# 22

# SELF-REGULATION INTERVENTIONS WITH A FOCUS ON LEARNING STRATEGIES

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Since ancient times we have tried to understand and harness our ability to identify, reflect upon, and take actions to control our own thoughts, feelings, emotions, actions, and destinies. This past quarter century has witnessed incredible progress in our understanding of diverse aspects of self-regulation. This book is a testament to our progress and many important aspects of self-regulation that have been identified and studied (e.g., motivational and cognitive management strategies), and many of the contexts in which it can be used (e.g., adult, mathematics, and reading education; effort management programs) are discussed. The purpose of this chapter is to address self-regulation in relation to the acquisition, use, and control of students' learning strategies. Learning strategies include any thoughts, behaviors, beliefs, or emotions that facilitate the acquisition, understanding, or later transfer of new knowledge and skills. We briefly describe a model of strategic learning that demonstrates the relationships among students' learning strategy knowledge, learning strategy skills, and self-regulation, as well as other variables that significantly impact learning and achievement. We also describe a sample of the interventions that have

been developed to help college-level students become more strategic learners; highlighting a highly successful program developed at the University of Texas at Austin. We start with a historical overview of some of the research and development work that has focused specifically on understanding or modifying the acquisition, use, and control of learning strategies. This overview helps to explain how researchers have come to understand the self-regulatory processes involved in strategy use.

## I. HISTORICAL OVERVIEW

In the early 1970s, the information processing model of cognition (Simon, 1979b) was proposed as a viable way to conceptualize cognitive processes and products. With the establishment of this model (or, perhaps more accurately, family of models), the cognitive revolution (see Simon, 1979a, for a review) was in full swing and the early battles were being fought. Within this new field of cognitive psychology, a consensus was growing among researchers that thoughts or mental processes could be studied and understood directly. This work led to an evolving focus on information processing research and models that emphasized that cognition was something that could be controlled through cognitive and metacognitive processes (Brown, Collins, & Duguid, 1989; Flavell, 1979; Garner, 1987; Pressley & McCormick, 1995), particularly in academic and training learning contexts (Wang, 1983; Weinstein, 1978).

## II. LEARNING STRATEGIES CAN BE MODIFIED OR LEARNED

One of the first practical applications of these new information processing theories was in the area of memory strategies that could be used in educational settings (Wood, 1967). Research on mnemonics and advances in our understanding of associative networks (Wang, 1983; Weinstein, 1978) paved the way for researchers to investigate different types of training that could be used to improve students' paired-associate learning (e.g., Danner & Taylor, 1973). The model of what it meant to be a learner was shifting from viewing the learner as a passive receptacle for knowledge to the leaner as an active, self-determined individual who processes information in complex ways (Weinstein, Underwood, Wicker, & Cubberly, 1979). This shift in thinking led to development of the concept of planful and self-directed "cognitive strategies" (Weinstein, 1978; Weinstein et al., 1979). This shift and the ideas and concepts that have been derived from it have been cited among the major accomplishments in instructional research in the last 30 years (Rosenshine, 1995). In particular, the conceptu-

alization of cognitive strategies is seen as a critical development in both instructional research and educational psychology, because knowing about and using learning strategies is a major factor for discriminating between low achieving students and those who experience success (Alexander & Murphy, 1998; Pintrich & De Groot, 1990; Weinstein, Goetz, & Alexander, 1988). One of the most important findings in the early strategy literature was that cognitive learning strategies represent a mutable factor in promoting academic achievement for students (Pintrich, Brown, & Weinstein, 1994; Weinstein, 1978).

Using cognitive learning strategies involves the intentional manipulation of information by the learner through processes such as repetition, elaboration, or reorganization of the material in such a way that the new information is able to be stored in the learner's associative network and accessed for retrieval. Weinstein and her colleagues (Weinstein & Meyer, 1991) further defined cognitive learning strategies as including the following three critical characteristics: they are goal-directed, intentionally invoked, and effortful.

As researchers learned more about cognitive strategies, they became interested in answering the following questions: Are they modifiable? Can we teach students how to improve their repertoire of learning strategies and will this affect their academic achievement? In an early study in this area, Weinstein (1978) demonstrated that cognitive strategies could, in fact, be modified through instruction. After a 6-week training program, junior high school students improved their learning performance for both laboratory (e.g., paired-associate word lists) and everyday learning tasks (e.g., a shopping task). In the early 1980s, a large number of researchers began investigating the effectiveness of specific memory strategies, such as mnemonics and categorization strategies (e.g., Bean, Inabinette, & Ryan, 1983). Many of these studies, which examined the effectiveness of strategy use, were investigating strategies that students had learned largely on their own, rather than those that they had learned from planned direct instruction. Several researchers also investigated how strategies spontaneously developed in children (e.g., Bjorklund & Zeman, 1983; Wade, Trathen, & Schraw, 1990). Although it did seem that strategies could develop spontaneously, their development was dependent on students' exposure to effective models of the use of specific strategies and to environments that provided opportunities for practice. However, many students did not have exposure to effective memory strategy use, and even when they did, not all students took advantage of the information provided to them in their environment (Bielaczyc, Pirolli, & Brown, 1995).

Only recently have effective programs focusing on learning to learn been developed, and most of these are at the college level under the rubric of "developmental education." Developmental education focuses on helping college students succeed and excel in their postsecondary studies by

deepening their prior knowledge in critical subject areas (e.g., mathematics), helping them to develop effective and efficient reading skills, or helping them to develop more effective learning and study strategies (e.g., the course to be described later at the University of Texas and programs offered through learning centers at many institutions). Over time, many developmental education programs at the college and university level have shifted their focus to developing students' self-regulation and strategic learning strategies and skills in a variety of areas related to student success and retention to graduation (e.g., DuBois, 1995; Hattie, Biggs, & Purdie, 1996; Lipsky & Ender, 1990; Weinstein et al., 1997).

## III. THE NATURE OF STRATEGIES AND STRATEGY INSTRUCTION

Although the importance of providing strategy instruction is clear from the work described in this and other chapters in this volume, how to go about providing strategy instruction is less clear and less well established. Many researchers are developing integrated approaches to examine strategic and self-regulated learning (e.g., Boekaerts, 1997; Pintrich, Marx, & Boyle, 1993; Weinstein et al., 1997). Many of the topics that are part of these integrated systems and are critical to strategy instruction (e.g., motivation) are more thoroughly described in other chapters within this volume. We only briefly discuss these areas and their importance to learning strategy instruction.

The primary goal of strategy instruction is to help students become "good strategy users" or "good thinkers" (Pressley, Borkowski, & Schneider, 1987; Pressley, Forrest-Pressley, Elliott-Faust, & Miller, 1985; Pressley & McCormick, 1995). One thing we mean when we say "good strategy user" is a student who possesses three kinds of knowledge about strategies: declarative, procedural, and conditional. Declarative knowledge is simply knowing about a variety of strategies (Paris, Lipson, & Wixson, 1983); for example, what does summarizing in your own words mean? Procedural knowledge is knowing how to use these strategies (Anderson, 1990; Garner, 1990); for example, knowing *how* to summarize in your own words and being able to do so effectively. Acquiring these two types of knowledge implies very different types of instruction. Students may obtain declarative knowledge about strategies by simply being told about them. However, these students will need hands-on practice with these strategies in order to learn *how* to use them. I may know the components of a three-part essay, but I had to create many essays before I felt that I knew how to write one. Acquiring conditional knowledge about strategies also requires a specialized type of instruction. Conditional knowledge is knowing when (and when not) to use particular strategies (Paris et al., 1983). Students need to

know the strengths and weaknesses, or costs, of using different strategies. Some strategies are applicable in some situations and not others, although the conditions might look the same on the surface. For example, mind mapping (mapping out relationships within the content being studied) is an excellent method for learning important material or material that is very complex or difficult for a student. However, mind mapping is a very time-intensive strategy and cannot be used for all of a student's learning needs. Therefore, for students to be effective in their use of any given strategy, they must first obtain conditional knowledge about when that strategy might or might not be effective. A good base of conditional knowledge can provide the foundation for transfer of strategy knowledge and skills to new situations (Garner, 1990; Paris et al., 1983).

## IV. TYPES OF LEARNING STRATEGIES AND THEIR RELATIONSHIP TO OTHER STRATEGIC LEARNING COMPONENTS

An early taxonomy of learning strategies was provided by Weinstein and Mayer (1986). In this taxonomy, five categories were delineated: rehearsal, elaboration, organization, comprehension monitoring, and affective strategies. Three of the categories represent strategies that operate directly on the information to be learned to aid in acquisition and organization of the information. The remaining two categories represent strategies that provide metacognitive and affective support for learning.

Strategies that aid in acquisition and organization of information can be applied to both basic and complex learning tasks. Basic learning tasks involve rote or verbatim memorization or learning. Complex learning tasks involve higher-level conceptual or content learning. For both basic and complex learning tasks, one of three types of strategies, either rehearsal, elaboration, or organization, can be used to master information, depending on the learner's purpose in acquiring the information.

Rehearsal strategies are used to select and encode information in a verbatim manner. Rehearsal strategies that are used for basic learning tasks involve recitation or repetition of information. Rehearsal strategies used for complex or content learning tasks include copying material, taking notes, and underlining or marking texts. Elaboration strategies are used to make information meaningful and to build connections between information given in the learning material and a learner's existing knowledge. Elaboration strategies for basic learning tasks include creating mental imagery and using mnemonic techniques to associate arbitrary information to personally meaningful knowledge. Elaboration strategies for complex

learning tasks include strategies that manipulate the information by paraphrasing, summarizing, creating analogies, relating the new information to prior knowledge, questioning, and trying to teach the information to another person. Organizational strategies are used to construct internal connections among the pieces of information given in the learning material. Organizational strategies for basic learning tasks include sorting or clustering related information based on common characteristics or relationships. Organizational strategies for complex learning tasks include outlining or diagramming the information and creating spatial relationships using strategies such as networking.

In addition to the strategies the learner uses to interact directly with the learning material, Weinstein and Mayer proposed two types of support strategies that could be used to enhance the acquisition of knowledge. Comprehension monitoring strategies and affective control strategies were thought to work in concert with the previously defined strategies for both basic and complex learning tasks. Comprehension monitoring strategies are metacognitive strategies used to assess the learner's understanding of the learning material and to executively control the use of acquisition and organizational strategies. Comprehension monitoring strategies include self-questioning, error detection, and problem solving.

Affective and support strategies are used to help focus the learner's attention and maintain the learner's motivation. Affective and support strategies include positive self-talk, anxiety reduction, and time management.

As can be seen in the Weinstein and Mayer (1986) taxonomy, as well as more recent conceptual work by other researchers, the use of cognitive strategies does not occur in isolation. Self-regulated and strategic learning involve integrated processes. The invocation and use of cognitive learning strategies is connected to other aspects of self-regulation such as motivation and metacognition (Paris & Cunningham, 1996; Pressley & McCormick, 1995). For example, from both empirical and anecdotal evidence it is clear that knowing what strategies to use and knowing how to use them is not enough. Students must want to use them and must maintain that desire throughout the learning task. To use cognitive learning strategies effectively, students must be able to manage the amount and direction of their effort, must be motivated to engage in the task, and must be volitional in their use of strategies (Corno, 1994).

The kinds of goals students have also impacts their strategy choice (Paris & Cunningham, 1996). Strategy use must be goal directed. This aspect of strategic learning has two implications. Goals are required so that strategic learners have a reference point to use for continued self-evaluation. The types of goals they set also may impact the kinds of strategies they select and the way they implement them (Pintrich, 1989).

## V. MODEL OF STRATEGIC LEARNING

Broadly defined, students' learning strategies include any thoughts, behaviors, beliefs, or emotions that facilitate the acquisition, understanding, or later transfer of new knowledge and skills. In the past, researchers and educational program developers usually have focused on one or a subset of topics within this broad definition, such as cognitive elaboration strategies or student motivation. Current work is more purposefully examining the interaction among two or more components or factors related to the acquisition and use of learning strategies. This change is a result of increasing understanding of the nature of student learning and school achievement at all educational levels. Like most areas of self-regulation, it is the interaction among varying factors that results in successful learning and transfer of new knowledge and skills. The components and factors that seem to have the greatest impact on students' acquisition and use of learning strategies are summarized in a model developed by Weinstein (Weinstein, Husman, and Dierking, in press), which is an extension of an earlier model developed by Weinstein and Mayer (1986). This model focuses on variables that impact strategic learning, that is, learning that is goal driven. Weinstein's model of strategic learning (Weinstein et al., in press) has at its core the learner: a unique individual who brings to each learning situation a critical set of variables, including his or her personality, prior knowledge, and school achievement history. Around this core are three broad components that focus on factors that, in interaction, can tremendously influence the degree to which students set and reach learning and achievement goals. These three components are referred to as skill, will, and self-regulation (see Figure 1). Both the components and the interactive nature of the model are discussed further in Section VIII, which describes the strategic learning course at the University of Texas at Austin.

## VI. TYPES OF STRATEGY INSTRUCTION AND THEIR EFFECTIVENESS

Several researchers have reviewed the literature available on programs designed to teach cognitive learning strategies. (When searching this literature, it is important to note that most developmental educators describe their programs that provide instruction in cognitive strategies as "study skills programs"; Hattie et al., 1996.) Simpson, Hynd, and Burrell (1997) created a program classification as a starting point for evaluating the effectiveness of particular types of strategy instruction. In our discussion of this classification scheme we highlight one of the most important criteria for evaluating the success of cognitive strategy instruction. That is,

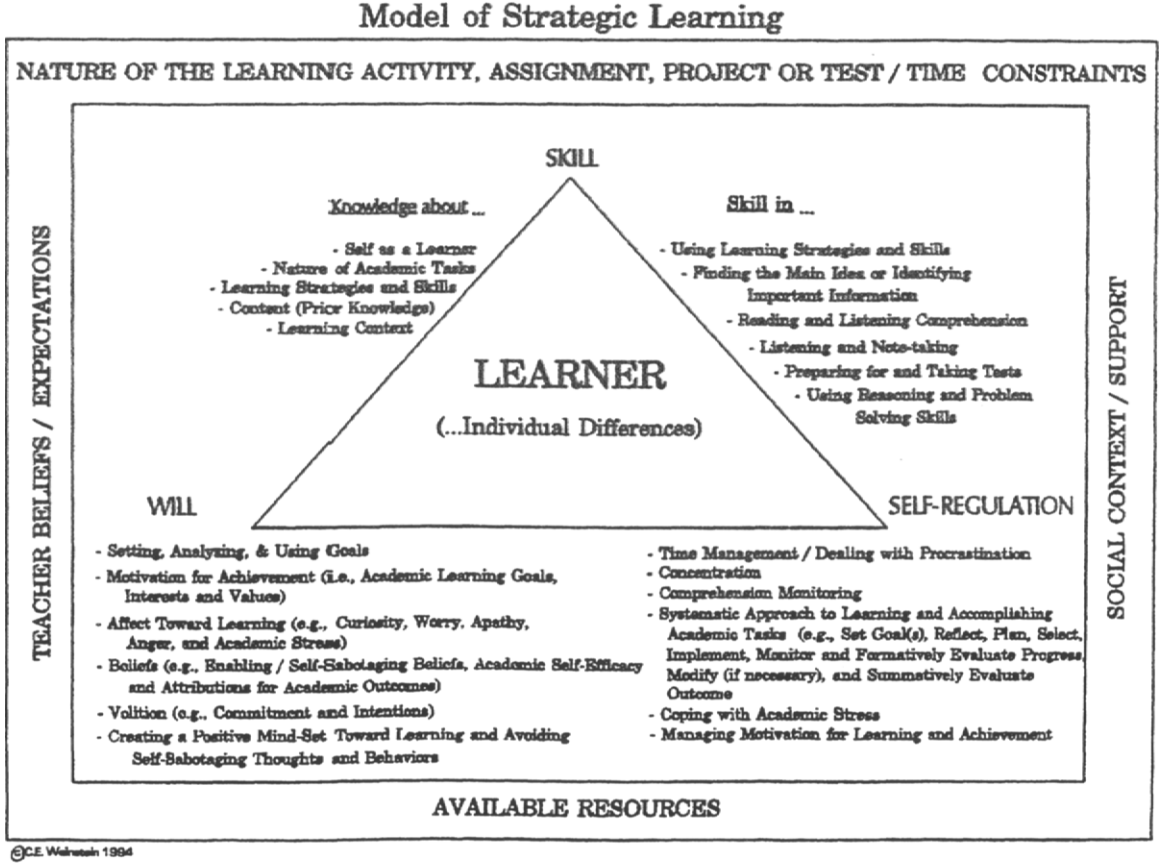


FIGURE 1 The Model of Strategic Learning. © C. E. Weinstein, 1994.

what is the degree to which students transfer the strategies and skills they learn to other contexts they encounter in academic settings, following their participation in a learning strategies course? This question is central for researchers and for both policymakers and educators concerned about the feasibility and practicality of providing strategy instruction. If transfer to other academic coursework and future learning tasks does not occur, these programs are of little value to the students or the institution.

Simpson et al. (1997) divided academic assistance programs into five general categories. The first category includes learning-to-learn courses that are semester-long, for-credit courses that are developmental in nature rather than deficit oriented. These courses are based on conceptual work in psychology and education (e.g., see the other chapters in this volume), and tend to focus on assisting students to become self-regulated learners by developing a repertoire of learning strategies that they can modify and adapt to novel situations. Learning-to-learn courses tend to be more process oriented as well. Students are encouraged to identify and utilize appropriate strategies based on the learning conditions they experience in the other courses they are taking concurrently with the learning-to-learn course. Such an orientation appears to enhance transfer because students develop an awareness of the conditions associated with a given academic task and then select the strategies that best fit the conditions, their goals, and their relevant prior knowledge and skills. Learning-to-learn courses have been demonstrated to increase grade-point averages, retention, and graduation rates significantly (Weinstein, 1994; Weinstein et al., 1997). This type of strategy instruction also has been referred to as adjunct instruction, because it is presented as an adjunct to the usual content-area courses (Weinstein, 1994; Weinstein & Meyer, 1994).

Simpson et al.'s second category is supplemental instruction or paired courses. Like learning-to-learn courses, these are generally developmental in nature and involve the embedding of strategic learning concepts (learning and study strategies) within the content of a specific course or in supplemental sessions (e.g., labs and small group seminars). As a result, these programs promote academic success in relation to a specific course or subject matter, and are less likely to be transferred to other courses. These programs appear to impact the grades obtained within the specific course positively, but do not seem to have much impact on the grades achieved in other courses (Simpson et al., 1997).

The third category is required programs for underprepared students. This category includes summer interventions and bridge programs (between high school and college). These programs are generally required for certain groups of first year students who are considered to be at risk for being underprepared for college. The summer or bridge programs generally focus on reading, writing, and more traditional study skills to prepare students for the coming academic year. Unfortunately, these programs are

likely to result in much less transfer of learning strategies due to the lack of concurrent course work in which to practice using the strategies and due to the time lag between when the strategies are learned in the summer and when they can be applied in the fall.

Simpson's fourth category is approaches integrating reading and writing. These programs are sometimes known as writing-to-learn or writing-across-the-curriculum programs, and are generally process- (as opposed to product-) oriented programs. The format of these programs varies, but typically it involves courses where a writing course is paired with a reading or content course. Writing courses also may be embedded within learning strategies or other courses. The goal of these programs is to enhance the writing proficiency of students as well as to enhance performance in the content area course. These programs have not demonstrated consistent results (Ackerman, 1993).

Simpson's fifth and last category includes learning assistance centers that provide a wide variety of services, such as self-paced and small group skill-specific programs to improve reading, writing, and various study skills as well as tutoring in specific subject areas. Students make use of these usually brief stand-alone services as they feel the need. Whereas each of the services provided by the centers is generally independent of the others, there is no overarching learning theory or conception guiding the provision of the services. Due to the varied offerings and the student-initiated nature of these programs, very little quantitative data on their impact on academic achievement and transfer are available.

It seems that the learning-to-learn end of Simpson's continuum has the greatest potential for positively impacting academic performance and transfer of skills as demonstrated through cumulative grade-point average, retention, and graduation. Learning-to-learn programs tend to be process-oriented programs that provide students with conditional knowledge as well as declarative and procedural knowledge. They also tend to provide a range of strategies and a self-regulation process to manage their application across varying academic challenges.

Another method that has been used to help students develop effective learning strategies within the context of a content area course is called the metacurriculum (Weinstein & Meyer, 1994). Instructors who use the metacurriculum provide direct instruction concerning motivational, self-regulatory, and cognitive strategies as it specifically relates to their content area (see Entwistle & Tait, 1992, for examples). Embedding the instruction within the context of a class provides an opportunity for immediate and authentic use of learning strategies. In their review of learning skills interventions, Hattie et al. (1996) found that learning skills courses were most successful when they were taught in context. This finding is consistent with other data on situated cognition (Brown et al., 1989). These findings make a strong case for the incorporation of strategy instruction into teacher training programs. Teachers need to be able to effectively show

their students how to learn course material most effectively. Although it is clear that this form of instruction can be an effective way to help students develop strategies within a domain, it is not clear that it is the most effective way to provide strategy instruction to all students in varying contexts. There are both pragmatic problems and conceptual problems with relying on the metacurriculum for all strategy instruction. The pragmatic problems are due to the fact that many instructors (particularly at the postsecondary level) feel that they have too little time to cover the course material, much less provide strategy instruction as well. The conceptual problems arise from the transfer issues raised earlier. Although some students are able to effectively transfer what they learn in a specific course to other novel situations, this seems to require a deep understanding of the strategies and how to use them (Salomon & Perkins, 1989). Students who have experienced consistent modeling of strategic learning and have a rich prior knowledge base of both strategies and content information may need only strategy instruction imbedded in a content course. However, for students who are considered at risk for failure or low performance in school, it is much more likely that they have less experience and prior knowledge about strategies, and require more practice and instruction. This kind of practice, for all practical proposes, can be provided only in a separate, or adjunct, course.

## VII. IMPORTANT COMPONENTS OF ADJUNCT COURSES

Based on the research and applied literature, there are several components that seem to be needed for an adjunct course to be successful. The first is that there must be ample opportunity to practice using the strategies on authentic tasks. Students not only need to understand that strategies exist, they also need to know how to use them. It is not enough for students to be told to apply a strategy any more than it is enough simply to be told to ride a bicycle. At first learning how to ride a bicycle may seem cumbersome and difficult. However, over time, if we are provided with opportunities to practice, we can become proficient. It is the same with strategies. With guided practice and feedback we can become proficient enough at using a strategy that it becomes invisible to us and we are able to focus fully on learning the content.

The second component is that to enhance transfer, cognitive strategy instruction needs to be taught using a model (Hadwin & Winne, 1996). According to Sternberg and Frensch (1993), there are four mechanisms of transfer that, taken together, have critical implications for learning-to-learn courses. The first mechanism is encoding specificity, in which the retrieval of information from memory is dependent on the manner in which the

information was encoded. Information that is encoded as context specific or self-contained is likely to be accessed within that context. Students in a learning-to-learn course need to complete assignments that require them to apply components of the model to a variety of contexts. Stahl, Simpson, and Hayes (1992) suggested that having students practice the strategies being learned on real course work from other classes results in more natural strategy transfer.

The second mechanism is organization, which refers to how the information is organized in memory. Information that is organized within a clear framework and is connected to prior knowledge is likely to facilitate retrieval of that information (Alexander & Judy, 1988). Therefore, strategic learning courses should encourage students to become involved in actively seeking to organize information into a format that is meaningful to the students themselves. With a framework in mind, the learner can identify which information is important or critical for them to focus on and which information is of secondary importance or just supporting details. This is also one of the reasons why it appears to be helpful to use a conceptual model in a learning strategies course.

Sternberg and Frensch's third mechanism for transfer is discrimination, which refers to the tagging of information as relevant or irrelevant to a novel situation. If the instructor provides a model for the students to use to organize the information they are learning, the students can use the model to help them discriminate between relevant and irrelevant information in novel situations, thus improving transfer (Salomon & Perkins, 1989).

The fourth mechanism is set, which is how the learner mentally approaches a problem or learning task; that is, whether or not the learner is planning to transfer or use what he or she is are learning. To maximize the transfer of information presented in adjunct learning-to-learn courses to courses the students will participate in during the rest of their academic experience, the students need to know how helpful the strategies are and how they have helped others who are similar to them. The students need to value and feel efficacious about using those strategies (Pintrich & Schunk, 1996; Schunk & Zimmerman, 1994).

## VIII. THE NATURE AND IMPACT OF A COURSE IN STRATEGIC LEARNING AT THE UNIVERSITY OF TEXAS

The course we describe was originally developed by Weinstein in 1977. A major purpose of this course is to provide learners with an awareness of the range of learning strategies and techniques available to them, the conditions that influence the selection and application of strategies (i.e.,

when to use which strategy), and a process for managing and evaluating the application process. Thus, this course addresses not only the declarative and procedural knowledge of learning strategies, but also the conditional knowledge by teaching students how to assess the learning situation and identify which strategies or techniques most likely will produce the desired outcome within the constraints and resources (personal and contextual) of any given situation.

One critical aspect of this course is that Weinstein's Model of Strategic Learning (Weinstein et al., in press) is at its center. The development of interventions specifically designed to help students become more strategic, successful learners is a relatively new phenomenon. Although interventions have been developed for late elementary, middle, and high school students, the most extensive interventions have been developed for postsecondary students.

An underlying concept of the Model of Strategic Learning is that learners need to be aware of elements from all four major component areas of the model: skill, will, self-regulation, and the academic environment. The use of a model in the design of a course and the direct teaching of that model helps the students to make the necessary abstractions for transfer to occur (Salomon & Perkins, 1989; Stahl et al., 1992).

The course begins with an overview of an outline version of the model. This provides students with a glimpse of the larger picture of the various factors that impact their academic performance. Throughout the course the students are not only taught specific strategies, they are also taught how the strategies fit together and interact with the other elements and larger components in the model. It is the interactions among components from all four areas (skill, will, self-regulation, and the academic environment) that are crucial for strategic learning, transfer of learning, and ultimately students' academic success, retention, and graduation (Hadwin & Winne, 1996).

Prior to the introduction of the model, the students are given extensive assessment instruments, including a reading battery and the Learning and Study Strategies Inventory (Weinstein, Schulte, and Palmer, 1987). The Learning and Study Strategies Inventory (LASSI) is used in this course to provide students with diagnostic and prescriptive information for each of the 10 scales, which include aspects from the skill, will, and self-regulation components of the Model of Strategic Learning.

Within the skill component, knowledge about oneself as a learner, knowledge about different academic tasks, and knowledge about context is assessed. Knowledge about oneself as a learner is important because it is a key step toward metacognitive awareness (a critical feature of strategic learning) (Pintrich, Wolters, & Baxter, in press) and the ability to think strategically about learning. This includes knowing one's strengths and weaknesses as a learner and one's attitude, motivation, and anxiety level

toward learning. This provides crucial information for conditional knowledge, because it cues learners to areas where they may anticipate problems in a given situation so that they may plan to avoid or minimize those problems.

Another element of the skill component is knowledge about different types of academic tasks, which includes an understanding of what is required to successfully complete a given academic task (e.g., writing a term paper), that is, the steps to be taken and how much time should be required. This directly impacts conditional knowledge by clarifying what needs to occur to reach a desired outcome.

Knowledge about the learning context is also a critical factor for strategic learners in terms of both their understanding of the academic environment and their instructor's beliefs and expectations, as well as their perception of the instrumentality of a course. For example, how will their performance in a particular course be evaluated and how will that evaluation impact them? How does the content of the course relate to their future academic, personal, or occupational goals? By providing instruction about these aspects of strategic learning and linking them to the effective use of cognitive learning strategies, the students obtain valuable conditional knowledge. By recognizing the importance of the information a course contains for their future goals, students may understand more readily the need to learn about and use strategies that are more effective for long-term retrieval (Husman & Lens, 1999). This implies that learners know which strategies are helpful to them for long-term retrieval of information. This is where the learning strategies element of the skill component of the Model of Strategic Learning comes in.

Knowledge and skill acquisition strategies that help to build bridges between what learners already know, the new things they are trying to learn, and how they could potentially apply the course content to current or future academic situations are used to increase knowledge of context as well as the participants' level of understanding of the course content. Such strategies help to build meaning for learning and encourage students to learn in such a way that their new knowledge will be easier to recall and use (Pressley & McCormick, 1995). If students understand the conditional knowledge necessary to successfully use and manipulate a strategy, they are more likely to acquire and transfer the strategy to new situations (Paris et al., 1983). Students in the learning-to-learn course are taught declarative, procedural, and conditional knowledge about three general types of knowledge acquisition strategies: rehearsal, elaboration, and organization. During the semester (approximately 14 weeks with 3 hours of class per week) students are provided with opportunities to apply these strategies to specific course content in their other classes. Providing students with the opportunity to apply strategy instruction to actual course material is considered critical for both acquisition of strategy knowledge and transfer

to new situations (Hadwin & Winne, 1996; Rosenshine, Meister, & Chapman, 1996; Simpson et al., 1997; Stahl et al., 1992). Specifically, after the students have considered their academic goals for the semester through class assignments and assessments and have considered their own academic strengths and weaknesses, they are provided with an overview of the information processing theory that is the basis for the strategy instruction. After the students have developed some degree of theoretical understanding for why strategies work, how they can help them, and how knowledge acquisition strategies fit into the model of strategic learning, they are required to complete a class assignment. This class assignment requires the students to use two new learning strategies while they are studying for another class and report on the strategies' effectiveness. By requiring the students to engage in using and evaluating these new strategies, the students get valuable experience and practice. By providing the students with an understanding of both information processing theory and how knowledge of strategies fit into the model of strategic learning, the students are better able to transfer what they learn to courses outside of those they use during the practice assignment.

Knowledge about strategies and knowledge of the contexts the strategies are to be used in are, of course, not enough. The students must also want to use the strategy. Students must be aware of their goals and how those goals impact their academic performance (Hadwin & Winne, 1996). As we said previously, strategies are simply tools used in the service of goals. How the strategies will be used or whether they will be used at all is determined in large part by the students' goals and their motivational orientation (Pintrich, 1989). Before strategy instruction can begin, students must first examine their goals and their motivation for being in school. Therefore, the first few weeks of the course are devoted to examining the will component of the model. This component includes elements such as motivation for attending college or taking a particular course, setting, analyzing, and using goals, anxiety about performing well in learning situations, and attitude toward learning and the degree to which education is valued. These are all-important variables for initial learning and subsequent transfer to other course work. Motivation and attitude toward learning are also closely related to knowledge of context. The instrumentality that the learner perceives for the course content affects his or her motivation for actively participating and the value he or she places on the course (Eccles, 1983; Husman, 1998; Husman & Lens, 1999). In addition to the perceived value of a course, the presence and types of students' goals for the class can have a significant effect on the degree to which they are strategic in their learning in the course (Heyman & Dweck, 1992; Pintrich, 1989). Students who are performance oriented and motivated primarily by extrinsic factors (e.g., grades) tend to use surface-level strategies (e.g., rehearsal strategies), whereas students who are motivated by their enjoy-

ment of the learning process tend to use deeper strategies (e.g., elaboration strategies). The course helps students to develop and examine their goals in the first few weeks of the course through both direct instruction and completion of an extensive project. By helping students become aware of the relationship between their goals and their academic achievement, students learn that they can consciously control their own thoughts and behaviors. The process of regulating motivation and strategy use creates a bridge to the self-regulation component of the model.

From the self-regulation component of the model, the systematic approach to learning plays a crucial role in contributing to academic success and enhancing retention and graduation rates. This approach cues students to consider all aspects of the model in planning for and completing academic tasks. Throughout the learning-to-learn course, students use this approach on projects involving material and assignments from other courses they are taking concurrently. This provides them with opportunities to practice transferring their use of this self-regulatory technique. Briefly, the systematic approach to learning involves eight steps:

1. Setting a goal
2. Reflecting on the task and one's personal resources
3. Developing a plan
4. Selecting potential strategies
5. Implementing strategies
6. Monitoring and formatively evaluating the strategies and one's progress
7. Modifying the strategies if necessary
8. Summatively evaluating the outcomes to decide if this is a useful approach for future similar tasks or if it needs to be modified or discarded for future use

The middle of the course is focused on providing training in specific learning strategies that the students are then encouraged to use in their other courses as part of the projects involving the systematic approach. This provides the students with the practical experience of applying strategies in different contexts while maintaining a metacognitive awareness about their activities and the success or problems they encounter.

The last portion of the course is devoted to reintegration of the components and elements of the model. The purpose of this is to emphasize for the student the heuristic nature of strategic learning and assist the student to understand the interactive nature of the model. Both the initial introduction of the model and the final reintegration of the parts of the model provide the students with the tools they can use to make mindful abstractions about the course. The issues involved in transfer are also directly emphasized.

Salomon and Perkins' (1989) concept of high-road transfer, particularly forward-reaching high-road transfer, and their concept of "mindful abstraction" seem to fit quite well with the tenets of Weinstein's Model of Strategic Learning as well as other conceptions of self-regulated learning. In each of these conceptions the learner is metacognitively aware that the information being learned has potential current and future applications outside of the original learning context. Salomon and Perkins (1989) stated that the main characteristic of the high road to transfer is the mindful generation of an abstraction during learning. This abstraction then can be applied in the future to a new problem or situation. The mechanism by which this takes place is the deliberate process of separating cognitive elements from the context in which they were learned and considering them for application in quite different contexts.

Research and evaluation data for this course have been obtained in a number of ways. From semester evaluations of the pre- and postdata on the Nelson Denny Reading Test (Brown, Bennett, and Hanna, 1981) and LASSI scores, it was found that students evidenced highly significant gains on these measures. However, given the importance of transfer issues in cognitive process learning contexts, data concerning the long-term effects of the course will be highlighted. The question addressed with this study was what impact the course had on students' subsequent GPAs and retention at the university over a 5-year period. The most interesting data concerning transfer data appears in the fifth-year followup statistics. Approximately 55% of the students who entered in 1990 and did not take the strategic learning course graduated after 5 years; this statistic has remained about the same for a number of years. However, despite significantly lower SAT scores and significantly lower motivation scores on the LASSI Motivation Scales, approximately 71% of the students who successfully completed our course (primarily those who did not drop out or fail due to excessive absences) graduated after 5 years. This 16-point difference is a dramatic finding that supports the long-term retention effects of an intervention in learning strategies. In addition, the cumulative GPAs for these students were higher than for the general population. These data offer strong support for the importance and impact of developmental education that emphasizes learning strategies for students at risk for academic failure or low achievement.

## IX. FUTURE DIRECTIONS FOR LEARNING STRATEGIES RESEARCH

We have come a long way in our understanding of learning strategies and their role in strategic, goal-driven learning. However, we still have crucial issues and questions that need to be addressed both for our

conceptual understanding of the processes and variables involved and for building a more solid foundation for the development of applications at all educational levels and in diverse educational settings, both in and out of formal school environments. For example, there is a need for more research that investigates the development and use of learning strategies and processes by young children and early teenagers. What are the precursors of effective strategy use? How can we facilitate the development of these skills at differing ages? What can we do to help teachers incorporate learning-to-learn activities into their classroom teaching? We also need to investigate further the nature of transfer of cognitive skills. How do we facilitate high-level transfer across tasks and content areas? How do we help students learn to cue themselves to transfer strategies? We need more refined models that learners can use to help them identify the most critical skill, will, and self-regulation elements they must consider in a given learning situation. How can we help them learn to take more control of their own learning processes and outcomes? Finally, we need to investigate the changing nature of learning in computer and distance learning environments, and the implications for both the roles played by learning strategies and the design of these learning environments.

This list is not in any way meant to be exhaustive, but it is reflective of the vibrant nature of the field of self-regulation and the critical needs we face in preparing for the learners and learning demands of the 21st century.

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# 23

# SELF-REGULATION

## DIRECTIONS AND CHALLENGES FOR FUTURE RESEARCH

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This handbook was designed to present the current state of the field of self-regulation, providing foundations of knowledge for the development of a more comprehensive understanding of self-regulation theory, research, and applications. The chapters in this book reflect recent advances in conceptualization, methodology, research, individual differences, and areas of application, and represent some of the best contemporary thinking and research on key facets of self-regulation. The work in this book represents current perspectives in the area of self-regulation and some of the contemporary ways in which changes in this domain have taken place. The contributing authors summarize and discuss important themes and issues, raising critical questions and providing some of today's best guesses about the answers. Many of the people blazing the trail to those answers over the past two decades have contributed their insights to this book.

To those who came of age professionally during the late 1970s and afterward, the concept of self-regulation is a natural and organic part of the landscape of psychology and education. However, this was not always the case. The vast majority of work in this field has occurred over the past 15 years or so, with self-regulation now the subject of intense professional interest and scrutiny. Research in the area of self-regulation has proliferated in the past few years, and synthesizing scholarship in this sprouting domain is quite a substantial task, the scope of which is evidenced by the

number and variety of chapters in this book. Today, after a virtual explosion of work in this area, the topography of research and theory pertaining to self-regulation has changed in a number of ways.

Although this book covers considerable terrain, many additional questions remain unanswered. Presently, a good number of issues, from the conceptual, to the methodological, to the philosophical, remain unresolved. The refinement of self-regulation models, research, and applications appears to be an important goal for scientific psychology in the 21st century. To advance this goal, we wish to point out several overarching issues that need to be addressed in future research efforts in this area. (In the following discussion, references relate to handbook authors and chapters, unless otherwise indicated by asterisk.)

## I. DEVELOPING A TRACTABLE CONCEPTUAL FOUNDATION AND CONSISTENT NOMENCLATURE OF SELF-REGULATION CONSTRUCTS

To facilitate communication among researchers in the self-regulation domain, a tractable conceptual foundation and taxonomy for self-regulation constructs needs to be systematically developed. At present, there is considerable confusion in the literature with respect to the criterial attributes of self-regulation, its key components, and related constructs from the same semantic domain. As noted by a number of contributors to this volume, there are almost as many definitions and conceptions of self-regulation as there are lines of research on the topic. Thus, the term has been used in somewhat different ways by researchers in different subfields, and various terms have been used to denote the same concept (e.g., self-regulation, self-control, self-management, problem solving, behavioral control, mood control, self-regulated learning).

It is unclear whether the concepts provided by prevalent theory and analytic techniques are both molar and molecular enough to cover all the important theoretical needs presently in the domain of self-regulation. Thus, above the main components, there also might be a need for compound constructs. Indeed, it is becoming clearer by the day that both broad, sweeping, higher-order constructs (e.g., self-regulation) as well as narrower constructs (e.g., self-regulated learning) and lower-order constructs (e.g., metacognitive strategies, self-observation, automaticity) need to be represented in the research. A principal advantage of lower-order concepts is that they often have clearer psychological referents, because the psychological clarity of individual differences dimensions often seem to vary inversely with the breadth of the dimension. Thus, lower-order categories often carry certain specialized and situational meanings that are not captured in the higher-order factors.

Although contributors to this volume differ in their specific perspectives on self-regulation and employ slightly different terminologies, the commonalities that exist among conceptualizations appear to be greater than the uniquenesses. A casual glance at the various chapters in the handbook (e.g., Brownlee, Leventhal, & Leventhal, Carver & Scheier, Jackson, MacKenzie, & Hobfoll, Matthews, Schwean, Campbell, Saklofske, & Mohamed, Shapiro & Schwartz, and Maes & Gebhardt) suggests that authorities view self-regulation as a systematic process of human behavior that involves setting personal goals and steering behavior toward the achievement of established goals. For example, both Zimmerman and Schunk and Ertmer conceptualize self-regulation from a social-cognitive perspective in terms of a multiphasic process in which self-generated thoughts, affects, and actions are planned and cyclically adapted as needed to attain personal goals. Similarly, Maes and Gebhardt define self-regulation as a sequence of actions, steering processes, or both, intended to attain personal goals. Matthews and his co-workers view self-regulation as a generic umbrella term for the set of processes and behaviors that support the pursuit of personal goals within a changing external environment.

Furthermore, there appears to be some consensus among contributors that self-regulation involves *cognitive*, *affective*, *motivational*, and *behavioral* components that provide the individual with the capacity to adjust his or her actions and goals to achieve desired results in light of changing environmental conditions. Contributors concur that self-regulatory behavior involves a feedback loop that serves to decrease the discrepancy between ideal and desired behavior (see chapters by Zimmerman, Carver & Scheier, and Vancouver). Overall, definitions and conceptualizations of self-regulation that appear in the various chapters of the handbook tend to embody the basic ingredients of goal setting, steering process and strategies, feedback, and self-evaluation (e.g., see models put forth by Endler and Kocovski, Brownlee et al., Demetriou, Pintrich, and Carver & Scheier). As suggested by Creer, apparent differences occur among contributors because of the way they tend to categorize specific processes, rather than from different conceptualizations.

In particular, the concept of self-regulation needs to be more sharply differentiated from related constructs in the same semantic domain (self-control, self-management, coping, adjustment, etc.). As pointed out by Creer, a myriad of terms (self-control, self-change, self-directed behavior) have proliferated recently to "further muddy the water." A number of contributors to this volume (e.g., De Corte, Verschaffel, and Op 't Eynde, Matthews et al., and Brownlee et al.) point out that major constructs that relate to self-regulation (metacognition, volition, planning) overlap each other and also overlap related domains (e.g., transactional theories of personality and stress; Matthews et al.). We now briefly highlight a number

of overlaps among concepts in the self-regulation literature that are in need of further clarification.

To begin with, the distinction between the two grand concepts of *self-regulation* and *self-management* is rather fuzzy. Self-regulation is sometimes taken to imply that people follow self-set goals, whereas self-management is taken to imply that people follow goals set by others. However, as noted by Creer, there appears to be no clear demarcation among the terms, and the preceding distinction is not universally accepted.

There is also some confusion regarding the concepts of *regulation* and *self-regulation.* Brownlee et al. propose that to distinguish between the two constructs, we need to know whether the goal originated in the external world or internal world (i.e., the social environment versus the self system), and whether the person sees its origin as being internal or external. Thus, when a person is setting a goal or defining a relevant procedure, he or she is self-regulating; otherwise, his or her behavior is being externally or "other regulated."

The distinction between *self-regulation* and *metacognition* is also somewhat unclear from the literature; there is considerable ambiguity and overlapping of definitions (cf. Demetriou, Pintrich). Metacognition is commonly construed as the awareness individuals have of their personal resources in relation to the demands of particular tasks, along with the knowledge they possess of how to regulate their engagement in tasks to optimize goal-related processes and outcomes. According to Demetriou, self-regulation may be viewed as the more comprehensive term, embracing both metacognitive knowledge and skills, as well as motivational, emotional, and behavioral monitoring and control processes. However, there is little consensus on the nature of the relationship among these terms.

The also seems to be considerable conceptual overlap between the concepts of *coping* and *self-regulation.* As pointed out by Matthews et al., the various processes employed in negotiating a goal in self-regulation are akin to the basic processes described when coping with a stressor. These include appraisal of the potential threat a situation poses to the person, its related emotional reactions, and the various procedures, mental actions, and overt actions taken to manage the problem and the feelings it evokes.

Brownlee et al. draw an important distinction between *self-regulation* and *regulation of the self.* They propose that self-regulation becomes regulation of the self when the problem-solving process focuses upon the self and leads to its reorganization and redefinition. In the case of regulation of the self, a component of the self is the focus of problem solving (redefinition of old identities, the creation of new ones, the addition or remodeling of existent procedures for managing the self, and illness threats) Furthermore, these authors point to the conceptual overlap between *self-regulation* and *problem solving* (Brownlee et al.). Both self-regulation and problem solving involve the extended process of setting

goals, applying strategies, monitoring, evaluation, and reinforcement. Thus, the question arises, "When should a process be called self-regulation and when should it simply be termed problem solving?" The answer to this question is awaiting further conceptualization and research.

In sum, self-regulation, as well as a number of concepts in the same semantic domain are "fuzzy" concepts and need to be defined more definitively and used more consistently by researchers and practitioners in the field. This confusion among concepts stems, in part, from the division of modern behavioral science into numerous subareas of specialization, each with its unique nomenclature and somewhat idiosyncratic use of the self-regulation construct. Furthermore, the fragmentation and disparate, but overlapping, lines of research within the self-regulation domain have made any attempt at furthering our knowledge an arduous task. Indeed, consistent nomenclature and taxonomy have been virtually impossible for many years because little coherence exists among theory and measures of self-regulation and other conative constructs

## II. CLARIFYING SELF-REGULATION STRUCTURE AND PROCESSES

Self-regulation is currently seen as involving a number of integrated microprocesses, including goal setting, strategic planning, use of effective strategies to organize, code, and store information, monitoring and metacognition, action and volitional control, managing time effectively, self-motivational beliefs (self-efficacy, outcome expectations, intrinsic interest, and goal orientation, etc.), evaluation and self-reflection, experiencing pride and satisfaction with one's efforts, and establishing a congenial environment (Zimmerman; Schunk & Ertmer, Pintrich).

A major goal for future research is to identify the specific elements and distinct steps in the process of self-regulation (see Rheinberg, Vollmeyer, & Rollett). Overall, the limited number of components or facets that comprise many models of self-regulation, typically three to five cyclical phases or elements (Vancouver cites three; Carver & Scheier identify four; Winne & Perry cite three to four), while they do represent the law of parsimony, they may represent only a fraction of the total number of phases or facets in the structure and morphology of self-regulation. Although the principles of parsimony should be endorsed whenever applicable, the evidence often points to relative complexity rather than simplicity (e.g., see Vancouver's probing discussion of Power's perceptual control mode or Carver & Scheier's discussion of chaos and catastrophe perspectives on self-regulation). Thus, future models may need to be less simplistic and more complex than current models, incorporating dynamic concepts

and additional structural components into the model (cf. Kuhl's chapter, for example).

Although there is little agreement on what a goal is, there is agreement on the critical role of goals in the structure and morphology of self-regulation. However, experts currently fail to agree on the number or the configuration of components involved in the self-regulation process. Thus, a casual glance at the chapters in this book shows that there is little consensus regarding the status of constructs such as metacognition or metamonitoring, self-awareness, automaticity, self-efficacy, self-evaluation, self-reinforcement, and self-reaction. For example, some contributors to this book include self-reinforcement in their models (e.g., Zimmerman; Endler & Kocovski), whereas others do not (e.g., Carver & Scheier). Whereas some models posit the existence of a metamonitoring system or process (e.g., Carver & Scheier), others do not see the need to do so (e.g., Vancouver; Zimmerman).

The role of a number of constructs in the self-regulation process, such as self-efficacy and affect, is somewhat ambiguous. Accordingly, some contributors (e.g., Creer; Zimmerman, Schunk & Ertmer) view self-efficacy as an integral part of the self-regulation process. As pointed out by Creer, knowledge of self-regulation skills is simply not enough to guarantee that these skills will be used appropriately; persons must also believe that they are capable of performing these skills to reach whatever goals they determine for themselves. Thus, the beliefs about one's capabilities to organize and implement actions are necessary to attain designated performance and, according to Zimmerman, are an integral component of the self-regulation process. Other contributors (Endler & Kocovski), while viewing self-efficacy as an important factor in self-regulation, do not view it directly as an element or facet of self-regulation.

An intriguing question for future research on the structure and process of self-regulation is, "How should we deal with emotions or affect?" Some experts (e.g., Brownlee, et al., Carver & Scheier, Shah & Kruglanski, Weinstein, Husman, and Dierking, Pintrich, and Zimmerman) view emotion as part and parcel of the self-regulatory process. Zimmerman views affective reactions, such as doubts and fears about specific performance contexts, as an integral part of the forethought phase of self-regulation. Furthermore, models proposed by various contributors (e.g., Carver & Scheier and Shah & Kruglanski) relate affect to goal promotion. Thus, if a goal is promoted, positive affect results; if a goal is blocked or prevented, negative affect results. By contrast, other models (e.g., particularly the TOTE models surveyed by Vancouver) do not assign a functional role to affect. A related issue that has not been sufficiently addressed in the literature is, "What are the effects of positive mood on performance? Does positive mood lead to coasting and withdrawal of effort or to investment of effort in the task?" (cf. the treatment of affect in self-regulation by Carver & Scheier.)

Current cybernetic or TOTE models (see Vancouver's chapter) have paid particular attention to *negative* feedback loops, a key component of self-regulation processes. Future research needs to pay more attention to positive feedback loops. As pointed out by Shapiro and Schwartz, positive loops engender heterostasis, leading to change, growth, and development. Negative feedback loops, by contrast, engender homeostasis—a stable state that a living organism strives to maintain by keeping vital parameters within viable bounds. Presumably, a system needs a reasonable balance between positive and negative feedback loops.

## III. MAPPING OUT THE NOMOLOGICAL NETWORK

A major problem in exploring the self-regulation construct is mapping out the pattern of interrelationships between self-regulation and related individual difference constructs, and the underlying processes to which they relate. Whereas research has examined the nature of the association between self-regulation and a selected number of individual difference variables (e.g., self-efficacy, optimism, and anxiety; see chapters by Carver & Scheier, Matthews et al., and Zimmerman), we know relatively little about the relationships between self-regulation (and its key components) and other variables, such as intelligence, extroversion, openness to experience, or conscientiousness.

Furthermore, whereas we have a body of research on the environmental determinants and outcomes of self-regulation in such areas as education (see Zimmerman and Boekaerts & Niemivirta) and health (see chapters by Maes & Gebhardt, Brownlee, et al., and Shapiro & Schwartz), other environments (family, social, religious, political, military) need to be carefully mapped out as well. Clearly the construction of a valid nomological network that maps self-regulation onto key environmental and personal (cognitive, affective, conative) variables is critical to further our understanding of self-regulation.

To map out the nomological network, it might be useful to employ a facet-analytic approach to investigate the interface of self-regulation and relevant constructs by constructing a matrix with self-regulation components represented by rows ($j$) and related variables or components in the nomological network represented by columns ($k$), where the entire two-dimensional matrix ($j \times k$), or Cartesian space, represents the domain of discourse for any future integrative attempt. A third facet—area of application (school, social, occupation, health, etc.)—may be added to form a three-faceted cubic model for examining the much needed mapping of variables. Indeed, tentative mapping of the domain may suggest entire areas that are uncovered by present research; these lacunae need to be identified and systematically researched. Even quite loose, provisional

classification structures might help guide exploration and provide a useful framework to which to pin individual data as they accumulate.

Researchers interested in dynamic interactions between self-regulation and other constructs will need to look at the reciprocal effects of self-regulation and other variables, say intelligence, in the course of development and day to day manifestations. Thus, poor self-regulated learning skills may constrain the development of a person's intellectual ability, which, in turn, impedes the development of self-regulatory skills. If what interests us is how self-regulation and another variable, say intelligence, interact to impact on a third variable, say leadership, we may need to consider synergistic interactions, that is, where the presence of one variable (say self-regulation) potentiates the effects of the other (say IQ) on some criterion performance (e.g., leadership). In this form of interaction, the effects of both factors on the third variable are greater than the sum of each.

## IV. CONSTRUCTION OF MORE REFINED MODELS

How best to model self-regulation is one major area that future research needs to address Because self-regulation is viewed as a sequence of activities or processes designed to attain personal goals, any model of self-regulation should contain a concept of personal goals along with the steering processes used to attain personal goals. The handbook chapters tend to be based on the more prevalent models of self-regulation, including social cognitive models (Zimmerman; Schunk & Ertmer), cybernetic control (TOTE) models (Carver & Scheier; cf. Vancouver), and expectancy models (Rheinberg et al.). The social-cognitive perspective and the control perspectives are the most prevalent models represented in this handbook. In addition, some novel perspectives, such as dynamic models (cf. Carver & Scheier and Kuhl) are discussed by contributors. Sociocultural and discourse models are not represented in this handbook.

An intriguing question for future thought is, "Should we stick with current models of self-regulation or perhaps shift away from these models and develop higher-order paradigmatic models?" Might it not be fruitful to examine alternative paradigms and conceptualize self-regulation in novel ways? One possible direction for future research is to construct more elaborate and refined processual models (theories) of self-regulation that allow us to make focused predictions of the relationship between self-regulation and other conative, affective, and cognitive factors as they unfold over time. The optimal approach to the study of self-regulation is to construct tenable models of self-regulation, arrange experimental conditions to test deductions (hypotheses) from these models, and interpret results cautiously in the light of the models being tested. In addition,

future models need to consider the effects of divergent environments and contexts that may interact with personal variables to impact on self-regulation.

## V. REFINING MEASUREMENT OF SELF-REGULATION CONSTRUCTS

It is evident that a sine qua non for the development of a sound knowledge base for furthering theory and applications in this area is the use of reliable and valid measures. Thus, one important goal for future research in this area is modeling relationships through more complex measurement models. The particular measures we use to gauge a given construct are particularly important, because they may impact strongly upon the outcomes of our research. Unfortunately, measurement methods currently in use to assess some of the more "slippery" self-regulation constructs (e.g., metaregulation, automaticity, open and closed feedback loops, and feedback control levels) are not always optimal in assessing the various components of self-regulation.

A major task for future research is to determine the optimal "grain size," that is, the unit of metric to measure components of self-regulation, and how best to integrate variables defined in quite different "grain sizes" into a coherent self-regulation model of human behavior (see Winne & Perry's in-depth discussion of this issue). As pointed out by Winne and Perry, the self-regulation components of tactic and strategy reflect differences in grain size; the latter are larger grains because they involve decision making to select among alternative tactics. The time span is another variant of a grain size: self-regulation conceptualized as an *event* occupies a very brief span. By contrast, self-regulation conceptualized as an aptitude is theorized to be enduring, at least over the course of a single research investigation that may span several weeks.

As pointed out by Matthews et al., current research relies heavily on self-report measures. Thus, more observational and performance measures relevant to self-regulation processes and outcomes are urgently needed. Because there is a fundamental problem with using self-reports and survey methods to demonstrate dynamic processes, we sorely need better ways to operationalize the self-regulation construct so that the processual nature of self-regulation is captured. Fortunately, a number of promising ways to measure the different components of self-regulation as they unfold over time are being developed and refined. For example, by employing computer simulations of different aspects of behavior (e.g., vocational, health, educational), we may be able to assess various components of the self-regulatory process "on line." Also, analyses of the protocols of "think-aloud" procedures, in which subjects describe exactly what goes through

their minds when self-regulating during a given task, might be useful for examining the subjects' phenomenological perceptions and understanding of different aspects of self-regulation. Additional techniques that may be useful for studying adaptive self-regulatory processes are study of experts who are known for their self-discipline and success, clinical studies of individuals experiencing self-regulatory dysfunctions, and experimental research on personal methods of control during demanding cognitive tasks (see Zimmerman).

Much akin to the state–trait distinction found in personality research, self-regulation may be conceived of as an *aptitude* or trait (i.e., a relatively enduring mental attribute of a person that predicts future behavior) or as an *event* or state (i.e., transient state in a large, longer process that unfolds over time). However, these two facets or forms of self-regulation are not clearly differentiated in measurement or research (see Winne and Perry). Thus, there is a need to better differentiate aptitude measures of self-regulation from event-related measures of self-regulation. As pointed out by Winne and Perry, when studying self-regulation as a state or an event, point estimates derived from these data (such as means) are not appropriate descriptions. Instead, methods are needed that characterize temporally unfolding patterns of engagement with tasks in terms of the tactics and strategies that constitute self-regulation, over time. In addition, work is needed on how measures of self-regulation, as aptitude and as event, can be interleaved to characterize the full spectrum of self-regulation.

Further attention needs to be given to the issue of *validity* of self-regulation measures. A number of cognitive, motivational, affective, and behavioral variables are components in an overall portrait of self-regulation. Multitrait–multimethod studies would help focus on the center of self-regulation and its relationships to contributing peripheral variables (see Winne and Perry's discussion). To date, however, there is little information of the kind that would be revealed by multitrait–multimethod investigations of convergent and divergent validity. Furthermore, additional work on the practical or diagnostic validity of self-regulation measures is also sorely needed. Beyond description for purposes of basic research, few measures have been used for formal diagnosis and evaluation in educational, occupational, and health contexts. Given that few formal studies of the diagnostic utility of measures of self-regulation have been done, assessing the discriminant validity of components of self-regulation in differing criterion groups would be most welcome.

The issue of reliability of self-regulation measures also deserves further work. Two methods of assessing reliability traditionally have been applied in self-regulation research: internal consistency reliability for measures generated by self-report and interobserver reliability for measurement protocols (Winne and Perry). Unfortunately, very little attention has been given to the issue of stability of self-regulation measures. Stability is a

difficult concept to apply to measures of self-regulation, mainly because self-regulation, by definition, is adaptive and should vary over time under certain conditions.

Furthermore, few attempts have been made to *standardize* and norm measures of self-regulation. This perhaps reflects the newness of work on measuring self-regulatory components and processes, the field's flexibility in adopting models that guide the development of measurement protocols, and genuine questions about what would be useful norms relative to purposes for measures of self-regulation.

## VI. IMPROVING RESEARCH METHODOLOGY

Clearly, the processual nature of self-regulation and the dynamic interaction among its component parts requires sophisticated methodology to capture the essence of self-regulatory processes as they unfold over time. Unfortunately, much of the current research methodology in the area of self-regulation has employed simplistic experimental designs or traditional correlational methods, which may not capture the dynamic and transactional process of self-regulation optimally. In particular, these methods are insufficient to validly test some of the more complex models found in many applied areas. Although recent advances in design and analysis are ripe for application to the self-regulation domain, there are currently few concrete examples of research that capitalizes on the power of such methods as dynamic modeling, structural equation modeling, partial order scalogram analyses, and higher-order linear models. Various contributors (Carver & Scheier; Kuhl) believe that now we can apply dynamic concepts and models to the area of self-regulation, the reason being that now we can handle the mathematical intricacies of nonlinear, dynamic, and bidirectional relationships. This is exemplified by contemporary models of deterministic chaos, catastrophe theory, and synergetics. By employing more sophisticated analytic techniques to research self-regulation constructs, we should greatly elucidate the dynamic interactive roles of these concepts.

Furthermore, self-regulation research would benefit from capitalizing on the complimentarities of methods in actual research. Nomothetic and ideographic designs, interindividual and intraindividual methods, quantitative and qualitative (the phenomenology of self-regulation), and experimental, correlational, and naturalistic descriptions are needed to investigate different research questions and hypotheses. The *triangulation* of research operations via complimentary designs, ranging from survey to multivariate experimental, to longitudinal designs, would be useful to tap different research questions. It would also be worthwhile to try out alternative methods and measures from a utilitarian and eclectic perspective, seeking to identify and explore functional complimentarities. Triangu-

lation across measurement protocols is infrequent (see Winne & Perry). Because each protocol generates a slightly different reflection of self-regulation, a fuller understanding of models and methods can be achieved by using multiple measurement protocols in research. However, as researchers move out into the real world, the different methods certainly need to be adopted to the specific contexts under consideration. For example, if we want to know more about the dynamics of the self-regulatory process in a given educational or occupational setting, a quasi-experimental design might be the most useful protocol.

In addition to the construction of valid measures and research designs, we need to develop appropriate *statistical techniques* to analyze the dynamic and transactional (interactive) nature of self-regulatory processes optimally. Simple correlational or even simple experimental designs, emphasized by self-regulation researchers at the expense of more appropriate multivariate and longitudinal designs, are inadequate for providing a better understanding of the self-regulation process. Although the interrelationships between self-regulatory components and related variables have been conceptualized generally and investigated as linear ones, the nature of the relationship, in fact, may be curvilinear (i.e., the linear correlation might be null, even if there is some substantial correlation). In addition, when self-regulation is employed as a predictor of some criterion variable in a regression equation, we also need to look at multiplictive functions, introducing both linear and quadratic functions of self-regulation as they impact on criterion performance. For example, if successful performance in tennis is a curvilinear function of self-regulation, with highest attainments at mid levels of self-regulation, self-regulation should be accompanied by the same variable *squared* in the regression equation predicting performance. An additional point to consider is that the magnitude or direction of the relationships explored may change across time, context, cultural group, or gender (see Jackson et al.).

Long-term research, employing longitudinal research methodology, and focusing on the development and training of self-regulation is in order. Presently, there is little long-term research aimed at development of self-regulated skills in student populations. A real experiment in which students receive instruction that promotes self-regulation throughout their schooling remains to be performed. Thus, no one yet has evaluated the hypothesis that a schooling career immersed in high quality instruction aimed at promoting self-regulation would, in fact, produce much better self-regulated learners than typical elementary-grades instruction.

In addition, more adequate sampling of variables is urgently needed in self-regulation research. It is necessary to select variables strategically to thoroughly cover the self-regulation domain. Studies often have sufficed with a few components and a small sample design, and, consequently, are flawed because of inadequate sampling of both variables and number of

subjects. Only by strategically selecting subjects, variables and settings can we expect to thoroughly cover the self-regulation domain and the facets of units, observations, and settings. In addition, future research needs to examine the consistency of self-regulatory processes across time and situations. Thus, it is presently unclear to what degree there is one set of self-regulatory processes across domains; perhaps the structure and processes of self-regulation are the same across various domains.

As noted by a number of authors (Winne & Perry and Endler & Kocovski), research into self-regulation has so far has included a limited range of populations. Postsecondary students and college students are most often participants in studies; hence, very little is known about young children's self-regulatory strategies in social and learning spheres. Until measurements are collected across the age spectrum, fully understanding measurement protocols and developmental trajectories will remain elusive. In addition, most research has been conducted from a Western perspective and on middle-class Western populations; relatively little research has been conducted on ethnic minority groups or individuals in non-Western cultures (see Jackson et al.).

Finally, the bulk of the data that relates self-regulation to other variables is of a correlational nature, so that the direction of causality in the association is indeterminate. Although the nature of the causal flow of direction in the observed relationships between self-regulation and other constructs has been conceptualized and interpreted in a variety of different ways, perhaps the most productive form of association is that of reciprocal determinism, with self-regulation and other key personal and environmental variables showing a bidirectional relationship.

## VII. EXPLORING INTERACTIONS BETWEEN ENVIRONMENT AND SELF-REGULATION

Person–situation interactionist perspectives have now largely superseded the old person versus situation debates; most researchers agree that behaviors are largely a function of the interaction among person and situational characteristics. Clearly, some situational characteristics (e.g., a traffic light) are sometimes powerful enough to regulate and produce consistency of behavior across many persons. Also, some personal characteristics (e.g., self-regulation) are sometimes powerful enough to produce consistency of behaviors across situations. As we consider interactions involving self-regulation and the environment, we need to be clear on the models being used and interpreted. The interaction between self-regulation and other variables may take many forms and may reflect different hypotheses about particular types of interactive effects and mechanisms presumed to be operative. Following Hettema and Kenrick*

(1992), we briefly point out six different forms of self-regulation–environment interaction that might be considered:

1. Person–environment matching, when relatively consistent characteristics of a person, that is, highly efficient and powerful self-regulatory processes, are assumed to suit that person for relatively consistent characteristics of situations (e.g., working as a surgeon, pilot, electrical engineer, or accountant), and vice versa, to prove a mesh.
2. Choices of environment by persons to suit their own self-regulatory skills (e.g., a student trying to self-regulate to limit tobacco consumption chooses to dine in the nonsmoking area of a restaurant).
3. Choice of persons by environment, as in most selection systems (e.g., using high goal setting and self-efficacy to choose members of an elite army unit).
4. Transformation of environment by persons to suit their own personal goals for self-regulation (e.g., removing all high-fat cheeses from the refrigerator to maintain one's diet).
5. Transformation of person by the environment, as in learning new self-control procedures or acquiring self-regulated learning skills in the classroom through explicit instruction and modeling.
6. Self-regulation–environment transaction—reciprocal interactions over time that change both persons and situations to attain a mesh.

In keeping with current cognitive-social models of self-regulation and the notion of reciprocal determinism, it is the latter approach that we believe is the most suitable for conceptualizing the person–situation interaction in self-regulation research. Accordingly, when a person is self-regulating to achieve a set goal, that person's behavior impacts upon the environment, which in turn, becomes the input function used to further self-regulate behavior.

Recent thinking in the area of self-regulation emphasizes the importance of taking contextual variables into consideration in models of self-regulation (see Brownlee et al.). Context operates at several levels, from the role of language (label of problem or reference point) through cultural myths and causes of particular situations, and established strategies for handling or managing problems. Problem solving and self-regulation are bounded by these contextual factors. Thus, future research in the area of self-regulation needs to pay greater attention to sociocultural factors and incorporate these factors into the model.

Jackson et al. underscore that the concepts on which self-discrepancy theories are based (standards, reference points, etc.) derive from culturally based notions of acceptable behavior and are rooted in socially based roles. Future definitions need to consider the communal components of models, because individual behaviors are nested within a wider collectivistic context. Future research would be served well by incorporating themes

from communally based theories and investigating what strategies individuals use to establish a balance between achieving goals that are beneficial for themselves and others. Future research should also examine the impact of self-set goals versus external standards or cultural norms on various facets of the self-regulation process.

## VIII. ACQUISITION AND TRANSMISSION OF SELF-REGULATORY SKILLS

As noted by Matthews et al., an important question for future research focuses on the vehicles of transmission of self-regulatory skills—an issue we presently know very little about. Thus, an important question for future consideration is whether self-discovery of self-regulatory skills suffices, or whether we need special training methods to inculcate and teach skills?

Although it is possible to develop self-regulatory competence by personal discovery, this path is often tedious and frustrating, and limited in its effectiveness. Zimmerman's chapter nicely illustrates how modeling and instruction serve as a primary vehicle through which parents, teachers, and communities socially convey self-regulatory skills. Thus, self-regulatory skills can be acquired from and are sustained by social as well as self sources of influence. However, the social-cognitive hypothesis that self-regulation of learning develops initially from social modeling and progresses through increasing levels of self-directed functioning needs further validation. The various phases in Zimmerman's model of self-regulatory skill acquisition, namely, observational, modeling, self-control, and self-regulation phases, need to be empirically validated and better differentiated.

Schunk and Ertmer urge researchers to conduct more research on self-regulation in the context of different content area domains. This is because self-regulatory processes are linked with content domains, and individuals learn how to apply them in a given learning or applied domain. Clearly, contexts determine, to some measure, what self-regulatory skills might be most useful. Embedding self-regulation processes within specific content areas brings up the issue of transfer. Thus, a key issue for future research relates to the transfer of self-regulatory skills from one situation to the next. At present, it is unclear whether persons will transfer skills from one content area to another or one disciplinary domain to another. What skills are necessary so that students make appropriate modifications in self-regulatory processes so that they match the current situation? Researchers need to conduct process-oriented studies to determine how students think about and employ the strategies they learn in one context to another setting. Individuals may need to be taught self-regulatory skills

and activities in different applied or learning setting and how to modify them to fit different applied areas or situations. Thus, additional studies need to be conducted to understand when self-regulatory skills are deemed to be useful by students. These skills need to be linked to particular contexts.

## IX. EXAMINING DEVELOPMENTAL DIFFERENCES IN SELF-REGULATORY SKILLS

Future research needs to carefully look at the development of self-regulatory skills across time. Thus, we need to understand how biology and aging (maturation, senescence) change both the self-regulatory processes (goal setting, monitoring, feedback control, self-evaluation, etc.) and the effects of self-regulatory skills. How do biological and age changes affect the inputs, representation, procedures, and errors in self-control? Does the pattern of relationship between self-regulation and other components grow weaker or stronger over the years?

As mentioned, Zimmerman's social-cognitive model posits that people acquire self-regulatory skills, mainly through observation, imitation, self-control, and self-regulation. This model does not assume that all phases are measured in sequence. Are different components of self-regulation managed in sequence? Do they show differential growth over time? Do they have similar age functions? These and other nagging questions need to be addressed in future research.

As suggested by Schunk and Ertmer, there may be developmental differences in acquisition and instruction of self-regulatory skills. Younger students may benefit more from modeled demonstrations, whereas older students may be able to formulate their own methods. Alternatively, we might predict that strategy modeling would be more effective during initial learning, when individual's ability to construct strategies is limited; as students develop competence, they may be better able to construct self-regulatory strategies.

## X. EXAMINING INDIVIDUAL DIFFERENCES IN SELF-REGULATORY SKILLS

We need to find ways to integrate research on individual differences with research on the development of self-regulatory components in individuals in the context of differential distributions and trajectories of development. As noted by Matthews et al., the assessment of individual differences in self-regulation could be immeasurably improved. Differential psychologists, who focus on measures taken at one or two points in time, can only speculate about developmental trends in self-regulation. By

contrast, developmentalists focus on the development of self-regulation trends, but usually measure no individual differences except age. Yet, the best way to understand both individual differences and individuality may be in the context of development, whereas development may be interpreted best in the context of differential distributions and trajectories of development.

Furthermore, little research has focused on self-regulatory processes (inputs and representations of goals, self-regulatory procedures, monitoring, and self-assessment) in different demographic and sociocultural subgroups in the population. Do males and females differ in the use of and efficiency of self-regulatory processes? If so, in what domains? Are there meaningful social class differences in the process and efficiency of self-regulation? Do different sociocultural groups differ in their self-regulatory processes?

In addition, we need to better understand the role of cultural actors in self-regulatory processes. For example, do people with traditional beliefs self-regulate differently from their modern counterparts? Do people in collectivistically oriented cultures self-regulate differently or more efficiently than those living in modern individually oriented cultures. Are the goals and procedures the same?

## XI. APPLICATIONS

There is little doubt that self-regulation plays a central role in influencing performance in a wide array of applied areas (school and academic performance, health, occupational behavior, etc.). Thus, over the years, a variety of conative factors, such as self-regulation, have been used jointly in various practical domains. In fact, it is at the applied or clinical level that the greatest amount of integration of self-regulatory and other variables takes place by necessity. For example, the clinical or school psychologist may assess a child's poor school achievement by gathering data on the child's intelligence, self-regulated learning skills, learning style, motivation, anxiety, and academic self-concept (as well as social behavior, physical and health status, and home environment) so as to arrive at a diagnosis and prescription of the most appropriate intervention program. Thus, the psychological practitioners' task is to develop a comprehensive and integrated description of the person by employing precise measurement strategies and continuously referencing the theory and research that describes the interrelationships among the various conative and intellective factors examined. Given that such an integration is not always explicit from the literature or measures available, clinicians may be required to make this integration on their own, that is, at an intuitive level.

Unfortunately, we know very little about considerations practitioners bring to bear in making decisions based on the integration between

conative constructs, such as self-regulation, and ability constructs. For example, how does the school psychologist, probation officer, personnel officer, or health provider combine information on a person's self-regulatory skills to make decisions that are of major importance to the individual and society as a whole? Systematic observations, in-depth interviews, self-observation and monitoring, single-subject design research, and protocol analysis are needed in a wide array of practical domains to shed light on this needed area.

In addition, a most worthwhile effort would be to conduct an intensive and careful analysis of individual cases, contrasting those individuals who are extremely high or low on self-regulation so as to identify qualitative differences between individuals. Such an analysis would provide avenues for understanding what it means to be exceptionally high or low in self-regulation (cf. Zimmerman). For example, one method that may be used is to study the biographies of individuals who are high on self-regulation; this information will allow us to spread a broader methodology. In addition, cross-partitioning individuals by specific self-regulatory and other factors would help the development of useful typologies in various domains.

We need to learn how best to promote self-regulation in different areas and how to motivate or influence people to self-regulate to achieve important behavioral objectives (e.g., managing study time, maintaining healthy behaviors, and adhering to a medicinal regimen). Thus, we need to learn how best to help people who need to self-regulate, such as the obese, those who abuse alcohol and drugs, parents who mistreat children, and adults who abuse their spouses.

More knowledge is needed on how best to develop and foster self-regulation skills in social microcosms that are not themselves systematically regulated (e.g., classrooms, hospitals, and homes). It may be especially hard to induce lawful behavior when the microcosm is in flux. Thus, we need to deal with the self as being reinforced and changed by the social milieu in which the self is operating. In addition, research needs to identify the various impediments to successful self-regulation, as well as the reasons for failure of self-regulatory processes

## XII. TRAINING AND PROMOTION OF SELF-REGULATORY CONCEPTS

A major reason for attempting to understand the nature of self-regulation and its determinants and consequences is the belief that more complete awareness of its nature might go far to stimulate thinking about ways to promote more adaptive self-regulatory aptitudes, practices, and interventions. We need to learn how best to promote an individual's

self-regulatory learning skills at various developmental stages, from nursery school children through college and adult lifelong learning. A number of chapters in this book (e.g., Creer on promoting self-regulation in the area of chronic disease and Weinstein et al. on promoting students' learning skills and habits) have provided some concrete guidelines for promoting self-regulatory skills in these areas.

There is an increasing recognition, according to Creer, that in many applied cases, self-regulation is apt to fail. By constantly alerting individuals, say chronically ill patients, to several factors that could lead to relapse, including exposure to high risk situations, failure to initiate responses, attributions to personal weakness, and initial relapse, patients can be taught about what factors to expect and how to manage them. Indeed, defensive inferences that may undermine successful adaptation, include helplessness, procrastination, task avoidance, cognitive disengagement, and apathy.

In researching the effects of instruction and self-regulation interventions, it is important to identify components that are responsible for the effects. As pointed out by De Corte et al., although some investigations show convincingly the possibility to foster self-regulation in students, they do not allow us to identify which components of the learning environments that were designed and implemented account for the observed effects. Therefore, there is a need for studies that set out to unravel how and under what specific instructional conditions individuals become efficient self-regulators. What are the crucial elements in the learning environment that help and support students in learning to manage and monitor their own processes of knowledge building and skill acquisition? Research shedding light on the specific parameters of treatment programs responsible for outcomes is urgently needed (Endler & Kocovski) to determine the effects of a specific aspect of self-regulation in therapy (e.g., goal setting, self-reinforcement), as well as the cumulative effects of targeting all aspects of self-regulation in therapy.

As pointed out by Schunk and Ertmer, little effort has been made to link self-reflective practices to interventions. Researchers need to determine whether the effectiveness of self-reflection varies as a function of setting. Is self-reflective practice more important when external evaluation is infrequent or students encounter difficulties? How should students be motivated to engage in self-reflection on their own, such as by teaching students to treat self-reflection as any other academic activity that must be planned? Another important question for future research is, "When are self-regulatory skills particularly important?" Randi and Corno hypothesize about some conditions in which skills are important, such as when instruction is incomplete, when a challenging task requires sustained attention, or when a person is confronted by competing goals. These hypotheses need to be tested empirically.

Clearly, we want to foster and promote self-regulation when it is adaptive for the individual and social context under consideration. Thus, we need to learn how to distinguish between adaptive and maladaptive self-regulation. This requires us to identify situations where self-regulation may interfere with the achievement of important goals (e.g., excessive self-regulation that involves obsessive or compulsive behavior). A case in point: Say we want to foster a creative and spontaneous learning or work environment. Excessive self-regulation may take people out of the flow of behavior, causing them to resist the affordances of the spontaneous and creative environment; thus, the effect of self-regulation is violated. Moreover, if a person is self-regulating to a negative goal or standard, we might want to reestablish goals or break this self-regulatory pattern (rather than promote self-regulation). Unfortunately, it is unclear exactly what constitutes an "excessive" or "insufficient" amount of self-regulation or whether or not too much self-regulation is as deleterious as insufficient self-regulation.

Unfortunately, many of the current applications are not based on sound conceptual or theoretical framework. Thus, additional research is needed on optimal ways to construct and implement interventions designed to train and promote functional self-regulatory skills within specific domains of application (alcohol consumption, substance abuse, weight reduction, etc.). The critical components of the intervention process need to be identified and practical guidelines are needed to determine the specific conditions for the promotion of self-regulatory skills.

In sum, additional research is needed to achieve a sound knowledge base for self-regulation theory, research, and applications. By bringing all the contributors together in this handbook, we hope to have come closer to developing some theoretical consensus regarding the construct of self-regulation, as well as seeing where there may be important conceptual disagreements across areas. We hope that this type of intellectual dialogue has refined the construct of self-regulation to some extent and that future research directions are now more clearly mapped out.

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# INDEX