elaborations that underlie and exemplify the abstracted notes.

The self-regulatory process of *imagery* refers to creating or recalling vivid mental images to assist learning. The purpose of imagery ranges across the four disciplines from aiding creative production to avoiding performance anxiety and motivating oneself to continue to study. For example, many novelists have learned to imagine a scene from a story in mysterious, sensual, or bucolic detail to enhance the vividness of their prose. Writers also use imagery of potentially adverse consequences to motivate themselves to deliver their work on time, such as loss of social or financial position. There are even cases in which writers relied on illegal techniques to enhance their personal imagery, such as the use of drugs by Jean Cocteau, or engaging in sadomasochistic conduct by the Marquis de Sade (Barzon, 1964). One of the most successful golf professionals to play the game, Jack Nicklaus (1992), regularly uses visual imagery to enhance both practice and competitive play. He described his use of it this way, "Visualize the shot that would best deal with [the situation], and actually 'see' its flight in your mind's eye. Finally, imagine and mentally 'feel' the swing you would need to execute the planned shot" (p. 131). The British voice coach Graham Hewitt (1978) recommended imagining the human diaphragm as a balloon in which air is trapped and slowly released in a steady column. He suggested the larynx be imagined as a shutter that opens to let in air and closes to make a singing sound as the air passes by the louvers. Harsh vocal attacks on notes can damage these sensitive vibration cords. The pianist Janina Fialkowska imagined going over a piece in her head continually as she prepared for a concert (Mach, 1991, p. 67). Self-regulated students often describe imagining the consequences of failing to study, such as the reactions of friends, classmates, and family members, when they need to motivate themselves to study for important tests (Zimmerman & Martinez-Pons, 1986).

The self-regulatory process of *self-instruction* refers to overt or subvocal verbalization to guide performance. There is also considerable similarity among the methods of self-verbalization reported across the four areas of expertise in Table 2—especially using words to guide or praise oneself for correct task execution. For example, letter writers often dictated orally before writing perhaps because speaking is 35% to 75% faster than writing (Gould, 1980). Poets, playwrights, and novelists commonly read drafts of dialogue aloud, often changing their voices when more than one character or a different emotion is involved in order to appraise its tone, realism, and rhythmic properties (Murray, 1990). The pianist Youri Egorov subvocally praised himself for successfully playing difficult passages in a piece. "When I started them, I thought, the most difficult parts, they're over. Oh good! I haven't made too many mistakes" (Mach, 1991, p. 48). For tennis players who have trouble controlling their negative outbursts on the court, Loehr (1991) recommended for students to list all of their negative responses and to find a positive alternative for each one, such as saying "let it go" or "come on" (p. 47) to focus or motivate themselves. Students' self-regulation can be improved by rehearsing steps in solving a math problem or writing an essay (Schunk, 1998).

The self-regulatory process of *time management* refers to estimating and budgeting use of time. There was a great deal of convergence across the four disciplines in their time planning and management techniques in the allotment of time for systematic daily performance. To improve one's writing, Goethe recommended, "Use the day before the day. Early morning hours have gold in their mouth" (Murray, 1990, p. 16). Through careful time planning, writers are able to sustain prodigious daily efforts: De Balzac wrote 6 to 12 hr per day, Joseph Conrad wrote 8 hr, and Hemingway wrote 6 hr per day (Wallace & Pear, 1977). The pianist Misha Dichter spent as long as 12 hr a day practicing as a youth to develop his competence. Now, he practices only 4 hr per day when on the road and 6 hr a day when learning new repertoire at home

(Mach, 1991). The pianist Glenn Gould felt that excessive practicing (beyond 4 hr a day) actually diminished his effectiveness, therefore he avoided it (Mach, 1991). Time planning and management can also occur for longer periods of time. For example, the Russian sports psychologist L. P. Matveyev used a 6-month "periodization cycle" to organize the training activities of athletes that uses five distinct phases before key competitions to avoid overtraining and enhance peak performance (Loehr, 1991). This training method focuses on different aspects of physical functioning during each phase and begins with cross-training exercises to build aerobic capacity and strength and gradually becomes more intensive for the sport in question. In the last phase, training tapers off to a level that will sustain peak performance but allows the athletes' physical reserves to be replenished. Academically successful students report scheduling regular daily time slots to complete their homework and studying (Kovach, 1997).

A key form of self-regulation is *self-monitoring*, which involves observing and tracking one's own performance and outcomes, often recording them. There was a high degree of commonality among the methods used across the four disciplines, and all respondents kept physical records of their performance accomplishments. With regard to writers, Trollop (1946) wrote more than 50 novels and was perhaps the greatest record keeper in literature. When he began each new book, he would organize his personal diary into weeks, and he would faithfully record the pages he completed each day. Trollop averaged 40 pages per week, never dropping below 20 pages and topping out at 112 pages for his most productive week. Graham Hewitt (1978) advocated new vocal students keeping daily graphs on a variety of vocal techniques, such as breath control, range, agility, vocal resonance, and articulation. He also advocated sitting in chairs to help singers manually feel whether their abdominal support for the voice was properly executed. At the Bolletieri Tennis Academy, students are asked to keep a daily record of their attainment of specific personal goals, such as first-serve percentages or points won at the net, to improve their game (Loehr, 1991). A medical student (Evensen, in press) described her strategy for studying as follows:

> I would make an outline and would say, "I'm going to look at these four topics tonight. I'm going to master them" And I would. And then I would check them off on the outline. I could sit there after four weeks of work and look at all those little check marks and I'd say, "Good, I'm doing really well. I'm a third of the way through."

The self-regulatory process of *self-evaluation* refers to setting standards and using them for self-judgment. The self-evaluative methods listed in Table 2 for the different disciplines are more varied than goal setting methods, with the former ranging from writers' delaying self-judgments to musicians' listening to self-recordings to refine their technique. To prevent himself from responding negatively to errors, the famous golfer Walter Hagen assumed that he would make three or four during each round (Nicklaus, 1992). This enabled him to shrug off the frustration quickly when he made an error and to avoid further rumination that could lead to more mistakes. The pianist Misha Dichter used audio recordings of himself to perfect his style (Mach, 1991). He said,

> There's something marvelous about being able to hear yourself and study from your own mistakes, from your own performance, and to hear and to study others on records as well. (p. 72) Initially, all the things that sounded fine in the practice room sounded quite different in the play-backs; this caused me to rethink many things and has been a very rewarding process. (p. 67)

Self-regulated students report systematically checking over their work before handing it in to their teacher (Zimmerman & Martinez-Pons, 1986). Self-evaluative standards must be appropriate to the skill level of the person involved. For example, the poet William Stafford (Murray, 1990) found that excessive self-evaluative standards are a major source of "writer's block," and he developed ways to lower his standards when his fluency dropped, such as delaying writing quality judgments until after text is generated.

Self-consequences entail making personal rewards or punishments contingent on accomplishment. The forms of self-consequences that have been reported varied considerably by discipline, but the self-regulators in all four areas made rewards contingent on successful completion of important daily activities. In general, negative contingencies are less effective than positive ones, and there is much less frequent use of negative forms of consequences (Kirschenbaum & Karoly, 1977). Among the consequences reported by writers, Ernest Hemingway used his records of daily written output to reward himself (Plimpton, 1965). If he could get more than a day ahead of his planned writing goals, he felt justified in taking a day off for pleasurable activities. For example, while living in Cuba, he made his fishing trips in the Gulf Stream contingent on extraordinary levels of writing. The late tennis champion Arthur Ashe kept a list of his opponents' weaknesses to use as criteria for self-reinforcement. After each match with the player in question, Ashe would consult the list to grade his effectiveness in exploiting these limitations. The pianist Janina Fialkowska used thoughts of playing poorly to motivate herself to practice more. "I don't want to second-guess myself during the performance ... chide myself for not working harder. I try to avoid such moments at all costs. It's really a matter of having practiced enough" (Mach, 1991, p. 67). Self-regulated students have often reported making television, telephoning, and even study breaks contingent on their completion of homework (Zimmerman & Martinez-Pons, 1986).

The self-regulatory process of *environmental structuring* involves selecting or creating effective settings for learning. Although writers and students appear to use similar tech-

niques to structure their environments, musicians and athletes use distinctive techniques. For example, the French poet and novelist Cendrars described his need to write in a small enclosed place, but the French novelist Marcel Proust, who was distracted by outside sounds, preferred to write in a cork-lined room that he had constructed to screen them out (Barzon, 1964). The British poet and dramatist Ben Jonson believed he wrote best when stimulated by the pungent odor of an orange peel, warmed by a lot of tea and a purring cat (Barzon, 1964). To strengthen the weakest part of his golf game, Jack Nicklaus (1992) built a practice green and sand trap in his backyard so that he could practice his pitches and putts on a daily basis. The pianist Glenn Gould gave up concert hall appearances because he found that

> even the presence of one person would make me tend to show off and to that extent, it actually got in the way of the performance. It meant that I was more concerned with their reaction than I was with what I was doing. (Mach, 1991, p. 92)

Self-regulated students often report studying in specific places where they will not be disturbed, such as a secluded place in the library or their room (Zimmerman & Martinez-Pons, 1986).

The self-regulatory process of *help seeking* is defined as choosing specific models, teachers, or books to assist oneself to learn. There was much commonality in the forms of help seeking that were reported across the four disciplines. It is important to note that help seeking differs from social dependence by its selective focus and limited duration, and there is considerable evidence that students who are not self-regulated tend to avoid asking for assistance because of concern about adverse social consequences of such requests. As examples of help seeking among writers, Victor Hugo had so much trouble resisting the temptations of tavern life while writing, he resorted to giving all his clothing to his valet with strict orders not to return until an appointed time (Barzon, 1964). The pianist Janina Fialkowska described how she preferred Arthur Rubinstein as a coach because he

> couldn't tell me how to do something, but he could demonstrate how it should sound.... So when I'd play something that wasn't up to par, he became very exasperated, and believe me he became exasperated very easily. Then he'd kick me off the bench and play it the way he thought it should be played.... (Mach, 1991, pp. 79–80)

Whenever Jack Nicklaus (1992) felt that some bad habits had crept into his golf stroke, he returned to his former golf instructor for assistance in spotting the flaws and correcting them. "In my case, Jack Grout can get me back to fundamentals in minutes, whereas it might take me weeks of trial and error to iron out a basic fault on my own" (p. 136). Self-regulated students often report finding a study partner to help them study and prepare themselves for examinations (Zimmerman & Martinez-Pons, 1986).

Thus, the use of self-regulatory processes is not confined to students but extends to elite performers, such as writers, athletes, and musicians, to achieve peak performance. These processes are also used by "just plain folks" to function effectively on a daily basis to achieve peak, such as counting strategies used by dairy truck loaders (Scribner, 1984) or recall methods used by shoppers at grocery stores (Lave, Murtaugh, & de la Rocha, 1984). These are practical techniques that the resourceful acquire and hone to a fine degree. Self-regulatory theory provides a framework for analyzing academic studying on the basis of processes used to learn and function effectively in out-of-school and professional contexts.

THE ROLE OF SELF-REGULATORY PROCESSES AND SELF-EFFICACY DURING ACADEMIC STUDYING

These same classes of self-regulatory processes were the focus of Martinez-Pons and my initial investigations of academic studying (Zimmerman & Martinez-Pons, 1986). We decided to use a structured interview, not unlike those conducted with writers, athletes, and musicians, to compare academically successful and regular students' use of these self-regulatory processes. Our assessment procedure involved presenting a series of common learning problems or contexts and asking students specifically how they would respond. The students' answers to these open-ended questions were then coded into key strategic categories similar to those described in Table 2. The procedure for scoring the protocols was reliable (86% intercoder agreement), and the quality and quantity of strategies reported were highly predictive of academic achievement. The differences in the verbal protocols of high and low achievers were dramatic in terms of both the quality and quantity of strategies reported. High achievers reported significantly greater use of 13 of 14 processes that were reported and they used them at a frequency of more than twice that of low achievers. In our first study (Zimmerman & Martinez-Pons, 1986), students' achievement track in school was predicted with 93% accuracy using these self-reports, and these reports were highly correlated with their standardized test performance, $r = .61$.

In a second study (Zimmerman & Martinez-Pons, 1988), students' reported use of self-regulatory processes was found to be factorially separate from their verbal ability and academic achievement, and these self-reports were highly correlated with teachers' ratings of their observed self-regulation in class and completion of homework assignments ($R = .70$). A written form of this structured interview has also been used to assess self-regulatory processes among minority, develop-

mentally disabled, and foreign populations of students (e.g., Ley & Young, 1998; Purdie & Hattie, 1996; Purdie, Hattie, & Douglas, 1996) as well as middle-class Americans. Together these investigations established that qualitative differences in the use of self-regulatory processes during studying could be reliably measured, were distinctive from other psychological constructs, differed across ethnic and national groups, and were highly predictive of students' achievement.

These studies led us next to investigations of how students' use of these self-regulatory methods to guide their studying were motivated. Prominent among the sources of motivation that were studied was students' perceptions of efficacy. Initially, we studied this issue using a cross-group developmental design with 5th-, 8th-, and 11th-grade students attending regular or gifted schools (Zimmerman & Martinez-Pons, 1990). Developmental increases in strategy use were reported by both regular and gifted students, and gifted surpassed the regular students at each grade level. A self-efficacy scale was developed by selecting mathematical problems and verbal definition problems that ranged in difficulty from elementary school to high school levels and by asking students to rate their confidence about answering each item correctly. Corresponding to the increases in strategy use were the increases in verbal and mathematical self-efficacy depicted in Figure 1. The correlation between strategy use and self-efficacy reports was $r = .42$ for verbal functioning and $r = .41$ for mathematical functioning, indicating that self-regulatory strategic competence was related to this key form of motivation.

This finding led to an investigation of the causal role of self-efficacy to self-regulate studying with high school students using path analysis procedures (Zimmerman, Bandura, & Martinez-Pons, 1992). Bandura (1989) developed a multidimensional self-efficacy scale that included two subscales related to academic studying: (a) self-efficacy for self-regulated learning (i.e., for using studying strategies that were assessed in our structured interview) and (b) self-efficacy for academic achievement (i.e., for a range of academic subjects, such as math, science, and social studies). It was hypothesized that self-efficacy to regulate learning would be linked causally to self-efficacy for academic achievement. Also of special interest was the role of academic goal setting. The goal measure used in this study involved the students' expected grade in their social studies course. It was also expected that self-efficacy for academic achievement would predict the grade goals that students set for themselves. It was hypothesized that self-efficacy would be directly linked to the grades the students attained at the end of the academic year as well

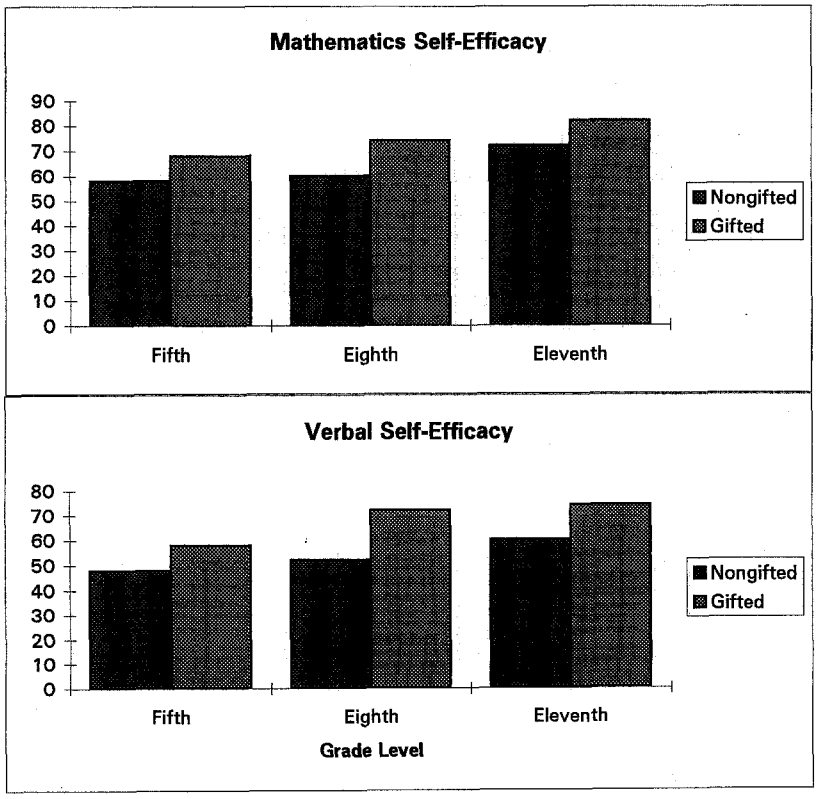

FIGURE 1 Developmental increases in verbal and mathematical self-efficacy for gifted and regular achieving students. From "Enhancing Student Academic and Health Functioning: A Self-Regulatory Perspective," by Barry J. Zimmerman, 1996, *School Psychology Quarterly, 11*, p. 55. Copyright 1996 by Guilford Publications, Inc. Adapted with permission.

as indirectly predictive of the grades through the types of goals they set for themselves. To ascertain the impact of the parents' grade goals for their children, the former were independently asked to respond to the same goal items with regard to their grade expectations for their child. Finally, the students' social studies grades for the prior year were included in the path model because prior achievement in a course area has been historically the best predictor of students' subsequent academic attainment.

The results, which are presented in Figure 2, supported the three main hypotheses: Self-efficacy for self-regulated learning was linked to self-efficacy for academic achievement, which in turn was predictive of the students' grade goals as well as their final grades. Self-efficacy for academic achievement was also indirectly predictive of their final grades through the goals they set. In addition to the impact of the students' self-efficacy beliefs on their goal setting, their parents' grade goals for them affected their goals. This indicated that self and social variables combined to predict the students' academic goal setting and attainment. The prior course grade predicted the parents' goal setting but not the students'. The self-efficacy and goal measures (which were administered early in the fall) greatly increased the prediction of the final grades—31% increase in explained variance. This study not only showed the predictive power of motivational forms of self-regulation, but it also showed that self-beliefs of regulatory efficacy were directly linked to self-beliefs of efficacy regarding academic outcomes.

To establish the generality of these findings, a similar study was conducted with college students enrolled in a writing course (Zimmerman & Bandura, 1994). A new measure of self-regulatory efficacy was developed that focused exclusively on writing as well as a new measure of self-efficacy for academic achievement (that pertained to the final grade in the course). A new measure of goal setting was developed that captured the students' grade aspirations for the writing course. Students' anticipated satisfaction at various letter grades was also assessed and labeled as self-evaluative standards. The students' verbal aptitude score was included as background predictor variable because it is widely used for admission into college. Finally, students who passed the advanced test in English enrolled in an accelerated class in writing, whereas other students enrolled in a normally paced class.

Despite differences in instruments, age of students, and course content in this second path analytic study, we found a very similar pattern of results to those found in the first study, which is evident in Figure 3. Once again, self-efficacy for writing was predictive of self-efficacy for academic achievement, which was in turn predictive of the students' writing goals as well as their final grade in the course. Self-efficacy for writing was also predictive of the students' standards of self-satisfaction, which in turn was linked to the writing goals that students set for themselves. It is interesting to note that verbal aptitude, a primary measure of competence used to predict verbal and written achievement in college, was not directly linked to the final course grade but rather was linked to the self-evaluative standards that students held for themselves. When comparing the level of prediction afforded by the measure of verbal ability, self-efficacy for academic achievement and goal setting increased the prediction of variance by 35%. Clearly, self-beliefs of efficacy in writing and goal setting played a major role in enhancing college students' writing achievement just like they did with high school students' achievement in social studies.

Thus, the distinction and causal link between self-efficacy for academic self-regulation and self-efficacy for academic achievement in these two studies was cross-replicated and showed generality over subject population, academic task, and assessment instrument.

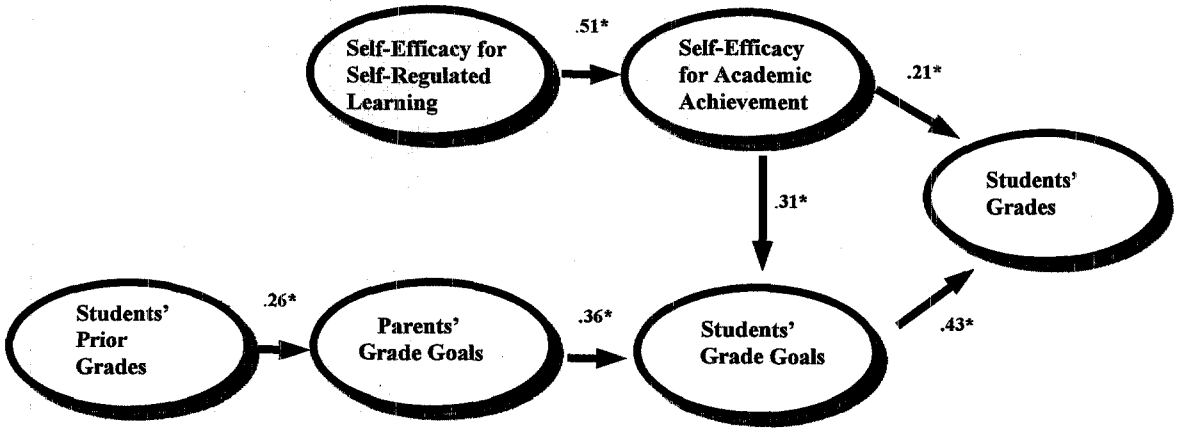

FIGURE 2 Path coefficients for significant paths between variables in the sociocognitive model of students' self-motivation and class grades (*$p < .05$). From "Self-Motivation for Academic Attainment: The Role of Self-Efficacy Beliefs and Personal Goal Setting," by B. J. Zimmerman, A. Bandura, and M. Martinez-Pons, 1992, *American Educational Research Journal, 29,* p. 671. Copyright 1992 by the American Educational Research Association. Adapted with permission.

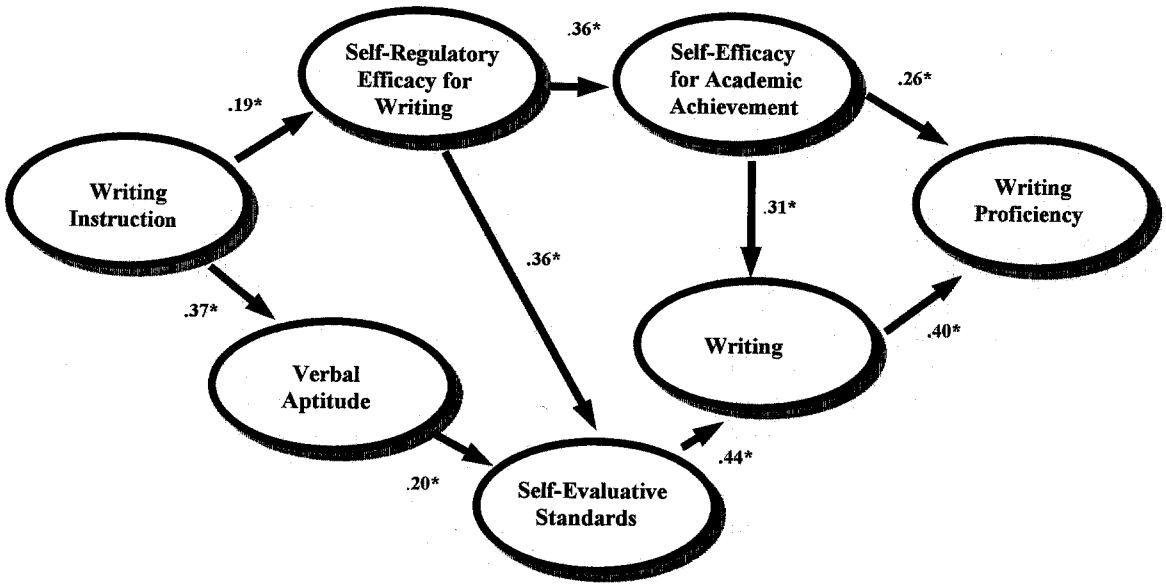

FIGURE 3 Path coefficients for the significant paths of influence between variables in the model of self-regulation and final academic grades (*ps* < .05). From "Impact on Self-Regulatory Influences on Writing Course Attainment," by B. J. Zimmerman and A. Bandura, 1994, *American Educational Research Journal, 31,* p. 856. Copyright 1994 by the American Educational Research Association. Adapted with permission.

A CYCLICAL SELF-REGULATORY MODEL FOR STUDY SKILL INSTRUCTION

In light of this growing body of evidence of the importance of self-regulatory processes in studying to students' success in school, efforts have begun to teach these skills in naturalistic settings. There is already extensive evidence that self-regulatory processes can be taught in experimental training studies, especially the research by Schunk (1994, 1998). There is recent research demonstrating how self-regulatory processes can be taught through a variety of instructional means (Schunk & Zimmerman, 1998). Self-regulation of studying is *cyclical* in the sense that mastery requires multiple efforts, and the results of each effort provides the basis for further development (Zimmerman, 1998, in press). Performance outcomes reveal personal sources of needed changes as well as successes. Ericsson (1996) found that deliberate practice (i.e., structured and goal directed) is indispensable to higher levels of development among expert performers, such as musicians and athletes. Homework has been assigned historically because it was believed to provide systematic practice in studying. For example, in recent unpublished research, we (Zimmerman & Kitsantas, 1998) found that the amount of time students spent studying was predictive of not only their self-efficacy in using various study strategies but also their academic achievement.

A cyclical model of self-regulating academic studying is depicted in Figure 4. Students' awareness of their study skills vary tremendously, and unsuccessful students have only a vague sense of what and how to learn from a homework assignment (Zimmerman & Martinez-Pons, 1986). These students can benefit from systematically observing their functioning and using self-recorded data to ascertain specific areas of strength and weakness. For example, often students are unaware of the inadequacy of their test preparation until after the test is over because they do not test themselves (Ghatala, Levin, Foorman, & Pressley, 1989). The first step of the cycle, *self-evaluation and monitoring*, occurs when students determine the effectiveness of their current study methods.

When the areas of deficiency are identified, students can consider the second step in the cycle of self-regulation, *goal setting and strategic planning*. This involves setting a specific learning goal for oneself and selecting an appropriate strategy to attain it. Students who have well-developed self-regulatory skills can dissect new tasks into components and set goals more effectively than novices (Butler, 1998). The selection of an appropriate study strategy to attain the goal depends on students' repertoire of existing strategies and on access to teachers or peers who can describe a new strategy, demonstrate it, and explain its effectiveness. For example, students who determine that their lecture notes are disorganized may set the goal of rewriting them after class using an outline strategy.

The third step in the cycle of self-regulated learning, *strategy implementation and monitoring*, occurs when students try to execute a study strategy in structured contexts and monitor their accuracy in implementing it. Students need to focus on performing all aspects of the strategy just like a skilled model would. Novice learners often require social feedback and guidance as they attempt to carry out the strategy on their own. For example, a boy trying to remember a French

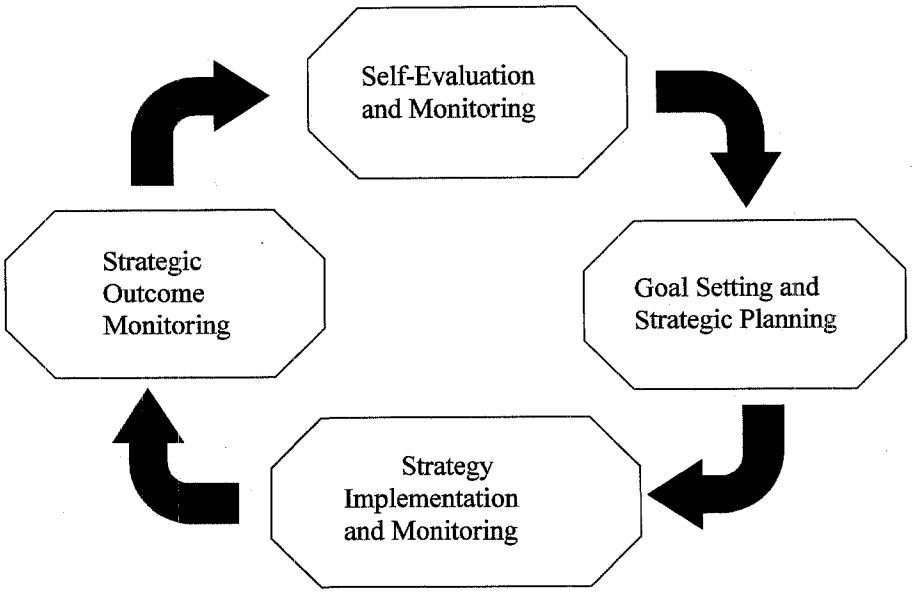

FIGURE 4 A cyclical model of self-regulated learning. From *Developing Self-Regulated Learners: Beyond Achievement to Self-Efficacy* (p. 11), by B. J. Zimmerman, S. Bonner, and R. Kovach, 1996, Washington, DC: American Psychological Association. Copyright 1996 by the American Psychological Association. Adapted with permission.

vocabulary list using the keyword method might have trouble coming up with key words, such as a word to connect the French word *froid* to its English translation *cold,* such as the keyword *frigid.* The boy might keep a record of the words he developed to analyze and discuss with his teacher later.

The fourth step in self-regulation, *strategic outcome monitoring*, occurs when students focus their attention on their studying outcomes in order to adapt their strategy to achieve optimal effectiveness. For example, the boy in our example might test himself on each French vocabulary word and analyze differences between keywords that were successful and unsuccessful in producing accurate recall during practice efforts. The quality of strategic outcome monitoring depends on one's routinization of the strategy, the specificity of one's outcome goals, and one's strategy attributions. Students who have not routinized the strategy will have trouble sustaining it while simultaneously focusing on strategy outcomes or making accurate process-outcome attributions (Zimmerman & Kitsantas, 1997). At the end of test preparation, students should rate their perceptions of self-efficacy for passing a short quiz on the assigned text material. These ratings can be compared to the actual quiz results to assist the students to develop accurate self-evaluative standards. Through repeated practice, the students' sense of self-efficacy for test preparation will increase in accuracy and level.

The model is cyclical because self-monitoring on each learning trial provides information that can change subsequent goals, strategies, or performance efforts. For example, self-monitoring current strategic outcomes may indicate the initial goals are too ambitious or that a particular strategy is not paying off. These results can also lead to setting more appropriate task goals or choosing a new strategy. A recent book for teachers published as part of the Division 15 Series on Psychology in the Classroom, entitled *Developing Self-Regulated Learners: Beyond Achievement to Self-Efficacy* (Zimmerman, Bonner, & Kovach, 1996), described how this cyclical model of self-regulation could be implemented by classroom teachers as part of the regular homework exercises to teach academic studying and performance skills. Five key study skills were taught—time planning and management, text comprehension and summarization, classroom note taking, test anticipation and preparation, and writing.

The self-evaluation and monitoring step was implemented by the teacher by using the following:

- Distributing forms for students to monitor specific aspects of their studying, such as reading assignments, note taking, test preparation, and so forth.
- Presenting students with daily assignments to develop their skills and a weekly quiz for them to assess the effectiveness of their familiar methods.
- Shifting the focus during each class for a week from the merely assessing the accuracy of students' homework to their processes of studying by having them exchange work with their peers, and after a class discussion of optimal learning strategies and outcomes, the peers will evaluate the homework and self-monitoring forms and make suggestions on how the students can improve their methods of studying.

The goal setting and strategic planning step was implemented by the teacher by using the following:

- Soliciting students' perceptions of strengths and weaknesses of their approaches to their studying methods after a week of monitoring and after the first graded exercise. The link between learning methods and learning outcomes is emphasized by the teacher, and students are encouraged to pursue a high level of specificity in their evaluations.
- Suggesting specific strategies that students might utilize to improve their learning methods. Whether the students may adapt the teacher's recommendations or devise their own, they should aim to improve their achievement through a specific set of strategy goals.

The strategy implementation and monitoring step was implemented by the teacher by using the following:

- Asking students to monitor the extent to which they actually implement the new strategies.
- Providing continued graded opportunities for students to gauge the implementation of their new strategies.

Once the students have assimilated the new strategy, the strategic outcome monitoring step was implemented by the teacher by using the following:

- Asking the students to monitor their personal effectiveness in using the strategies and encouraging them to optimize their academic outcomes by varying their learning strategies and determining the most effective combination.
- Continuing to provide graded opportunities for students to gauge the effectiveness of their new strategies and refine their use.

This cyclical system involves the use of simple monitoring forms to help students focus on the selected learning strategy and see its impact on these forms. It also requires students' self-efficacy judgments as part of the self-monitoring process that can inform them (as well as the teacher) of overestimates or underestimates of confidence that can be systematically corrected. The training assists students to become aware of the importance of accurately estimating what they know and do not know academically. These judgments can be plotted to show the student their increasing accuracy and self-efficacy regarding the academic task. Although this description of the instructional sequence is merely a brief overview of the training process presented in the text, it illustrates one way that teachers can show students how to self-regulate their study skills as part of the regular classroom curriculum. The coding and other self-regulatory tools help the students focus on the process of learning (including self-efficacy beliefs) rather than on just the outcomes, which research has shown to have particular benefit (Zimmerman & Kitsantas, 1997).

CONCLUSIONS

Since the topic of academic studying was brought to our collective attention as educational psychologists by Rohwer (1984), it has benefited from research and theory on self-regulation of learning. Self-regulation theories enabled researchers to analyze academic studying in terms of underlying multidimensional processes that students selectively use in specific contexts to succeed in school rather than as a unitary characteristic of students. These processes have been distinguished qualitatively, measured quantitatively, and found to be highly predictive of academic motivation and achievement. Self-regulatory theories have also provided a framework for understanding parallels between self-initiated and self-sustained learning and performance outside the field of academic functioning. There is extensive anecdotal evidence that similar self-regulatory processes are used across such disciplines as music, sports, and writing by seasoned learners. Descriptions of diverse experts' use of self-monitoring, goal setting, strategy use, and other processes reveal that they are not only helpful during initial learning but also in subsequent performance of a skill in naturalistic settings. Thus, there is reason to believe that teaching self-regulatory approaches for studying may be particularly well suited to attain Rohwer's goal of self-education throughout life.

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