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A Self-Regulated Learning Approach to Teaching Educational Psychology

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In this paper, we describe an undergraduate educational psychology course that utilizes self-regulated learning as the organizing principle. The course aims to facilitate students' development in self-regulated learning and to promote students' understanding of how to embed instruction for self-regulated learning strategies into classroom teaching. In the first section of the paper, we develop the rationale for this position and identify underlying assumptions we believe should guide the development and implementation of such a program. In the second section of the paper, we demonstrate how we have incorporated these assumptions in a basic educational psychology course.

KEY WORDS: teaching educational psychology; self-regulation; learning strategies.

INTRODUCTION

In this article, we describe an educational psychology course based on self-regulated learning. First, students learn about their self-regulated learning characteristics as they study relevant course concepts. Second, they do this by examining their own learning strategies and analyzing their own motivational and learning beliefs, while contrasting these with the strategies and belief systems of self-regulated learners. Third, they practice many of the strategies examined in the course by learning when, how, and why the strategies are effective. Last, after such reflective experiences, our students should begin to develop personal meaning of the psychological constructs presented in the course and use them in their learning and teaching.

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RATIONALE FOR THE DESIGN OF THE COURSE

Self-regulation has become a unifying concept bringing together diverse fields of research to provide a coherent picture of how a learner manages the complex activities inherent in academic learning. As Butler and Winne (1995) state "Theoreticians seem unanimous—the most effective learners are self-regulating" (p. 245). In this section, we describe why developing self-regulated learners is an important goal for an educational psychology course, why self-regulated learning is an effective organizational scheme for a course in educational psychology, and why teaching self-regulated learning to college students requires a self-change instructional model.

The Need for Self-Regulated Learning

Rapid change is common in this nations' knowledge-based economy. Workers in numerous occupations—from clerical to professional—must frequently update their skills and knowledge or learn new skills and knowledge independently (Toffler and Toffler, 1995). The ability to manage one's own learning, therefore, is becoming increasingly important. Citizens without such skills are at a disadvantage in such a society, perhaps in the same way as people who are illiterate.

Unfortunately, most students are not taught study strategies explicitly. Many go through their entire academic career with poor or inefficient methods for studying. For example, many college students lack effective strategies to process information adequately from expository text (Mayer, 1996); to adapt to poor instructional conditions, such as inconsiderate texts or lectures (Pressley, Yokoi, van Meter, Van Etten, and Freeburn, 1997); or to take notes skillfully (Kiewra, 1988; Kiewra, Du Bois, Christian, and McShane, 1988). Finally, many students lack strategies to learn procedural knowledge effectively (Chi, Bassok, Lewis, Reimann, and Glaser, 1989: DuFresne, Gerace, Hardiman, and Mestre, 1992; Heller and Reif, 1984; Sweller, 1989).

Not only do many students lack knowledge about effective learning strategies, they also lack learning goals, beliefs, and attitudes that lead to the adoption of effective learning strategies (Dweck and Leggett, 1988; Nicholls, 1992; Nolen, 1996; Schommer, 1990; Schommer, Crouse, and Rhodes, 1992; Zimmerman, 1989). For example, many students believe the purpose of learning is to recognize or repeat the information from the text or lecture. These students most often employ rereading, rewriting, and rehearsal strategies to review for tests (Mayer 1996). The goals for these stu-

dents are to reproduce the information in the same order it is presented. Furthermore, students often lack adequate knowledge about time-management strategies (Britton and Tesser, 1991), and they may lack the volitional strategies to sustain their academic motivation and learning for even moderate amounts of time (Kuhl, 1985).

Given our analysis of the learning demands we believe will be placed on citizens in the twenty-first century, and given the current status of our schools and their graduates, we developed two general goals for the course. Our first goal was to help our students become self-regulated learners. To do this, students answered questionnaires about their learning, motivation, volition, and metacognition. The students used these questionnaires to assess their preferences and practices. We also informed students how, why, and when to employ appropriate learning, motivational, and volitional strategies. We required the students to make plans to change their inappropriate attitudes or practices, where appropriate, and to practice appropriate strategies. The second goal of the course was to help our students understand how they could embed strategy instruction into the curriculum. We did this by demonstrating how they could incorporate these strategies in their teaching. Oftentimes we employed group assignments to discuss these issues.

The Need for a Coherent Model for Course Organization

An *ad hoc* Committee on the Teaching of Educational Psychology was created by Division 15 of the APA to examine the teaching of educational psychology in the broader context of teacher education reform. In an article entitled "*Educational Psychology for Teachers: Reforming Our Courses, Rethinking Our Roles*" (Anderson, Blumenfeld, Pintrich, Clark, Marx, and Peterson, 1995), the *ad hoc* committee recommended that a major goal of educational psychology courses should be to help students develop a contemporary psychological perspective. They note:

> A psychological perspective provides a teacher with a way to "get hold of" a complex situation and think about its problems and possibilities in light of views of human learning. This advantage is not afforded by mere knowledge about concepts, principles, and theories; it is only manifested when those ideas are tied together as coherent frames that suggest when and how the ideas can be used. (p.145)

We concur that students should develop a coherent framework of ideas related to learning and teaching as a result of taking an educational psychology course. However, we fear that the typical student does not develop such a coherent structure when the organization of the educational psychology course reflects the organization of the typical educational psychology text. For example, typical educational psychology texts present separate

chapters on behavioral and cognitive approaches to learning. Thus students are introduced to these differing conceptions of the learning process with little emphasis on helping students develop a coherent perspective of learning. Rocklin (1994) expressed similar concerns about what kind of organizational schema students develop when they encounter current educational psychology texts that appear to be guided by mixed models. Therefore, we believe an educational psychology course should possess an organizational structure that helps the student develop a coherent psychological perspective. Given the need for a coherent psychological perspective as an organizational structure and the increased demand upon people to be self-directed learners in a knowledge-based economy, the model of the self-regulated learner seemed the most logical choice for that coherent perspective.

The Need for Personalizing Self-Regulated Learning Through Self-Change

Many of our students lack the productive learning, motivational, and volitional characteristics necessary for effective self-regulation. In fact, many of our students enter the course with knowledge and beliefs about learning that impede self-regulated learning. These beliefs may also impede their effectiveness as a teacher.

As stated previously, our major goals are that students become more self-regulating as learners and that they learn instructional strategies for integrating learning strategy instruction into their teaching. These goals require students to personalize knowledge of self-regulated learning. Students must be aware of their current level of functioning by contrasting relevant attitudes, beliefs, and strategies of self-regulated learners with their own beliefs and strategies. Furthermore, they experience the effects of self-regulated strategies by engaging in guided practice. Such experiences are important in achieving these objectives for two reasons.

First, becoming a self-regulated learner necessitates more than learning a set of strategies; it requires changing beliefs about the nature of learning. Butler and Winne (1995) describe self-regulated learning theory as a "lens model" where perception of the learning task is mediated by a set of beliefs about subject matter, learning processes, and the products of learning. Changing beliefs about learning, as well as changing the repertoire of strategies students employ, takes considerable effort and time to achieve significant results (Pressley, 1995). Such a task is long-term, beginning in one course and continuing after students exit the course. Because students only begin to develop self-regulated learning in our course, we believe that

the appropriate change model to facilitate student growth as a self-regulated learner is one of *self-change*. The initial step in changing oneself involves increasing awareness of one's current level of functioning, acquiring knowledge of alternate courses of action, and self-reevaluation of one's current level of functioning (Prochaska, Norcross, and DiClemente, 1992).

Second, by practicing strategies, students can experience the effectiveness of the strategy and compare its benefits to their current practices. According to Pressley, Borkowski, and O'Sullivan (1984), a key to consistent long-term applications of self-regulated strategies is the student's specific knowledge about a strategy's applicability and effectiveness. Such knowledge is most effectively acquired through metacognitive acquisition procedures (MAPS) which are self-evaluation procedures for acquiring knowledge of cognitive strategies. This includes knowledge about when, why, and how to employ the strategy as well as techniques to compare and contrast the effects of various strategies on the student's performance (Pressley *et al.*, 1984). Consequently, students must experience some of the strategies used by self-regulated learners and contrast those strategies with their learning activities.

CATEGORIES OF SELF-REGULATED LEARNING STRATEGIES

Self-regulated learning is commonly viewed as the fusion of "skill" and "will" (Garcia and Pintrich 1993),

> Skill is generally defined as the deployment of different learning strategies, including cognitive strategies such as rehearsal and elaboration; metacognitive strategies such as planning and monitoring; and more recently, volitional control strategies such as controlling one's efforts and environment in order to protect one's intention to learn . . . . Will refers to students' motivation, specifically, their goals for learning (reasons for engaging in a task). (Garcia and Pintrich, 1993, p. 2)

To fuse "skill" and "will" requires the successful orchestration of four general categories of strategies: motivational, metacognitive, volitional, and cognitive. Motivation, metacognition, and volition are concerned with supporting and managing the processes that manage learning. In contrast, cognitive strategies support the processes that lead most directly to the production of knowledge.

Motivational Strategies

Motivational strategies are employed by learners to initiate and direct their behavior toward desired learning goals. These include strategies to

influence expectancy for success, task value, academic goals, and attributions. Self-regulated learners typically believe they can perform the appropriate learning tasks to master the course content. They desire to master the content, and they choose strategies to achieve the same. Furthermore, self-regulated learners successfully coordinate proximal and distal goals and pursue challenging goals with persistence. Finally, self-regulated learners tend to attribute their academic successes to effective strategic effort and their academic failures to ineffective strategic effort.

Throughout our course students evaluate their motivation. A major goal for our course is that students understand the preferred qualities associated with self-regulated learning and that they begin to acquire these qualities. Additionally, if they value and acquire these qualities, we want them to help their students acquire these same qualities.

Cognitive Strategies

Cognitive strategies are roughly synonymous with strategies traditionally referred to as study strategies. Study strategies are methods and actions such as note taking, mental review, and self-questioning students undertake to learn the curriculum in a course of study. Educational psychologists in the last two decades have developed a number of strategies more effective than traditional study strategies (Weinstein and Mayer, 1986). For example, a number of strategies help students recognize structures in expository text and use those structures to identify and organize important ideas in a text or lecture in order to better retain the information (Armbruster, Anderson, and Ostertag, 1987; Cook and Mayer, 1988; Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, and Evans, 1979). Another example is the development of self-questioning strategies. By constructing questions to answer while studying a text, students focus their attention on and test their comprehension of important ideas. Attempts to teach students to develop self-questions while they study has shown consistent positive results (Rosenshine, Meister, and Chapman, 1996). Successful students apply cognitive strategies to select important information, organize information in a coherent manner, and connect it in some relevant fashion to prior knowledge.

Information that is organized and connected to prior knowledge is retained better and can be used more flexibly in a wider range of circumstances to solve problems of significance to the learner. Such knowledge is said to be *meaningful learning*, or learning with understanding, and the cognitive strategies that produce it are often referred to as *deep processing strategies*. Meaningful learning and deep processing cognitive strategies are often contrasted with rote learning and surface processing strategies as two

general strategic approaches students take (Marton and Saljo, 1976a,b). *Surface processing* strategies focus on reading/rereading and rehearsal as primary means of learning without much effort exerted to organize new information into a coherent whole or to connect it to prior knowledge. These strategies tend to result in the memorization of discrete factual information which the learner finds difficult to remember in circumstances even slightly different than the circumstances under which the information was learned. Such knowledge is difficult to access and apply to problems and is said to be the result of *rote learning*, or learning without understanding. Self-regulated learners employ deep processing cognitive strategies, and are more likely to acquire meaningful learning than less productive students (Zimmerman and Martinez-Pons, 1986, 1988).

We try to facilitate our students' growth as informed strategy users and influence their students' potential classroom practices by introducing information about effective cognitive strategies. We then provide opportunities to acquire and practice selected cognitive strategies. From such experiences, we expect that our students will adapt many of these strategies when they study. If our students perceive the value of cognitive strategies and employ them in their own studying, then they should be more inclined to incorporate strategy instruction in their own classroom instruction.

Metacognitive Strategies

Metacognition refers to knowledge about the facilitation and regulation of cognitive processes. Metacognitive strategies perform an *executive* function in cognitive processing (Garner, 1987). Important metacognitive knowledge utilized by the learner includes knowledge about characteristics of the learner, characteristics of the task that influence cognitive processing, and knowledge about when, why, and how to use cognitive strategies. Zimmerman and Martinez-Pons (1986, 1988) found that self-regulated learners report more frequent planning for achieving academic goals and greater monitoring and evaluating of their performance than other less productive students. Such strategies are involved in the control of cognitive processing including planning of cognitive actions, allocation of resources during execution of planned actions, and evaluation of performance.

Metacognitive knowledge is brought to bear in planning which cognitive strategies to use to achieve a desired goal, monitoring the use of the chosen strategy, and modifying one's actions if necessary to achieve the desired goal. For instance, suppose a student is studying a chapter in a science text and encounters a four-phase process. This student recognizes that she must remember the names and order of the four phases. Further-

more, she knows that a mnemonic strategy such as the first-letter mnemonic will facilitate remembering such an ordered list of items. She develops an appropriate first letter mnemonic and practices recalling it until she can say it rapidly without error. This example illustrates several ways in which metacognitive knowledge is involved in the control of processing. First, she uses her knowledge of learning tasks to select an appropriate strategy to accomplish her learning goal. Next, she monitors her performance and makes a judgment about the time she needs to learn the task. Finally, she terminates studying only when she has decided she has learned the information sufficiently to retain it in long-term memory.

In our course, we introduce students to the important role of metacognition in cognitive functioning. We inform our students about when, why, and how to use a strategy as well as emphasize the pivotal role of metacognitive monitoring to regulate effective use of strategies. We also demonstrate how to include this type of knowledge in strategy-embedded instruction. Indeed, this is a central focus of the course.

Volitional Strategies

Volitional strategies refer to those actions students employ to protect their learning activities from competing activities. Kuhl and Kraska (1989) suggest that volitional strategies are similar to metacognitive strategies because both are executive control strategies. The major difference is that metacognitive strategies operate on cognitive processes and volitional strategies operate on motivational processes. These include strategies learners can employ to avoid, remove, overcome, change, and/or create alternative solutions to obstacles. For example, a student can often avoid an obstacle simply by not creating or being in an environmental situation in which the obstacle is likely to occur. An example is planning to avoid studying in the dorm room at 7:00 in the evening. The student can plan to remove the obstacle if it occurs. For instance, the student might decide to study in the room. If distracted, the student might politely ask the other student to leave. Perhaps a meeting later in the evening is in order. A student might overcome distractions by studying with earphones. The student might change the obstacle by planning only light studying during the 7:00 p.m. hour. Finally, the student might create an alternative solution by giving in to the distraction while simultaneously making a strong commitment to study at an alternative time. Again, we want our students to acquire strategies to overcome obstacles and then teach the strategies to their future students.

Processes of Self-Regulated Learning

To effectively orchestrate the complex of strategies involved in self-regulated learning, the student must obtain and make effective use of feedback about use of these strategies. Bandura (1986, 1991) describes a set of three interrelated processes by which the learner utilizes feedback to self-regulate learning and performance. These processes are *self-observation*, *self-evaluation*, and *self-reaction*. All three processes are necessary and function together for effective self-regulation.

Self-Observation

Self-observation refers to the strategies learners employ to describe the critical features of their behavior and the critical features of situations that might enhance or impede learning (Bandura, 1991). Self-observation includes a self-diagnostic function and a self-motivating function. The self-diagnostic function occurs when students, by careful observation of their own performance, identify how environmental factors affect their thinking and how their thinking affects their emotions, motivation, or performance. The self-motivating function occurs when the self-observation activates the self-evaluation process.

For instance, consider procrastination. To fully understand the patterns of behavior associated with procrastination, the student needs to systematically observe the targeted behavior over an intermediate time span. We suggest that the student record a table, with columns for days and rows for hours. By using this table, the student can easily identify reoccurring patterns of free time. This self-observation should lead to an increased awareness about procrastination patterns.

Self-Evaluation

The first phase of self-evaluation consist of judgments about success and failure and a causal analysis of those outcomes. "Success" depends on both learners' goals and the standards they employ to evaluate goals. To evaluate performance, students must develop clear standards upon which to judge their behavior, learning, or performance. Behavior means the typical daily activities of students. Learning refers to the strategies students employ to convert information into knowledge once they have chosen to study. Performance means their attainment level on a test or project.

In the second phase of self-evaluation the student identifies the "reasons" for the level of performance. Self-regulated learners tend to attribute "reasons" to variables which they can control. In contrast, nonregulating students tend to explain failures to variables which they perceive they cannot control. Thus, self-regulated learners should know how to evaluate their daily behavior, learning, and performance on tests and projects. For example, students should understand how they spend their free time. When do they study, for how long, and under what conditions? How much time do they study? Before they study, do they make plans to anticipate interruptions? When they study, do they manage interruptions successfully? They also need to understand how they process information once they choose to study. This analysis includes such assessments as an analysis of the quality of reading, marking, note taking, and review strategies. They need to determine how close their studying strategies match the demands of the test. Last, they should employ strategies to classify the types of errors made on a test or project and to identify the corresponding strategies to take corrective action.

While examining test errors, it is particularly important that students ask *what*, *when*, and *how* questions rather than *why* questions. The first three questions easily lead to corrective actions; the latter question often leads to causal attributions students cannot control. For instance, assume the student discovers that daydreaming is a problem. If the student describes the daydreaming behavior, and then develops a plan to control daydreaming, the student is likely to manage the daydreaming. On the other hand, if the student asks *why* the daydreaming occurs, the student is more likely to generate explanations such as "I am not interested," or the "Text is boring." These explanations often lead to inaction. Boring texts become the excuse for inaction.

Self-Reaction

According to Kanfer and Kanfer (1991), self-evaluation can lead to feelings of satisfaction or dissatisfaction and feelings of self-efficacy or feelings of inadequacy. Self-satisfaction/dissatisfaction is dependent not only upon the outcome of performance (success/failure), but also the perceived cause of success or failure identified during self-evaluation. Because self-regulated learners perceive themselves as responsible for their learning, the dissatisfaction energizes them to take corrective action. We want our students to acquire the attitude: "Effective strategy usage leads to successful performance; ineffective strategy usage leads to inadequate, poor or failing performance." Assume a student takes a test and does poorly. For change

to occur, this student needs to experience dissatisfaction with the current level of performance and then take corrective action.

DESCRIPTION OF COURSE

Our course consists of five major topics, four about self-regulation, and one about evaluation. The self-regulation topics include academic motivation, metacognition, volition, and cognitive strategies. The unit on evaluation presents typical information about measurement and evaluation as well as a section on evaluating self-regulated learning.

An instructional unit for each of the self-regulated learning topics consists of the following events. First, we present the supporting theories and research findings for the topic. Concurrent with this exposition, we administer a questionnaire to assess students' current functioning in this topical area. Second, we provide the students with the results of the questionnaire and ask them to engage in self-reflection on their functioning in this area. Third, we demonstrate corresponding strategies from this domain and provide students with the opportunity to practice the strategies and monitor their performance. Fourth, we demonstrate how teachers could embed the teaching of such strategies in different subject areas. Throughout the course we emphasize that successful self-regulation in learning situations requires the orchestration of numerous strategies. Self-regulated learners effectively manage their motivation, volition, and metacognition in relation to the cognitive strategies they employ. Because strategy orchestration is a major principle spanning topics, we regularly present demonstrations of this principle and have students practice orchestration where possible.

As stated, previously when our students enter the course, many lack the beliefs and strategies necessary to support successful self-regulation. Many of the students enter the course with unproductive motivational, metacognitive, volitional, and strategic knowledge. Furthermore, they have practiced incorrectly for years, while at the same time they achieved some "success" for their efforts. Given that they have no comparative knowledge about alternative practices, they have remained "successfully" ineffective. Many students have to significantly change their underlying beliefs about learning and motivation as well as their practices. We immediately recognized that we needed a model that addressed the complexity of changing unproductive beliefs and firmly entrenched habits.

We adapted a model of self-change proposed by Prochaska, DiClemente, and Norcross (1992) to inform our instructional practices. Prochaska *et al.* (1992) propose a five-phase model of change. In the *precontemplation phase* the person is unaware of the problem and does not intend to change.

Awareness of the problem begins to occur in the *contemplation phase* where increased self-awareness can lead to a personal conviction to change. It is during this phase that thoughts of change begin to occur, but the commitment is lacking. In our opinion, it is during this phase that significant conceptual changes begin to occur for the poorly self-regulated student through self-observation, self-evaluation, and self-reaction. The self-reaction should result in a dissatisfaction with the current attitude or behavior. This dissatisfaction, in turn, should lead to planning and a desire to self-regulate effectively during studying (Posner, Strike, Hewson, and Gertzog, 1982).

During the *preparation phase*, the student continues self-evaluation and develops a plan to take action in the immediate future. This also includes strategies to self-regulate and manage obstacles that are likely to occur. In the fourth or *action phase*, the student takes the steps necessary to change the desired behavior. It is also during this stage that the student monitors the action and engages in appropriate self-reward. Finally, during the *maintenance phase*, the student concentrates on consolidating gains made in the action stage. Both automaticity and performance evaluation occur during the latter phase. It is during this stage that strategy usage becomes less effortful. Because students have learned to practice the strategies under many circumstances, they are able to spend more cognitive effort on learning rather than spend a lot of time on how to execute the strategy (Anderson, 1983; Butler and Winne, 1995).

Given the time constraints of a one-semester course, our goal is to help students assess their strengths and weaknesses as self-regulated learners, develop a plan for appropriate changes, take action, and monitor the effects of their actions on their academic performance.

Illustrative Instructional Activities

In this section, we provide several illustrative instructional activities we employ in the course to help students construct the beliefs and strategies leading to self-regulated learning. Because our goal is to affect significant change in many of our students, we had to design activities to help our students construct personal meaningfulness for the course content. Thus, we constantly employ instructional activities that encourage students' reflective thinking about their beliefs, motivations, and strategic practices. Self-reflection is postulated to be a necessary condition for growth towards greater self-regulation (Ertmer and Newby, 1996; Pintrich, 1995). This self-reflection, in our opinion, is necessary to move students from the precontemplation or contemplation phase into the preparation phase. During this

phase, the students compare and contrast their current beliefs and practices in relation to productive self-regulation principles and practices.

Self-reflection Activities:

Journal. Early in the course, students are asked to keep a journal for 2 weeks in which they record information about when, where, how much, and how they studied during those 2 weeks. They use this information to evaluate their current performance, react to it, plan to change unproductive behaviors, and execute the plans.

Questionnaire. For each topic in the course, students are given a questionnaire drawn from the research literature on that topic. The purpose of the questionnaires is to focus students' attention on concrete illustrations of the course concepts and to assist students in identifying weaknesses for that dimension of self-regulated learning. See the Appendix for a sample questionnaire and a description of its use.

After coverage of the topic, students use the results of their responses to the questionnaire to write a reaction paper. The reaction paper consists of two components. First, students take the perspective of a psychologist writing a report. To do this, students report what the questionnaire reveals about their functioning as a self-regulated learner. This component encourages students to think about the content just covered and to write an explanation of it. In the second component, students evaluate the accuracy of the description to assess their functioning. As evidence to support their reasoning, they are encouraged to reflect on information from their journal about their study activities. The purpose of this perspective is to help students elaborate the course concepts with personal references. Thus students compare and contrast their beliefs, attitudes, and strategies with more effective ones. The questionnaires also help make the strategies more compelling.

In some cases, we have students turn in their answers anonymously. We then evaluate the class results and provide the whole class with feedback about the typical responses. We also use the data to analyze the effectiveness of the course.

Group Reflection. Quite often when we introduce a strategy, we have the class form groups to discuss how they would employ the strategy for an assignment in the course. Next, we discuss this at the class level. Students provide feedback to their peers, and the instructor provides feedback vicariously to individual students through the group discussions.

Error Analysis. After the administration of the first test, we instruct students how to perform an error analysis strategy developed by one of

the authors of this paper (ND). The purpose of this strategy is help students identify patterns of errors on a test and then take corrective action. The error analysis system consists of three dimensions: test-question analysis, information-processing analysis, and self-management analysis.

Test-question analysis requires students to identify the informational source(s) of the question. Likely informational sources include the text, lecture, other sources, or a combination of sources. Students also learn about their listening and reading skills. For example, they often discover that many of their errors originate from one source. Second, they identify the type or types of knowledge the question assesses. Students classify each question as mainly measuring either factual information, conceptual information, or procedural information. This information is used during the information-processing stage of the error analysis.

Information-processing analysis requires students to identify the strategies they should have employed to make information more meaningful and memorable. First, for textual information, the students determine if they marked the information necessary to answer the question. Second, if they marked it, they then evaluate their notes to determine if this information was recorded in an appropriate format for review. From this type of analysis, students get valuable feedback about the efficiency of their note taking. Often students take incomplete notes, or they find that the format of their notes was not conducive to discovering the important relationships among the concepts necessary to answer the questions.

The final step of the information-processing analysis requires students to identify types of items they missed on the test. Quite often we have students who frequently miss conceptual items and rarely miss factual items. After identifying the types of items missed, students then try to recall how they reviewed for the test. Very often, they discover that their review strategies do not correspond to the type(s) of knowledge assessed on the test.

Self-regulation analysis requires students to evaluate the extent to which they control, plan, execute, and monitor strategies to manage their time, motivation, volition, and information processing. Checklists are provided for each self-management dimension. Once students identify error patterns on our test, they generate a study plan to repair the deficiencies encountered in the analysis. Thus, we ask students to apply the cognitive, metacognitive, motivational, and volitional principles taught in the course to guide their performance and to repair their errors. This approach has several benefits. First, students self-regulate their own behavior more effectively. Second, they better understand the relationships between test performance and the preceding learning strategies necessary to perform well. Third, and perhaps most importantly, when these students become teachers, they will be able to identify the common errors their students make

on the exams. This knowledge should lead to better instructional practices. Finally, our students should know how to provide corrective strategy training for their pupils.

Teaching Strategy Orchestration

Strategy orchestration refers to the student's ability to choose appropriate strategies for a task, allocate the proper amount of time necessary to achieve the desired results, and then maintain the effective effort necessary to achieve the results. Successful strategy orchestration requires the necessary *when*, *why* and *how* knowledge to coordinate the strategies. Many unfortunate outcomes occur when students fail to acquire successful orchestration strategies.

For example, students can fail at strategy orchestration by not knowing how to manage one or more of the dimensions of self-regulation that support learning strategies. In this case, students know the strategies associated with specific learning tasks, but fail to manage volition or motivation. Second, failure can result from not knowing how to implement a specific learning strategy. This lack of knowledge may then affect later learning strategies. For example, students may not know how to record effective notes even though they apply general self-management strategies reasonably well. Poor notes lead to poor review strategies. This input–output problem is prevalent. Working at one phase of learning, the student produces a product that is inappropriate for the next phase. Third, students simply may not know how to combine strategies into a coherent repertoire. For instance, students may know how to record quality notes, but because they apply inconsistent time-management strategies or daydream frequently while reading a chapter, students fail to record effective notes. Given the poor notes, they then fail to produce effective elaborations during review.

Teaching students how to orchestrate strategies requires careful coordination among the various dimensions of self-regulation. We use a three phase system to teach the strategies necessary to orchestrate self-regulation (see Fig. 1). In the first phase, we provide students with the theoretical background and supporting research for each strategy. During the second phase, we "contextualize" the strategy. We do this by having students identify potential support strategies that would likely interfere with successful information processing. We also ask students to identify their own attitudes or habits that would likely interfere with the successful execution of the new strategy. Last, we identify prerequisite strategies the students should perform to maximize the success of the new strategy. These instructional practices rarely take much time. We employ these instructional practices

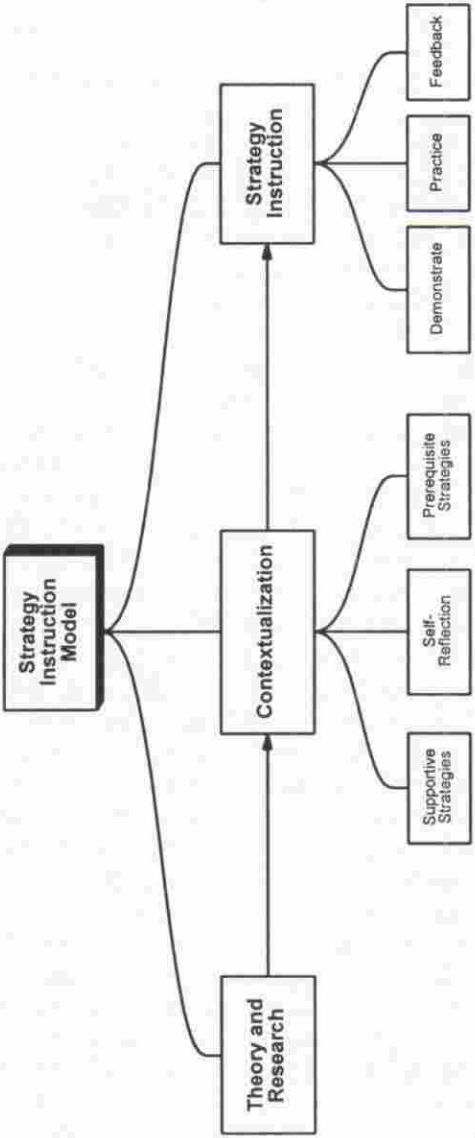

Fig. 1. Instructional model for strategy orchestration.

to continually reintroduce the self-observation, self-evaluation, and self-reaction model proposed by Bandura (1991) as well as the informed strategy user model proposed by Pressley (1986). In the third phase, we provide students with the actual strategy training. Practice on real instructional problems and feedback are included in this phase.

The following example demonstrates how we introduce students to a new learning strategy. Assume we want to teach knowledge about text-processing patterns, with a secondary outcome that the students will mark their text effectively. After we provide students with the supporting theoretical and research knowledge supporting the strategy, we engage the class in a discussion about those factors that would likely facilitate or destroy the execution of the new strategy-to-be-learned. This includes students' general motivational patterns (e.g., mastery learning goals), volitional strategies, and even selective attention strategies.

This part of the instruction is critical. For this example, assume we have not talked about daydreaming. Knowing that students tend to daydream, and knowing that daydreaming interferes with text processing, we ask them on which page they typically start to daydream when they read textbooks. Our goal is to help the students realize that daydreaming results from the employment of unproductive self-management and information-processing strategies and that it will interfere with current information processing. We also want them to understand that they could not daydream if they marked a text successfully.

As it turns out, the preponderance of students report daydreaming on the fourth or fifth page. We have replicated this many times. Interestingly, almost none of the students report awareness of this daydreaming pattern before we ask them. Thus, the students begin to think about strategies they might have to employ to pay attention to their work in order to mark their text successfully.

We also ask students to describe the time and location when they tend to daydream and are interrupted. The purpose of this question is to sensitize students to the environmental contexts within which they are likely to find themselves. Students consistently report they study in the evenings in their dorm room. Again, they report that they had never really considered other alternatives.

Given this information about themselves, students work in groups to discuss these findings. The goal of the group interaction is to help students generate realistic alternatives to their unproductive strategies. Groups typically suggest such logical alternatives as: study during the day, study in a quiet location, only read five pages at one sitting, distribute the study time

throughout the day, mark the textbook effectively, and record quality notes. The latter two information-processing strategies are particularly incompatible with daydreaming behaviors. This little exercise takes just 5–10 minutes, but students become more aware of unproductive habits and discover that they can affect appropriate change. We employ this self-change model for every component of the course. Some of the benefits of this method are:

1. Students employ more reflective self-observation skills. As an aside, students learn to describe the unproductive studying behavior. This is one of the first steps leading to self-change.
2. Students identify the dimensions and processes in the self-regulated learning model they need to control.
3. Students recognize that they have often made unproductive choices that lead to unproductive outcomes. This was not apparent to them initially. This self-evaluation is necessary for self-reaction.
4. Self-reaction must also occur. We need to arrange the conditions in the group to help students understand that their current default strategy is not only unproductive, it is unsatisfactory. Eventually we want our students to replace their performance goals with mastery goals.

Note-Taking Strategies

Graphic organizer notes play a central role in the course. Graphic organizer notes represent information in spatial arrays. We emphasize two types of graphic organizers: conceptual maps and matrices. Conceptual maps portray hierarchical relationships among different topics and subtopics. Matrices use rows and columns to represent the supporting detail associated with the concepts. We also emphasize note cards to record information and create connections among different concepts. To put note taking in perspective with the course goals, we employ a variation of the select-organize-and-integration model proposed by Mayer (1996). We demonstrate that each processing activity often has multiple purposes. For example, note taking increases selective attention, knowledge about organization, and knowledge about potential connections within, between, and among the topics and supporting details.

Quality notes, in turn, become the input for test-appropriate review. Thus, each information-processing strategy leads to an output. During note taking, for example, the learner predicts the types of elaborations to be made during review and predicts likely test questions.

Contrasting Achievement Goal Orientations

Repeatable categories Coordinate Topics

Goal focus	Learning Goal	Performance Goal
Internal Beliefs:		
Beliefs about success:	improving personal performance	being better than others
Attributional beliefs:	effort	ability
Behavior:		
Orientation:	mastery	helpless
Study strategy:	deep-processing	surface-processing

Fig. 2. Example of a matrix.

We employ the matrix representational system in five ways. First, we identify the structure of each unit using the matrix and associated knowledge patterns. Second, we use the maps and matrices to guide the construction of our tests. Third, when we present information in class or in handouts we employ the system. We constantly explain to the students why, when, and how we used the system to construct our overheads or handouts. We also demonstrate ways instructors and students can use the matrix system in related instructional activities. Fourth, we have students use the maps and matrices to generate likely test questions and to guide their elaborations. Finally, we have students use the system to analyze error patterns on their tests. To demonstrate how we employ the matrix, refer to Fig. 2.

Matrices are used in any situation in which a learner should elaborate coordinate information. To use a matrix effectively, a student must master three major skills. First, the student must learn how to construct the outer structure of the matrix. This includes both the top and side of the matrix. Second, the student must learn how to record the supporting detail information in the intersections. Finally, the student must learn how to use the matrix to generate appropriate questions during review. Of particular significance are the questions the learner generates to make connections between or among coordinate information in the rows. For example, given Fig. 2, a student might ask, " How do the beliefs about learning differ

between a learning and performance-oriented student?" Or "How do the behavior orientations differ?"

Guided Peer Questioning

Guided peer questioning is a cooperative peer questioning strategy in which students use generic question stems to generate questions over a reading assignment or lecture (King, 1989, 1991, 1992). We provide students with instruction in the difference between descriptive and explanatory questions as well as a set of generic questions to facilitate the development of explanatory questions. Descriptive questions require the student to list the parts of or characteristics of an object, action, or idea. For example, a descriptive question may ask the student to describe three categories of metacognitive knowledge. An explanatory question requires that the student explain how or why certain actions occur or why an object possesses certain characteristics. Asking a student to explain the importance of metacognitive monitoring in effective cognitive strategy use would be an example of an explanatory question. After generating explanatory questions outside of class, students meet in groups of 4–5 and take turns asking each other the questions they developed from their notes. King (1992) has shown that students trained to develop such questions benefit more from such collaborative questioning groups.

The more information students have about strategy orchestration, the more likely they are to employ flexible strategies, the more likely they are to optimize the correct selection of the strategy, and the longer they retain the targeted information. In our opinion, strategy orchestration training is a central construct in strategy training.

Modeling Strategy Instruction: Informing Students About Teaching

As we present the course content, we model various ways in which instruction can support the development of self-regulated learning strategies. We include examples of direct teaching, various collaborative learning practices, modeling, and scripted learning strategies. Scripted learning strategies are an adaptation of the reciprocal teaching model in which students are provided with a series of questions and guidelines to support their strategies. Thus, strategy training is embedded throughout the course. For example, whenever we present regular course content to the class through textbook reading assignments, lecture presentations, or group as-

signments, we either directly inform students when and why the strategy under discussion is appropriate and how to implement the strategy or we have students discover the same. Because we have a dual purpose of helping students become self-regulated learners as well as teachers of self-regulated learning strategies, we inform students about the rationale for employing the instructional method we employ. Whenever feasible, we contrast the strategy with alternate strategies.

Next we model the strategy. During the modeling, we again inform the learner why and when to employ the strategy. We also model how we use the strategy. Additionally, we often demonstrate or have students discover why a slight variation in the way a specific strategy is implemented can produce large differences in future processing demands. For example, consider the difference between two students using a matrix note-taking system. Student A records only phrases in the matrix, whereas student B records complete sentences. During review, student A has a clear advantage. Student A only needs to compare and contrast the critical phrases recorded in the notes. In contrast, student B has to reread each sentence, select the critical idea units in the sentence, then compare and contrast the idea units among the topics. Efficiency is greatly diminished when the student fails to record critical idea units in the initial representation.

Strategies to Evaluate Self-Regulation

When we introduce a new strategy to the class, we want students to understand its effects. As a result, we often formally or informally ask students the following questions about the strategy and then use their responses for further discussions.

1. Do you think the strategy is worthwhile?
2. Do you know how to employ the strategy?
3. Do you employ the strategy?
4. What types of problems does it present for you?
5. How do you employ the strategy?
6. How do you know it has a positive effect on learning or performance?
7. Can you think of a better way to teach it and provide transfer experiences?

We want the students to adapt the instructional strategies in their teaching. If we obtain negative evaluations of our instructional practices, even though the instructional practices might be highly successful in

terms of student performance, we try to modify our practices. Our reasoning is that if the students don't like the instructional practices, they will not likely use the practice when they teach. For example, in some recent informal assessment we found that a significant number of students rated small group efforts negatively, even though we attempted to make the small group projects an important part of the course. To counter the tendency for members of the group to fail to participate on the assignment, one of the authors (RS) gives the members of the group a few extra points on the unit test if all members of the group achieve a predetermined criterion score. This strategy appears to increase group participation.

In some cases we design classroom experiments to assess the effectiveness of a strategy. Aside from the intrinsic value of the experiments, this models an important dimension of teaching: the teacher as an action researcher. Students can help design the experiment, participate in it, and evaluate it. We discuss classroom research strategies teachers could employ to collect data and to informally evaluate the impact of their instruction on student performance.

Program-Wide Integration. As stated in the introduction, students should begin to develop a coherent framework of ideas related to learning and teaching as a result of taking an educational psychology course. Unfortunately, if this perspective is not presented consistently throughout their teacher-preparation program, it is highly likely that many students will fail to develop the self-regulated learning perspective as an organizing instructional framework. To increase the likelihood of transfer, students should practice those strategies in a variety of learning situations over an extended period of time, receive appropriate feedback about their performance, and then repractice the strategies. Thus, we recommend that instruction in self-regulation receive a central role in the total teacher-preparation program. This implies that educational psychologists would have a broader role than just teaching one course in the teacher-preparation program.

In fact, a one-semester course on self-regulated learning is likely to have only a minimum immediate impact on many students. Self-regulated learning is guided by attitudes one acquires over an extended period of time about ones' capabilities, learning, knowledge, motivation, and volition. It takes time to integrate these components. The goal of our course is to start students thinking about self-regulated learning. As we develop the instructional practices mentioned in this paper, we would like to extend them to the programmatic level.

CONCLUSION

Our redesign of a basic educational psychology course for preservice teachers resulted in a major alteration in what and how we teach. Our analysis of research and our past efforts lead us to conclude that our basic goal for the course has not really changed. We want to influence the educational practices of our students. Rather, what has changed is that we want our students to help their future pupils become self-regulating learners. In most cases, this requires a conceptual change on the part of our students. The students enter the course with many prior conceptions that are often incompatible with the desired psychological perspective we are trying to promote. The best way to bring about this conceptual shift is to teach students more productive learning strategies. This conclusion was based on research in metacognition showing that students tend to use strategies that they believe to be effective (Pressley *et al.*, 1984). If students use these strategies successfully, they should come to value them more, and the strategies should have greater personal meaning to them. They should, therefore, perceive the theoretical basis of these strategies as a more intelligible and plausible explanation of cognitive functioning. Both of these factors should lead to learning the course content as "conditionalized knowledge," thus making it more accessible to students later in their career in relevant situations.

At this stage in the development of the course, we have engaged in informal evaluations of a formative nature. Formal evaluations to this point have been limited to surveys of student satisfaction which has been very positive. Future evaluations will focus on improvement of course components and follow-up assessments of how the course affects students' learning strategies after they exit the course.

APPENDIX

A Sample Questionnaire

The questionnaire was derived from the Personal Goals in School Questionnaire developed by Nicholls, Patashnick, and Nolen (1985). What is presented is the scoring sheet with the questions grouped according to the common factor underlying those items. In scoring the questionnaire, students are encouraged to think about the meaning of what was being measured. After scoring their responses, students are informed of the

course concepts measured by the questionnaire and how they functioned in self-regulated learning

Scoring the Success in School Questionnaire

Directions. The number in parenthesis after each question indicates its position on the questionnaire. Locate each question on the questionnaire, and in the appropriate space below write the numerical value that appears below the adjective that you circled as your response to that question.

When do you feel you have had a really successful day in school?

Factor 1

I feel most successful if I get out of some work. (10) . . . . . _____
I feel most successful if all the work was easy. (13) . . . . . _____
I feel most successful if I score high on a test without studying. (1) . . . . . _____
I feel most successful if I fool around and get away with it. (15) . . . . . _____
I feel most successful if I don't have to do any homework. (6) . . . . . _____
_ **TOTAL** . _____

Using one or two sentences, describe in the space below the human characteristic or motive that the five questions of Factor 1 are probably trying to measure.

Factor 2

I feel most successful if I do the work better than other students. (5) . . . . . _____
I feel most successful if I show people I'm smart. (7) . . . . . _____
I feel most successful if a teacher says I did well. (8) . . . . . _____
I feel most successful if I am the only one who can answer the teacher's questions. (12) . . . . . _____
I feel most successful if I don't do anything stupid in class. (3) . . . . . _____
_ **TOTAL** _____

Using one or two sentences, describe in the space below the human characteristic or motive that the five questions of Factor 2 are probably trying to measure.

Factor 3

I feel most successful if something I learned makes me want to find out more. (2) . . . . . _____
I feel most successful if I solve a tricky problem by working hard. (9) . . . . . _____
I feel most successful if something I learned really makes sense to me. (11) . . . . . _____
I feel most successful if I work hard all day. (4) . . . . . _____
I feel most successful if I get a new idea about how things work. (14) . . . . . _____

TOTAL_____

Using one or two sentences, describe in the space below the human characteristic or motive that the five questions of Factor 3 are probably trying to measure.

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