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6 Learning Strategies: The How of Learning

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1 The term *learning strategies* is used in a very broad sense to identify a number of different competencies that researchers and practitioners have postulated as necessary, or helpful, for effective learning and retention of information for later use. These competencies include cognitive information-processing strategies, such as techniques for organizing and elaborating on incoming information to make it more meaningful; active study strategies, such as systems for note-taking and test preparation; and support strategies, such as techniques for organizing study time, coping with performance anxiety, and directing attention to the learning task at hand. In addition, there is a range of metacognitive strategies that learners can use to detect discrepancies between what they know and what they do not know and to monitor and direct their acquisition of the new information. It should be noted that the term "learner" is being used here to refer to any person trying to acquire new knowledge, attitudes, or skills, regardless of whether this occurs in a formal school setting, an on-the-job placement, or an informal interaction.

2 This chapter describes some of the work that has been conducted as part of the Cognitive Learning Strategies Project at The University of Texas, a project that is concerned both with increasing our basic understanding of human learning and with the development of programs and teaching practices to help students become more effective learners. Here we focus on the more applied aspects of our work. We begin by briefly reviewing some recent research on the nature of effective learning strategies that provides a conceptual framework for much of our instructional work. Next, we discuss our progress on the development of an instrument that can provide diagnostic information about students' strengths and weaknesses as learners. Finally, we describe the kinds of instruction in learning

strategies that we offer students, and briefly discuss some of the research we have undertaken on various aspects of our instructional program.

FOUNDATIONS OF LEARNING STRATEGIES RESEARCH

Recent research and development efforts in psychology, education, and training have resulted in changed perceptions of the roles assumed by learners and instructors. In these new conceptions of the teaching/learning act (Wittrock, 1974, 1978), effective learners are seen as active information processors, interpreters and synthesizers, who use a variety of different strategies to store and retrieve information. Such individuals assume much of the responsibility for their own learning, as evidenced by their efforts to adapt the learning environment to fit their needs and goals.

In the past, learning was viewed as an almost mechanical response to incoming stimuli; it was believed that the learner was greatly limited in what he or she could do to improve comprehension and memory. Gradually, the growth of cognitive psychology shifted the attention of many researchers to studying the ways learners process incoming stimuli. George Miller (1956) was one of the first researchers to investigate the methods by which individuals transform, or code, incoming information to make it easier to learn and remember.

Miller was interested in the operations by which stimulus inputs could be coded to form higher order units called chunks. He hypothesized that people tend to organize incoming information into these chunks, or groups, as a way of reducing limitations imposed on learning and memory by our limited capacity information-processing capabilities. Another type of coding operation that enables one to reduce the amount of information to be processed involves selecting a specific portion of the to-be-learned information as the critical element to code and then using this portion as a cue for reconstructing the entire stimulus. Coding by stimulus selection can occur whenever a stimulus can be analyzed into component parts (Navon, 1977).

Not all coding operations reduce the amount of information to be processed. Some operations may require that the learner expand incoming information to make it easier to learn and remember. Examples of this type of process include the use of imaginal or verbal elaboration (Paivio, 1971; Reder, 1980; Rohwer, 1970; Weinstein, 1978). The use of these strategies requires a learner to create some type of symbolic construction, such as an image, an analogy, or an inference, to help make the new information more meaningful. Creating imaginal and verbal elaborators to learn new information can be done any number of ways. One could relate the new information to previously acquired knowledge or experience, or one could examine the new material and identify logical relationships among the component parts or attempt to draw inferences from its content. For example, learning about arbitration and how courts try to settle

disputes may be made easier if this unfamiliar process is compared to students' knowledge about how friends settle disputes. The goal of each of these processes is to relate the new, unfamiliar material to the old, already learned store of knowledge and experiences possessed by the learner.

When learners try to relate new knowledge to what they already know, we call this active, or generative, learning (Wittrock, 1974, 1978). It is generative because the learner must generate the relationships between what he or she already knows and the new information to be learned. For example, if students were studying a unit about the circulatory system, generating comparisons to an analogous system, such as the operation of a sink and its plumbing, could help them to learn this new information. Creating inferences about the role of the circulatory system and its relations to other parts of the body could also help in understanding the functions and operations of the circulatory system. Each of these strategies involves taking active steps to manage one's own learning processes to facilitate knowledge acquisition and comprehension.

Research on learning strategies received even more attention after the national trend in the 1960s to establish open admission or special admission policies. Colleges and universities began to accept students who previously would not have been admitted. Gradually, learning theorists began to recognize that "the new students" were not only lacking in reading skills, motivation, and stress management skills (Cross, 1969) but also in active coding and information-processing strategies (Rohwer & Ammon, 1971; Rohwer, 1973). More recent studies of the learning strategies used by Army recruits, community college students, and university students indicate learning strategy deficits that are inversely related to the level of education attained (Weinstein, Wicker, Cubberly, Roney, & Underwood, 1980).

Still other researchers, such as Golinkoff (1976) and Ryan (1980), have noted that active information-processing strategies play an important role in successful reading comprehension—good readers differ from poor ones in their use of a variety of strategies for transforming the information contained in texts so that it becomes easier to understand and remember. A large body of research on reading comprehension has documented the effects of the learner's schemata (knowledge structures) on comprehension and recall (see Anderson, Spiro, & Montague, 1977). Schema theorists argue that comprehension depends on an interaction between two factors: (1) the learner's knowledge of the characteristics of the message and the context in which it is given; and (2) his or her efforts to relate the incoming idea units to each other and to previously acquired information. Additional evidence of this interaction is found in a number of structure-of-text studies showing that experienced readers are able to infer the author's textual schemas with explicit cues, whereas inexperienced readers are not (e.g., Meyer, 1980).

Given these and similar findings, some researchers have turned their attention to the investigation of methods and programs for instructing students to use

effective learning strategies. However, in contrast to classic experimental designs, the paradigms used in learning strategies training research are often quasi-experimental, the instruction is typically long in duration, and students are taught a range of different strategies that are considered to be effective for different kinds of learning situations (Anderson, 1979; Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1979; Jones, Amiran, & Katims, this volume; McCombs, 1981; Sticht, 1979; Weinstein, 1978; Weinstein, Underwood, Wicker, & Cubberly, 1979; Weinstein & Underwood, 1982). The work by Jones and Sticht has focused on embedding learning strategies instruction into regular reading curriculum materials, whereas the work of Anderson, Dansereau, McCombs, and Weinstein has focused on the development of special training programs that are used as an adjunct to regular classroom instruction. In addition, a paradigm that involves training subject matter teachers to incorporate instruction in learning strategies into their regular classroom presentations has also been proposed (Monroe, Fegan, & Scott, 1980; Weinstein, 1982).

11 Regardless of which paradigm is used, successful implementation and evaluation of a learning strategies training program requires a reliable and valid means for measuring students' deficits. An accurate diagnosis of students' entry-level learning strategies deficits could be used to create individualized prescriptions for training, and subsequent assessments could be used to evaluate the effectiveness of that training.

ASSESSING LEARNING STRATEGIES

12 Currently, the majority of instruments available for assessing learning strategies focus on the individual's study practices. These instruments are generally used in high school or college settings for a number of purposes, including: (1) prediction of academic performance; (2) counseling students concerning their study practices; and (3) screening or criterion measures for study skills courses.

13 Several study skills instruments are available commercially. A review of these instruments (Schulte & Weinstein, 1981) revealed that most of them covered traditional areas of study skills, such as note-taking, time management, work habits, and student attitudes toward school and study. Generally, these instruments use a self-report format and sample a broad range of topics within the area of study skills. For those instruments that provide such data, reliability was generally found to be in the acceptable range of .80 and above (Anastasi, 1976). However, subscales, partially due to their shorter length, often were found to have somewhat lower reliability (.46 to .93).

14 Most of these inventories have used what Svensson (1977) terms a "correlational" approach. That is, they seek to find behaviors or activities that are correlated with successful studying, but may not be the direct cause of successful learning. Such a correlational approach is reflected by the manner in which study

skills inventories are typically constructed and validated. For example, Carter (1958) constructed his California Study Methods Survey by weighting items on the basis of how well they distinguished between students with high and low grade-point averages who had similar IQ and achievement test scores. A similar procedure was used in selecting items for the Survey of Study Habits and Attitudes (Brown & Holtzman, 1967), the Effective Study Test (Brown, 1964), and the College Adjustment and Study Skills Inventory (Christensen, 1968).

15 Although all of these inventories predict grade-point average to a moderate degree (.19 to .60), they do not yield information about *how* the student learns, only the conditions under which he or she does it best. Svensson (1977) distinguishes this correlational approach from a functional approach that seeks to find qualitative differences in how students study that may affect learning outcomes. For instance, Svensson found that students learned reading passages by attending to either specific details of the text or by searching for overall meaning. He found that a student's strategy for reading influenced both the amount and the type of information recalled from the text.

16 Goldman and Warren (1973) constructed a study strategies questionnaire to determine if different types of learning strategies were used by successful versus poor students across various college majors. Using discriminant analysis, the authors found that the items that highly discriminated between students with high and low grade-point averages across all majors seemed to tap two dimensions of effective study. These were diligence in study habits and an active learning style. They defined an active learning style as one that involved building on previous understanding of subject matter or relating new information to material learned in other classes.

17 Another instrument, the Inventory of Learning Processes (Schmeck, Ribich, & Ramanaiah, 1977), is one of the few instruments developed expressly to measure the kinds of information-processing activities students use while trying to learn academic material. This instrument consists of four scales obtained by factor analyzing students' responses to the inventory items. Three of the scales assess information-processing strategies students use while learning. The Elaborative Processing Scale contains items concerning the use of an active learning approach whereby the to-be-learned information is related to the learner's previous knowledge in the same field, as well as in other topic areas. The Synthesis–Analysis Scale contains items measuring the learner's use of organizational strategies. The third scale, Fact Retention, examines the learner's techniques for remembering specific facts and details. The last scale, Study Methods, consists primarily of items assessing learners' use of traditional study techniques on a regular basis.

18 Schmeck et al. (1977), as well as Schmeck and Grove (1979), and Schmeck and Ribich (1978), provide extensive reliability and validity information for the Inventory of Learning Processes. Test–retest reliability for the scales ranges from

.79 to .88. Scale scores were found to correlate with performance on several types of learning measures, such as a test over the material covered in a classroom lecture, and both recall and recognition scores on verbal learning tasks.

19 Dansereau (Dansereau, Long, McDonald, & Actkinson, 1975) has also developed a questionnaire designed to measure individual differences in college students' learning strategies. The Learning Strategy Inventory consists of 201 multiple-choice items based both on previous study skills inventories and on descriptions of learning techniques derived from the current psychological and educational literature. Based, in part, on research with their questionnaire, Dansereau and his associates have identified four areas where students may use strategies to help themselves complete academic tasks: selection of material that needs special attention because it is unfamiliar or important, comprehending and retaining important information, retrieving information from memory, and coping with internal and external distractions that can occur while studying (see Dansereau, this volume).

20 Weinstein has also developed an assessment instrument to measure learning strategies; however, she has used a slightly different format from the ones used for the instruments previously discussed. The Learning Activities Questionnaire (Weinstein et al., 1980) asks respondents to describe the methods they would use to learn various types of stimulus materials including paired-associate and free-recall lists, and reading passages. In one section, learners respond to open-ended questions that require them to provide descriptions of how they would learn the information contained in the various learning tasks. In a second section, the same questions are presented, but are followed by a checklist that describes several different strategies. In this section, learners need only recognize the strategies they would use. Descriptions of learners' strategies are then classified into one of six strategy categories: (1) verbal elaboration; (2) imagery; (3) grouping; (4) physical similarities; (5) rote responses; and (6) unscorable responses. Test-retest reliability for the instrument is .88. Interrater reliability is .90.

21 Although a number of these experimental instruments have proved to be highly useful research tools, they have limited utility as diagnostic measures. In fact, after an extensive review of both commercially available and experimental instruments conducted as part of our current work on the Cognitive Learning Strategies Project, the following conclusions were reached:

1. Across study skills inventories, there seems to be no consistent definition of study skills. The term includes a broad range of topics, and inventories vary in their coverage of these topics. In addition, the specific topics covered by a particular inventory often are not specified.

2. Although several inventories have subscales that measure specific topics within study skills (e.g., note-taking, scheduling), the reliability of the subscales is often so low that the subscales cannot be used separately.

3. Most of the recommended or "good" study practices in study skills inventories have not been empirically validated. Therefore, a high score on a study skills inventory does not necessarily mean that a student's study practices are effective.

4. No instrument has been validated for use as a diagnostic instrument. The majority of validity studies have demonstrated the usefulness of a given instrument as a predictor of academic achievement.

5. Most of the instruments can be easily faked. That is, students who want to give the impression that they use effective learning strategies could respond to the instrument in ways that would not provide accurate information about their actual strategy use.

6. Although recent research has suggested that there are two components to effective study—consistent and regular study, and an "active" learning style—most items in published inventories deal primarily with the first component.

22 Given these problems, a major goal of our current work on the Cognitive Learning Strategies Project has been to develop an instrument to help educators and trainers diagnose strengths and weaknesses in students' learning and study strategies in order to provide individualized remedial training. To accomplish this goal an instrument is needed that: (1) assesses a broad range of topics within the area of learning strategies in a reliable and valid manner; (2) assesses covert and overt behaviors that are related to learning and that could be altered through training; (3) reflects the current state of the art in learning strategy research *and* cognitive psychology; and (4) is validated for use as a diagnostic instrument. For the past 2 years we have been developing an instrument to meet these criteria. This measure, the Learning and Study Strategies Inventory (LASSI), a 90-item self-report measure, has undergone extensive pilot testing and a small-scale field test. In addition, several concurrent validity studies have been conducted using both self-report (e.g., test anxiety) and performance measures (e.g., reading comprehension and note-taking). Several larger scale field tests are also underway.

23 The results thus far are highly encouraging. The LASSI is being used in high school, community college, and university settings as a diagnostic tool and as a basis for designing individualized interventions. Information gathered from these programs will be used to refine the instrument and finalize its content. The current form emphasizes both active cognitive strategies and more traditional study skills and support strategies. Potential subscales include information processing, anxiety management, elaboration, motivation, attitudes and attributions, selecting main ideas and themes, test preparation, review and practice, and memory.

24 Items selected for inclusion in the LASSI assess both overt and covert strategies and skills that can be modified through training. This is an important consideration for a diagnostic instrument. An item such as "My mother read to

me when I was a child," may be highly predictive of performance, but would be useless as a basis for designing remedial training.

In addition to providing a tool for individual assessment and prescription, the data obtained from administering the LASSI have helped to focus the curriculum designs for our experimental training programs. In particular, studying the patterns that differentiate between more and less successful students helps us to identify training priorities. Given the realities of limited time and resources for learning strategies programs in either the public schools or higher education settings, this data base is helping us identify the skills and strategies most critical for inclusion in learning strategies instructional programs, such as elaboration, selecting the main idea, and self-testing and monitoring activities.

DEVELOPING LEARNING STRATEGIES TRAINING PROGRAMS

For the past several years, we have been involved in a program of applied research to determine how to help students acquire more effective learning strategies. We have used several approaches in conducting this research. In the sections that follow, we first describe one of our brief training studies and indicate how the findings that have emerged from this approach have provided an empirical basis for our more extended attempts at instruction. Next, we describe our semester-long course in learning strategies and our attempts to evaluate it. Finally, we discuss other approaches to incorporating learning strategies instruction into the school curriculum.

Our brief training studies have attempted to build on the cognitive psychology research literature discussed earlier in this chapter documenting that effective learners attempt to relate incoming information to their previously acquired store of knowledge to make the new information easier to understand and remember. We have referred to the methods effective learners use to relate incoming information to previous knowledge as elaboration skills. In our brief training studies, we have asked whether it is possible to teach these skills to students, whether doing so would produce improvements in their ability to learn and remember academic material, and what instructional techniques should be used.

To make the nature of our instruction in elaboration skills clearer to the reader, we discuss some learning tasks that students frequently encounter in school and indicate how the use of elaboration skills can help them more effectively cope with these tasks. One set of academic tasks is to memorize arbitrary associations between symbols and their referents. For example, in a driver education class, students might be asked to learn the following arbitrary association: Round signs on a highway warn a driver that railroad tracks are ahead. Effective learners approach the task of remembering arbitrary associations by using their background knowledge to impose meaning on these associations. That is, as an aid in remembering that "round" and "railroad" go together, they might imagine

these two terms interacting in some meaningful way, such as through the formation of an image of the *round* wheels of a *railroad* train. In short, the effective learner's strategy for remembering isolated bits of information is to think up some meaningful way in which they can be seen as related to one another.

Another task that students frequently encounter in school is to learn complex bodies of information in which the individual facts already bear a meaningful relationship to one another. The effective learner's approach in situations like these is to attempt to discover these meaningful relationships—that is, to use their previously acquired background knowledge or experiences to draw inferences, seek out implications, look for underlying themes, and so on. All these different methods for coping with learning and memory tasks may be described under the general label of elaboration skills in that they involve expanding on the material to be learned in ways that make it more meaningful to the learner.

Initial Feasibility Study

In the initial research study, Weinstein (1975) explored whether students could be taught to use elaboration strategies as an aid in coping with school learning assignments, and whether their use of these strategies would result in improvements in their ability to understand and remember academic materials. Toward this end, she created a diversified elaboration skills training program for use with ninth graders. Instruction centered around the following five strategies: using sentences as elaborators, using images as elaborators, forming analogies, drawing implications, creating relationships, and paraphrasing. Instruction involved teaching students how to apply these strategies to a variety of learning tasks typically encountered in school, including paired-associate learning tasks, free-recall learning tasks, and reading comprehension tasks. The stimulus materials used during instruction were drawn from the ninth-grade curriculum in science, history, English, foreign language, and vocational education. More specifically, one of the reading comprehension tasks involved a passage from a science textbook describing the features that distinguish arteries from veins. Students were asked to read this passage and to learn and remember the information it contained. They were taught that an effective strategy for learning and remembering information from text about concepts and their attributes was to use sentences and images as elaborators. That is, they were told to try to think up meaningful associations between the concepts discussed in the text and the information that was provided about their defining attributes. For example, to remember that veins are thinner than arteries, students were told to try to form a picture in their minds of veins as being thin tubes, or to make up sentences associating veins with thin tubes such as "the vein woman is thin as a rubber tube."

For this study, 75 ninth-grade students were randomly assigned to one of three groups: training, control, or posttest-only. The training group participated

in a series of five 1-hour elaboration skill training sessions, administered at approximately 1-week intervals. Students were exposed to a set of 19 learning tasks. They were required to create a series of elaborations for each of these tasks. Experimenter-provided directions for the early tasks emphasized the properties of an effective elaboration strategy. The later training sessions provided opportunities for additional practice in using these skills with little or no experimenter-provided instructions. The control group was exposed to the same stimulus materials, but their task was simply to learn the information without any type of strategy prompts or directions. A posttest-only group was not exposed to the stimulus materials but did participate in the posttesting sessions. The immediate posttest was administered a week after the conclusion of the training, and the delayed posttest was administered approximately a month later. Both immediate and delayed posttests consisted of two reading comprehension tasks, two trials of paired-associate learning and serial recall, and a one-trial free-recall task.

The results of the data analyses for the immediate posttest revealed significant differences between group means on the free-recall task and Trial 2 of the paired-associate learning task. In each instance, the training group's performance surpassed the performance of the control and posttest-only groups, which did not differ significantly from each other. On the delayed posttest, a significant difference was obtained for the reading comprehesion tasks and Trial 1 of the serial learning task. Again, these differences favored the training group. It seemed that students could learn to use these elaboration strategies, but further research was required to determine the optimal conditions for their learning and use. Much of our later research has focused on this issue.

Developing an Experimental Learning Strategies Curriculum

Studies such as the one just described helped to provide the foundation for more extensive training programs developed as part of the Cognitive Learning Strategies Project. In addition, a variety of other sources was used to help refine both the content of these programs and the instructional methodologies used. For example, student interviews during learning sessions and analyses of individual talk-aloud protocols provided additional information about the learning strategies used by good and poor students. A more extensive data base was also created by administering the Learning Activities Questionnaire and the Learning and Study Strategies Inventory to students at a variety of educational levels.

This work also led to the creation of an experimental, integrated learning strategies curriculum. This curriculum has been implemented in a three-credit lower division course established in the Department of Educational Psychology at the University of Texas at Austin. The preliminary research design and development of this course is described by Underwood (1982). While providing a needed service for students attending The University of Texas, the course, entitled Individual Learning Skills, also provides a real-world laboratory for our project. Both the successes and the problems identified in this course often form the basis for further research.

Course Overview. Although the students who enroll in this course range from freshmen to seniors, the majority are lower division students. Many students are advised to take the course because they are doing poorly in their studies or have been placed on academic probation. However, a number of the students who take Individual Learning Skills do so because they want to improve their learning ability in preparation for advanced study or graduate programs.

Specific goals for the course are developed individually with each student after a battery of entry measures is administered. These include the Learning and Study Strategies Inventory, the Survey of Study Habits and Attitudes (SSHA) (Brown & Holtzman, 1967), the Trait Anxiety Inventory portion of the State–Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, & Luschene, 1970), and the Test Attitude Inventory (TAI) (Spielberger, Gonzalez, Taylor, Algaze, & Anton, 1978). In addition to these self-report measures, the Nelson–Denny Reading Test, either Form C or D (Brown, Nelson, & Denny, 1973), is also administered. The information obtained from these measures, from individual interviews, and from group discussions is used in designing the curriculum, individual focus projects, and laboratory exercises.

One of the many problems in designing a course of this nature is that of individualization. This is difficult to achieve with one teacher and 30 students per section. Therefore, given these and other logistical constraints, both group and individual goals are established.

General course goals are that, upon finishing the course, students will: (1) be able to monitor and modify their use of learning strategies; (2) increase their ability to use effective learning strategies; and (3) be able to reduce the stress and negative affect often associated with academic tasks. To help operationalize these goals, a variety of specific content areas is discussed.

Course Content. Although the specific content varies, general topics include: background information about motivation and cognition, for example, information documenting the importance of being an active learner or discussions of basic cognitive principles and concepts that form the foundation for the course; methods students can use to monitor their understanding and help direct their learning activities, such as stopping periodically while reading and using self-testing to determine if comprehension has occurred; instruction in a variety of information-processing strategies that students can use to help themselves acquire and remember new knowledge, for example, using imaginal or verbal elaboration to create a link between the new, unfamiliar information and already learned

information; instruction in more traditional study skills techniques such as note-taking, selecting main ideas and themes, and test taking; and a variety of support skills such as techniques for managing stress, improving negative self-images, improving concentration, and organizing one's study time.

The majority of principles, strategies, and skills discussed in the course can be generalized to a variety of academic content areas. However, much of the training research literature documents the problems of transfer without specific training. We have found that effective methods for dealing with this problem include: (1) referring to a variety of academic content areas when presenting material about learning principles and strategies; (2) directly addressing the issue of transfer when providing examples; (3) providing practice exercises in a variety of content areas; (4) conducting group discussions of strategy or skill use, using a "brainstorming" format; and (5) requiring that students document their use of learning strategies in a journal reviewed by the instructor.

Instructional Methods. In spite of limited resources and a traditional format of three 1-hour classes per week, the instructional methods used in this course are quite eclectic. Mini-lectures, group discussions, role playing, peer tutoring, and practice-feedback exercises are among the in-class activities. Special sessions are devoted to individual consultation or small-group consultation on a shared problem. Instructional feedback sessions are also conducted for analyzing and evaluating instructional procedures, which are continually being modified as a function of these sessions, other research conducted by our project, and other projects described in the literature.

A critical component in the instructional plan focuses on student activities. In a series of studies we conducted that were designed to identify the key variables involved in learning strategy acquisition, two variables were found to be important: opportunities to *practice* as well as to *receive feedback* about both the new strategies and the kinds of self-monitoring activities necessary for selecting, modifying, and evaluating strategy use. In fact, we discovered that the provision of numerous examples by the instructor prior to student practice and feedback sessions can inhibit strategy acquisition and use, particularly for those strategies that can be characterized as heuristics. For example, the use of elaboration as a knowledge acquisition strategy centers around the general principle of relating to-be-learned information to knowledge already present in the student's semantic network. Unlike an algorithm that specifies the precise steps necessary to achieve a specified goal, such as the directions for building a model, the use of elaboration involves applying a set of general guidelines that must be operationalized, tested, and perhaps modified to meet a specific need. When the instructor provides more than a few examples prior to the students having an opportunity to try out the strategy and practice using it, students may attempt to mimic what they perceive to be the "right" way to use the strategy. That is, novices or individuals attempting to improve their ability to use a learning strategy will often try to copy what

they perceive to be a correct method used by an expert. Although this can be capitalized on by the instructor when presenting highly routinized processes or procedures, it is a problem when teaching heuristics.

To help overcome this problem most learning strategies discussed in the course are presented in a cyclic manner. First, the instructor will discuss how the strategy can help address one or more problems described by the students or identified in the entry-level assessments. These discussions are also related to the initial class sessions that cover student motivation, the concept of the active learner, and the need for students to take more responsibility for managing their own learning. Following this, the instructor will identify the key elements of the strategy and provide two or three examples.

Given the state-of-the-art in the learning strategies literature, this is not always an easy task. Much of our research has been directed to identifying the important attributes of a variety of learning strategies. The older literature is replete with folklore and common-sense notions about study skills that only recently are being subjected to more systematic empirical study, and much of the literature on cognitive strategies is too new to offer well-documented procedures. When these problems occur, we must create instructional guidelines based on the data available. These new instructional sequences are then field tested in supplementary studies and in the course itself. This is a challenging and laborious task, but a necessary step toward the development of effective training programs.

In the course, practice exercises are presented after the rationale for a type of strategy is established and the characteristics of the strategy have been discussed. As the issues of transfer and generalization are important, exercises are selected from a variety of content areas, including other courses in which the students are enrolled. During each set of exercises (a set includes a maximum of three tasks), the instructor provides individual feedback and assistance. Following each set of exercises, there is a group feedback and discussion session that also incorporates an expanded discussion of the strategy. For certain topics, such as setting up a weekly time schedule, this amount of in-class practice and discussion might be sufficient, whereas for other topics, such as comprehension monitoring during reading, it is not. For the more complex or difficult strategies, additional practice and feedback discussions are provided.

Out-of-class assignments are also used. These assignments take a variety of forms. A journal describing progress on individual problems is updated on a weekly basis. Short papers describing particular strategy applications and problems encountered are also completed on a weekly basis. Practice exercises and guidelines for practicing in other classes are provided at each class meeting.

As the student's repertoire of strategies develops, attention is also given to integrating the use of various strategies into more comprehensive learning and study systems, in which individual strategies can be used in a coordinated fashion. Students are taught how individual strategies relate to one another and the holistic properties of systematic approaches to learning and study are discussed. These

discussions occur frequently throughout the semester. There are also periodic review sessions and special problem sessions where individuals or small groups can be helped to improve their use of one or more specific strategies.

48 *Evaluation Data.* In addition to the various problem papers, homework assignments, and quiz grades, performance changes are also assessed by a battery of postcourse measures. These include a readministration of the entry-level measures as well as responses to simulated student learning problems. The results have been very exciting. Significant increases in performance on a variety of tasks have been demonstrated. For example, students have made substantial gains in reading comprehension as measured by the Nelson-Denny Reading Test. At the beginning of the course, the average score for the entire group was at the 44th percentile; at the end of the course, the average score was at the 65th percentile—a gain of 21 points. For students whose scores on the Nelson-Denny upon entering the course were in the bottom one-third, there were even larger gains; these students demonstrated average gains of 45 points. In addition, self-reported levels of anxiety have been reduced and the use of effective learning and study strategies has increased. Follow-up studies of student grade-point averages also demonstrate significant gains.

49 Indirect evidence is also provided by the increasing number of students registering for the course and the feedback from academic advisors about students who have participated. Despite the relatively heavy work load in this class, students suggest it to their friends and listed it as a top priority for students on academic probation.

50 However, these findings are difficult to interpret due to the lack of control data. We have encountered a number of obstacles to obtaining an appropriate control group, for example: Although the enrollment has increased each semester, we are still able to accommodate all students wishing to enroll, which precludes the use of a waiting-list control group. Few courses have as diverse a student enrollment as this course, but even for those that do, (1) the students are not comparable, for example, in terms of motivational levels; and (2) even the most cooperative instructors feel imposed upon when asked to donate from three to six class periods for research purposes. The use of volunteers would present its own unique set of problems with respect to comparability. Thus, appropriate comparison data are not available at this time, but we are able to demonstrate significant improvements during the semester for students enrolled in the course.

The Metacurriculum—An Alternative Training Method

51 Providing an adjunct course or program for teaching learning strategies is just one method of imparting this knowledge to students. Part of our research has focused on the role of content-area teachers in high schools and community colleges in developing students' learning strategies. Teaching students how to

learn and process knowledge more effectively is a metacurriculum that can be included in any content-area course. By using teaching and instructional methods that cue, demonstrate, and reinforce the use of learning strategies, instructors can enhance their students' ability to be independent and effective learners while also teaching the content-specific material in a course. Incorporating this metacurriculum into content-based curricula enhances student learning in both areas.

52 As teachers, we have many opportunities to teach learning competencies while we are teaching the knowledge, skills, and attitudes that comprise our content areas. In fact, it is almost impossible to separate effective teaching strategies from effective learning strategies in a didactic interaction. Many effective teaching strategies are just the flipside of effective learning strategies. The teacher who gives a variety of examples of a principle is trying to make contact with the individual experiential backgrounds of his or her students. The instructor who creates an analogy that relates the topic under study to an everyday phenomenon is trying to help the students use knowledge they already possess to elaborate on the new information and make it more meaningful. Converting these teaching strategies to a learning strategies metacurriculum involves making these effective teaching processes more explicit and incorporating discussions and examples of learning competencies that may not have been included before.

53 For example, in introducing the court system used in the United States, teachers often try to relate legal forms of settling disputes to their students' experience with arguments and disagreements. They compare the judge to the teacher, parent, or police officer who tries to settle the differences, or to decide who is to blame for the damage. The jury may be compared to a group of friends who try to help two members of a group settle a dispute, and so on. Clearly, the instructor is trying to help his or her students understand the court system by relating the components to their own experiences and previous knowledge by creating analogies. With very little effort, this excellent teaching device could also be used as part of the metacurriculum for teaching learning strategies simply by making the technique explicit. Instead of just presenting these analogies and then continuing with the class, the teacher could take a few moments and draw attention to the method being used, why he or she thought it would help the students learn the new information, and how they could use this technique on their own when studying. Clearly, this one experience would not be sufficient for most students to learn to use analogies as an information-processing strategy, but repeated exposures to this technique in a variety of contexts over time, along with prompting and corrective feedback, can contribute to students' development of effective learning strategies.

54 Thus far, we have only produced pilot programs to train teachers to implement a learning strategies metacurriculum. Results in both high school and community college settings have been very encouraging. Teacher interest and motivation have been high, even though the training sessions are usually conducted after normal working hours. [illegible]

discussions occur frequently throughout the semester. There are also periodic review sessions and special problem sessions where individuals or small groups can be helped to improve their use of one or more specific strategies.

Evaluation Data. In addition to the various problem papers, homework assignments, and quiz grades, performance changes are also assessed by a battery of postcourse measures. These include a readministration of the entry-level measures as well as responses to simulated student learning problems. The results have been very exciting. Significant increases in performance on a variety of tasks have been demonstrated. For example, students have made substantial gains in reading comprehension as measured by the Nelson-Denny Reading Test. At the beginning of the course, the average score for the entire group was at the 44th percentile; at the end of the course, the average score was at the 65th percentile—a gain of 21 points. For students whose scores on the Nelson-Denny upon entering the course were in the bottom one-third, there were even larger gains; these students demonstrated average gains of 45 points. In addition, self-reported levels of anxiety have been reduced and the use of effective learning and study strategies has increased. Follow-up studies of student grade-point averages also demonstrate significant gains.

Indirect evidence is also provided by the increasing number of students registering for the course and the feedback from academic advisors about students who have participated. Despite the relatively heavy work load in this class, students suggest it to their friends and listed it as a top priority for students on academic probation.

However, these findings are difficult to interpret due to the lack of control data. We have encountered a number of obstacles to obtaining an appropriate control group, for example: Although the enrollment has increased each semester, we are still able to accommodate all students wishing to enroll, which precludes the use of a waiting-list control group. Few courses have as diverse a student enrollment as this course, but even for those that do, (1) the students are not comparable, for example, in terms of motivational levels; and (2) even the most cooperative instructors feel imposed upon when asked to donate from three to six class periods for research purposes. The use of volunteers would present its own unique set of problems with respect to comparability. Thus, appropriate comparison data are not available at this time, but we are able to demonstrate significant improvements during the semester for students enrolled in the course.

The Metacurriculum—An Alternative Training Method

Providing an adjunct course or program for teaching learning strategies is just one method of imparting this knowledge to students. Part of our research has focused on the role of content-area teachers in high schools and community colleges in developing students' learning strategies. Teaching students how to

learn and process knowledge more effectively is a metacurriculum that can be included in any content-area course. By using teaching and instructional methods that cue, demonstrate, and reinforce the use of learning strategies, instructors can enhance their students' ability to be independent and effective learners while also teaching the content-specific material in a course. Incorporating this metacurriculum into content-based curricula enhances student learning in both areas.

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Thus far, we have only produced pilot programs to train teachers to implement a learning strategies metacurriculum. Results in both high school and community college settings have been very encouraging. Teacher interest and motivation have been high, even though the training sessions are usually conducted after normal working hours. Follow-up data indicate student performance gains after

a 6-month interval. In a time of budget cuts and limited resources, this cost-effective training method is worthy of further investigation. Part of our future focus will concentrate in this area.

CONCLUDING COMMENTS

This chapter has presented a brief survey of learning strategies research and an overview of some training studies being conducted by the Cognitive Learning Strategies Project. If, as educators, we expect individuals to take greater responsibility for their learning and to have the skills necessary to adapt the learning environment to fit their needs and goals, then we should be able systematically to teach students to use effective learning strategies. Research is still needed to address a number of basic issues in this area: (1) identifying the types of strategies used by successful learners; (2) investigating the nature and critical attributes of those strategies; (3) selecting the most important strategies to teach; (4) developing assessment methods for identifying individual learner deficits; (5) developing instructional methodologies and curriculum materials to teach learning strategies; (6) creating appropriate assessment instruments for training programs; and (7) fostering generalization of the use of these strategies across different content areas. A number of efforts to address these issues are discussed in this book, but reaching the goal of teaching students to be active learners who use effective information-processing strategies will require the combined efforts of cognitive psychologists, educational psychologists, instructional psychologists, curriculum developers, and classroom teachers.

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