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ABSTRACT

A study investigated the test study habits of college students in the context of Effort Management theory, which describes metacognitive and self-regulatory activities. The subjects, 20 upper-division education majors enrolled in a required Educational Psychology course, were interviewed to discover their study activities for the course final at each of 4 levels of the Effort Management hierarchy monitoring, regulating, planning, and evaluating. Questions were open-ended. Responses were categorized first according to activity level, then according to whether they referred to concentration, time, or learning effectiveness components. These data were analyzed for patterns or differences between higher- and lower-achieving students. Results showed no differences in response patterns between the groups for monitoring or regulating activities, but some differences in planning and evaluating. Most students showed some difficulty in monitoring their effort. Self-regulating activities were found useful to sustain concentration, control persistence and momentum, correct or repair comprehension errors, and focus on test-relevant information. Many students engaged in self-instructional sequences as part of planning activities, and some form of self-appraisal, with qualitative differences found between performance groups. Criteria used to score study activities are appended. (Contains 40 references.) (MSE)

Assessing college students' self-directed studying using self-reports of test preparation.

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How students adapt and apply their cognitive resources and effort strategies to meet the demands of academic work is known as self-directed studying. Because studying is such an effortful, ill-defined, and individual activity, the notion of personal agency is crucial. Self-directed students are resourceful learners who carefully appraise tasks, select appropriate strategies, set up self-instructional sequences, evaluate learning outcomes, obtain productive feedback, and regulate thinking and behavior in adaptive and creative ways to attain goals (Pintrich, 1995; Schunk & Zimmerman, 1994; Thomas & Rohwer, 1986; Weinstein & McCombs, 1994; Zimmerman, 1990).

Recently a number of conceptual models have been provided to describe the components and processes involved in proficient self-directed studying (Thomas & Rohwer, 1993). One such model, the Effort Management hierarchy (figure 1), describes metacognitive and self-regulatory activities. The model proposes four hierarchical levels of study activities: Monitoring, Self-regulating, Planning and Evaluating. The hypothesis is that these activities are organized along a continuum of increasing self-knowledge ranging from awareness to control over one's concentration, time and learning effectiveness. Self-knowledge involves the connection between effort and achievement, the value of strategic activity, and the sources of effort interference. For example, research shows that self-directed learners employ a variety of Monitoring activities that influence their level of concentration, comprehension, memory, and awareness of factors related to effortful learning (Zimmerman & Martinez-Pons, 1986). Self-directed learners also Regulate and remediate their own learning efforts (Pressley & Ghatala, 1990; Pressley, Levin, & Ghatala, 1984; Winne, 1995). That is, once they become aware of a learning difficulty, they take action to do something about it. They modify the pace of studying to enhance alertness; they go back to a previously read paragraph to improve comprehension; they spend more time on difficult parts to augment their memory. In addition, self-directed learners also engage in a variety of Planning and goal-setting activities to create purpose, direction and focus to their learning efforts (Schunk, 1989). Such learners persist and overcome obstacles, they challenge themselves, and pay attention to their progress. Finally, self-directed learners engage in a variety of Evaluating activities. They reflect upon and assess the relationship between their learning efforts and their performance; they obtain feedback regarding the strategy effectiveness; they assess their actions and their results and look for ways to improve (Bereiter & Bird, 1985; Pressley, Borkowski, & Schneider, 1987). Although much research has been done on the individual activities defined by the model, the hierarchical organization of these activities is still an empirical question.

The present study was designed (a) to further explicate the nature of these Effort Management activities using retrospective reports of studying, and (b) to explore possible relationships between these activities, (c) to obtain qualitative information about students' efforts within an ecologically natural setting. The methodology of the study involved using the Effort Management hierarchy as a blueprint to construct a set of open-ended questions specifically designed to capture information regarding students' engagement in each of the four activity levels. Students' responses were then analyzed according to the theoretical conception underlying the hierarchy. In summary, systematic observations of students' self-directed activities were obtained using interview questions designed to tap those features shown to be particularly crucial to awareness and control over effortful learning. In a previous investigation (Warkentin, Bol, & Wilson, 1997), students' study practices were assessed using a check-list questionnaire. In that investigation however, it was not clear whether students responded to questionnaire items in a manner congruent with the theoretical design specified in the hierarchical model, or whether students made idiosyncratic interpretations of the items. To better understand the specific cognitions, affect, and behaviors students report in response to each of the four activity levels, the present study used an open-ended interview format to capture students' spontaneous comments about their studying. The results could then guide the revision of the check-list questionnaire.

One method that has been used successfully to understand complex activities is to compare the processing of more proficient and less proficient learners on a task they have recently performed (Ericsson & Simon, 1980). In the present study, we used students' achievement exam scores in their course to create a higher-achieving and a lower-achieving group and analyzed their reports of studying for unique patterns. Differences were expected to occur especially in the higher-level activities involving Planning and Evaluating since these activities are hypothesized to depend upon greater levels of self-knowledge and strategic effort (i.e., awareness and control).

In addition, the present investigation provides information about how students actually study within a natural setting, that is, for a real exam in a course they were currently enrolled. Such information is valuable on its own merit. However, our goal for investigating students' study activities within naturalistic settings was not to assess every possible variable and relationship that might impact on students' studying. In contrast, by first specifying a theoretical model and using that model to inform data collection, the variables and relationships that were observed were explicitly defined in advance. In our particular study, the hierarchical model acted as a theoretical window through which we viewed that part of the landscape relevant to our current interests. Our efforts were aimed at trying to build a more valid model of studying.

Method

Participants: Twenty education majors (junior and senior level) enrolled in two sections of an Educational Psychology course participated in the study. Students were randomly selected from a total of 62 students. Educational Psychology is a required course that all education students must pass with a grade of C or better. All education majors are represented including Early Childhood, Middle and Secondary, Special Education, and Technology Education.

Interview questions: Interview questions were constructed to tap students' study activities at each level of the Effort Management hierarchy -Monitoring, Regulating, Planning and Evaluating. All questions were open-ended format and related specifically to how students studied for the most recent test (the final) in their Educational Psychology class. Students were prompted for clarification to their answers if necessary. Questions designed to elicit students' Monitoring activities and Regulating activities focused on what students did during a study episode. Questions designed to elicit students' Planning activities focused on what students did to plan their study activities before starting to study. Evaluating questions were designed to focus on what students did after studying. Students' answers were recorded and transcribed for later analysis. The interview questions are presented in the Appendix A.

Recent research into assessment of students' self-regulated learning has indicated the importance of embedding questions within the context of real situations and authentic material, purposes, goals, responsibilities (e.g., Zimmerman & Martinez-Pons, 1986). Assessment techniques should provide students with real academic situations and contexts so that their verbal reports are rich in description and authenticity. In the present study, the open-ended questions referred to students' recent test preparation activities in the Educational Psychology course they had just completed.

Categorization scheme: Students' responses were first classified according to activity level (Monitoring, Regulating, Planning, and Evaluating), then according to whether they referred to Concentration, Time or Learning Effectiveness component. Monitoring activities were operationalized as self-assessments or self-appraisals of one's concentration or persistence, time, and learning effectiveness while studying. Regulating activities were operationalized as activities made in response to an awareness brought about by monitoring while studying, such as self-corrections, self-adjustments, or redirection of one's efforts or actions during a study episode. Planning responses were operationalized as actions and cognitions engaged in before a study episode to set up a self-instruction episode or to establish a goal designed to "direct the educational experience to insure learning (Corno, 1987), or "to optimize the study episode" (Thomas & Rohwer, 1993). Evaluating activities were operationalized as self-assessments (self-appraisals,

self-judgments) of the relationship between effortful action and achievement, strategic effort to learn (understanding of content and test-readiness) and time and concentration and are engaged in after a study episode. Concentration activities involve two subcategories, internal and external distractions to concentration and diligence. Time involve allocating and scheduling time for study episodes. Learning effectiveness involves efforts to master course content or test-relevant information. The categorization scheme is summarized in Table 1.

Course characteristics: The course required students to complete four tests over the term (which accounted for 55% of the student's final grade). Each test covered approximately three to four chapters of the textbook and five supplementary articles. Each test included 30 multiple choice questions (from the test bank) and three short answer essay questions. Instructional activities included lectures, cooperative group activities, discussion, and student presentations, etc.

Higher- vs. lower-achieving student status: Students' test scores in the class were used to determine the higher vs. lower-achieving groups. First, each student's total test score in the course was calculated (the total for four course exams) and z-transformations were performed. Then the twenty participating students' scores were rank ordered. An arbitrary cutoff point was used to divide the students --students who scored above the mean (z-score of 0) were designated as higher-achieving (n=11; group mean z-score = .64); students who scored below the mean were designated as the lower-achieving group (n=9; group mean Z score = -.64).

Procedure: The students were interviewed immediately following the final test in the course by the first author. Students were asked to restrict their responses to how they studied for "the final test in this course," that is, the Educational Psychology. Student's responses were transcribed for content analysis. First, all responses were analyzed according to the four principal activity levels, and, within each of these levels, according to categories of effort concentration, time and learning effectiveness. After this analysis and categorization of responses, students' responses were sorted into either a higher-achieving or lower-achieving group. The responses were then analyzed for distinctive patterns and differences between the higher and lower-achieving groups. Data were analyzed by a second rater for consistency of categorizing.

Results

No differences in the pattern of responses were found between the higher- and lower-achieving groups for Monitoring and Regulating activities. Therefore, the main findings for these two activities are presented together for all students. However, differences were found between groups for Planning and Evaluating activities.

Monitoring activities

Students reported monitoring distractions to their concentration in several ways. Internal distractions involved (a) difficulty beginning and maintaining the study episode (e.g., "I had problems starting", "I tried to keep myself alert and interested", "I had problems concentrating for long periods of time on one subject."); (b) difficulty sustaining reading due to the length of the chapters, unfamiliarity of the material, or apparent similarity of the information (e.g., "The chapters were so long I got bored", "The chapters had so much material, it all seemed the same after a while", "I got confused reading so much new information"); (c) difficulty maintaining a positive emotional state due to anxiety about the test (e.g., "Multiple choice tests are just confusing", "I don't do very well on multiple choice tests", "The alternatives on the questions are so similar, I can't see any difference between them, I usually end up guessing a lot"), or (d) other negative affect (e.g., "I don't like the book").

Monitoring the effectiveness of learning involved (a) efforts to understand (master) content information (e.g., "I try to learn the main ideas", "I relate information that I'm reading to something I know so I can make sense of it"), and (b) efforts to identify test-relevant information, (e.g., "I focus on what's going to be on the test", "I make sure I can explain answers to essay questions"). However, for many students, knowing what to study was an ambiguous task at best. In general, students' responses revealed an uncertainty of what to study, or what was important to

know, or what was going to be on the test, or how to study for a multiple choice test. This finding reinforces the notion that studying is an ill-defined problem for most students.

Regulating activities

To cope with internal concentration difficulties (described above) students reported taking breaks to keep alert, partitioning the study session into smaller intervals to increase concentration and diligence, and parsing the reading assignment into smaller chunks to reduce stress (e.g., "I take a break after every 20-30 minutes or when I get tired", "I study in 15-20 minutes intervals to reduce the stress of the work", "I spread out the work so I don't get bored", "I would read one section of the chapter and then take a break"). Others used breaks along with a specific study tactic, such as taking notes while reading or making a concept map for each section of the chapter, to increase concentration, interest or intensity (e.g., "I used highlighting to keep focused and interested while reading", "I made myself make a concept map for each section before I went on so that I wouldn't read aimlessly"). To cope with external distractions students adjusted their environment or avoided a place where they knew they would be distracted (e.g., "I turn off the TV or phone machine to make sure I don't get interrupted", "I close the door or go to a quiet room", "I wear loose clothes", "I go to a room I know I can get work done, where I can be alone", "I stay away from studying in the library, it to noisy", "I wait until everybody has gone, then I go to the back room where I won't be interrupted").

To cope with learning effectiveness problems, students reported using several specific tactics such as taking notes while reading to check their understanding, relating reading material to other content to increase memory, underlining while reading to keep from daydreaming, mapping each section of the text to maintain momentum and to help detect errors in comprehension, focusing on important or test-relevant information, and rereading information when a comprehension error occurred (e.g., "I focus on lists concepts and definitions", "I go back over key experiments and names that might be on the test", "I study the important vocabulary words", "I pay attention to the instructor's directions for what's important for the test", "I take notes while reading to check my understanding", "I try to relate the reading material to other subjects so I remember better", "I underline while reading to keep from daydreaming", "I make myself make a concept map for each section before I go on to the next section", "I reread the parts I didn't understand", "I call a friend if I don't understand something and ask them to explain it", "I would make up an example to help me understand the idea").

Finally, to cope with time management problems, students reported allocating time to focus on test-relevant information, difficult parts of the information, and personally interesting or familiar information (e.g., "I spend time on the definitions, main ideas, summaries, and vocabulary words because this helps me on the test", "I spend time on facts that are difficult to remember for the test", "I spend time on the difficult reading articles", "I spend time on topics that I think are interesting").

Such regulating activities serve a number of functions. First, breaking the session into smaller segments (or parsing the reading assignment into chunks) serves to create intermediate goals, which in turn, can facilitate persistence. Second, the use of a study tactic serves to regulate effort concentration (i.e., sustain attention or interest) as well as to facilitate the detection of difficulties in reading comprehension or selective processing. For example, using tactics like "underlining while reading to maintain interest and to focus on the main ideas" are likely to sustain effort and diligence because they make learning more active and to increase the likelihood that students will grasped the main points of the passage. Finally, breaking the study session into smaller units and using a specific study tactic helped students cope with the large amounts of information they had to read and helped them cope with uncertainty (or ambiguity) regarding what information was most important or likely to be on the test.

Planning activities

Students' comments of their planning activities revealed differences between the higher and lower-achieving students in two major categories: (a) self-instructional sequences used to structure study efforts, and (b) goals and purposes for studying.

Self-instructional sequences. Students' planning activities generally involved setting up a sequence of study sessions, starting about 1 to 5 days before the test, to structure and regulate concentration, reading pace, learning effectiveness, and selection activities. For example, students reported that they planned to distribute reading for the test across several days to avoid "cramming." The study sequences were important events to students and appeared to involve intermediate goals (e.g., first-day activities, second-day activities, so on) so that students could monitor and obtain feedback on progress across sessions. Planning for tests typically involved parsing the workload (e.g., amount of reading) into manageable segments and sequencing these segments so that each subsequent event built upon the prior event. For example, a general template or format of a self-instructional sequence involved: "If the test is on Friday, then I'll start studying about 4 days before; I'll do _____ first, _____next, _____next, and _____ last." If the test covered 3 chapters, for instance, the student may start by reading chapters one and two the first session, reading chapter three with note taking the next session, and then end with a general review of all chapters and notes on the last session. The events served to guide students' overall behavior, to allocate time for study, to cope with concentrations problems (e.g., avoid cramming, distribute reading and practice) and to sustain diligence (e.g., engaging in regular practice). Sixty-four percent of the higher-achieving and 55% of the lower-achieving students' responses specifically indicated this approach test preparation (engaging in a sequence of events). Thus, in terms of time scheduling and coping with concentration and workload demands, the two groups of students were somewhat comparable.

Although most students reported setting up such events, what distinguished the higher-achieving students was the nature and goals of these self-instructional sequences. In general, the higher-achieving students' plans emphasized more selective processing, were more systematic and coherent (connected across sessions), and mentioned a wider range of tactics. Higher-achieving students' instructional plans gave more attention to selection activities (e.g., reading to identify and focusing on main concepts; trying to discover crucial ideas) and reviewing and applying knowledge (e.g., review all notes, go back and look up critical words heard in class). Thus, the higher-achieving students' templates reflected more connectedness and coherence with each event building upon the results of the prior event (articulating events together). The higher-achieving students' templates revealed a cumulative pattern with more attention to selection activities at the beginning of the sequence (e.g., deciding what ideas/concepts are important) and more attention to reviewing of all prior learning just before the test (e.g., focusing on crucial points within notes, reviewing everything for the test). Ninety-one percent of higher-achieving students' reports of planning activities explicitly mentioned this general pattern with no students saying that they did not engage in planning activities. In contrast, only 44% of the lower-achieving students' reports of planning revealed such a pattern, and 22% of the lower-achieving students said that they did not plan at all.

Nature of goals and purposes for studying. The higher-achieving students also differed in the kind of goals and purposes they reported for their study sessions. Overall, all students' responses revealed three major categories: (a) 60% of the students reported understanding goals (e.g., "to understand the basic concepts; to understand concepts in relation to the class discussion, to relate information to real-life situations; to use the information in future teaching situations); (b) 56% of the students reported remembering goals, either to remember information for long-term use (e.g., use the information when I become a teacher) or to remember material for the test (e.g., to memorize the information for the test; to recall the information to pass the test; to remember the information verbatim for the test); and (c) 90% of the students reported a goal of getting a good grade on the test. These goals were not mutually exclusive and their was overlap with some students reported two or more goals.

Sixty-four percent of higher-achieving students indicated an understanding goal compared to 56% of the lower-achieving group. However, the most striking difference between the two groups of students involved remembering goals. Fifty-five percent of the lower-achieving students indicated that their goal for studying was to remember the long enough to recall it for the test or to memorize the information verbatim ("I try to remember enough to pass the test", "I try to memorize

the information so I recall it for the test"). In contrast, only 9% of the higher-achieving students indicated that same goal. In contrast, higher-achieving students reported that the purpose of studying was to understand the information and to remember it so that they could use it in their vocation (teaching). We hypothesize that students' goals for studying are important factors affecting the kind of strategies they select for reading and studying and that the goal of the lower-achieving students (i.e., to remember for the test) impeded their ability to engage in more constructive (meaning-enhancing) memory activities. Ironically, lower-achieving students may have actually hindered their own test performance by choosing such narrowly focused goals. For example, if the test (multiple choice) requires students to recognize paraphrased information or to recognize new examples of concepts, strategies that involve surface-level rote memorization and verbatim rehearsal are likely to impede test performance.

Finally, it should be noted that for some students, planning activities involved routinized, rote events such as perfunctory "I focus on boldface words or on definitions at the end of the chapter." This tends to relegate learning to a passive exercise. However, we hypothesize that textbooks, test questions, Educational Psychology content, as well as teachers of Educational Psychology often perpetuate such ritualized routines in students. Further research is needed on this dilemma.

Evaluating activities

Although a majority of the students (75%) reported that they reflected upon their study efforts after studying, a fine-grain analysis revealed important qualitative differences between the higher- and lower-achieving students' self-reflections and self-evaluative activities. The results indicated that the majority of the lower-achieving students' responses (66%) were vague and imprecise statements or statements of worry or regret about whether they studied the "right" information for the test (e.g., "I thought that I should have put more effort or time in studying for the test", "I thought about whether I had studied the right things for the test", "I thought about how well I'm going to do on the test"). Such self-assessments are likely to interfere with insights about the relationship between effort and achievement.

In contrast, the majority (55%) of higher-achieving students reported that they reflected upon what worked, or what was effective, or what accounted for achievement. These students' evaluations focused on what helped them learn the information, assessments aimed at finding better strategies to improve learning, and assessments about how well they knew or could apply the information (e.g., "I thought about what helped me learn like the examples given in class or in the textbook", "I think about how well I understand or if I can explain the information especially Ed. Psych. material", "I noticed that when I wrote out notes for each section of the chapter I did better", "I relate the material to my other education classes, it helps me do better", "I think about what I could have done to improve on something, I notice what works", "I compared what I did (while studying) with my grade on the test, I changed", "I tried to see how what I was learning would help me teach a class", "I thought about what I would write for the essay, I organized it in my mind").

In addition, higher-achieving students' evaluations tended to be more precise in the connection between effort and achievement, for example, more than half (54%) indicated that they evaluated the efficacy of a specific elaboration strategy (e.g., relating Ed. Psych. information to another education class helped them learn, or using a concept map was helpful to learning). Finally, higher-achieving students made fewer comments about whether they put in enough effort or mentioned uncertainty about whether they focused on the "right" information for the test. In summary, higher-achieving students' comments indicated that they perceived their actions more strategically, seeing themselves as directly responsible for the outcomes of their learning. Such reflections are likely to generate productive feedback about one's study activities. We hypothesize that the more precise evaluations of the higher-achieving students in making connections between their actions and learning outcomes, and the absence of worry statements, resulted in greater self-knowledge and control of learning and subsequent achievement.

Discussion

Monitoring activities

The results reveal that most students experience a variety of difficulties monitoring their effort activities. These difficulties arise because students must concentrate for extended periods of time on one subject, they must cope with negative affect and uncertainty about the test, and they must cope with ambiguity regarding what information is important or likely to be on the test. The results are consistent with the notion that studying is an ill-defined problem and ambiguous task for most students (Brown, Bransford, Ferrara, Campione, 1983; Covington, 1984; Snowman, 1986; Thomas & Rohwer, 1986; Thomas & Rohwer, 1993). Students do not possess a clear understanding about what it is (exactly) they are required to know or how they are to demonstrate their knowledge (on the test) (Crooks, 1988). The results are also consistent with the idea that students are novice learners --that is, students experience difficulty selecting or differentiating levels of importance in to-be-learned information, making distinctions and recognizing the significance of information (Alexander, 1995; Meyer, Brandt, Bluth, 1980).

Ambiguity in studying may be exaggerated when certain conditions exists, such as lack of clarity in the instructional objectives of a course, lack of self-directed skills needed by students to monitor instructions (e.g., comprehension of the teacher's instructions), or lack of domain-specific knowledge on the part of the student. However, we hypothesize that particular course features may accentuate the ill-defined, ambiguous nature of studying (Thomas, Strage, Bol, Warkentin, 1990; Thomas & Rohwer, 1993). For example, in courses where great uncertainty exists regarding what is going to be tested or how to study for a particular test, students' monitoring of their selection activities may be strained beyond their capability. As a result, many students' study practices may become desultory, erratic, or haphazard, or deteriorate into perfunctory ritual, or "blind routinized" habits (e.g., read over the chapter once and look at the boldface words).

This result points out the need to assess students' study practices in relation to specific course features that are likely to affect students' selection activities. Important course features may include, the clarity of the test criteria (e.g., clarity regarding what is going to be on the test and how students will be assessed); the degree of correspondence between instructional content and test content (i.e., the articulation between the content covered during instruction and content covered on the test); the amount, difficulty or unfamiliarity of reading material required for a test (Bol & Thomas, 1991). All of these features would be expected to impact on students' level of effort monitoring, students' reading concentration and comprehension monitoring, selection activities and personal efficacy. Alternatively, the ill-defined nature of studying may be accentuated by students' lack of domain-specific knowledge thereby overwhelming their capabilities to effectively monitor their study efforts. As past research has shown, metacognitive strategies and efficacy beliefs are directly linked to variation in student achievement (Corno & Mandinach, 1983; Snowman, 1986; Weinstein & Mayer, 1986; Weinstein, Schulte, Palmer, 1987; Zimmerman & Pons, 1986). Thus, the present results suggest that it is important to investigate how specific courses features affect students' metacognitive strategies and efficacy beliefs (either as impediments or facilitators) and, in turn, how these strategies and beliefs affect student learning and achievement.

Regulating Activities

How do students cope with intense demands on their concentration and with the ambiguous nature of studying? First, the results show that self-regulating activities function to sustain concentration by regulating the pace and momentum of a study session. Breaking the session into smaller intervals or parsing the reading assignment into smaller chunks appears to create proximal/intermediate goals. Such goals facilitate persistence by enabling students to monitor their progress more frequently, to reflect upon the adequacy of their comprehension, and to assess the potency of their study efforts. For many students this is an adaptive response. Research shows for example, that students who set proximal goals are more likely to notice progress and that such awareness increases students' learning efficacy (Bandura & Schunk, 1981; Schunk, 1990, Schunk, 1994).

Second, the results also show that students use specific self-regulating tactics to control concentration (persistence and momentum) as well as to correct or repair comprehension errors. For example, making a concept map for each section of a chapter before going on, was a tactic that served to sustain students' attention and effort during studying, but also served as a "detection device" to signal when to engage in a corrective activity (i.e., not to go on to the next section until the map is complete). Using such regulation tactics served a dual purpose of keeping students on-task (e.g., making learning more active) and contributing to the acquisition knowledge (e.g., regulating comprehension errors) (Dansereau 1985; Pressley, Wood, Woloshyn, Martin, King, Menke, 1992).

Third, the results demonstrate that students regulate their efforts by spending more time on test-relevant information. The results support the common observation that students are strategic, test-wise learners; they approach studying as a detective searching for important clues and hints that are likely to be useful or relevant. However, it should be pointed out that for some students, selection activities are truncated and short-sighted involving merely spending time on explicit cues and signals (e.g., boldface words, lists, vocabulary) from the textbook that involve little self-directed initiative (Anderson & Armbruster, 1984).

In summary, parsing the session and the workload into more manageable chunks, provided students with intermediate steps and a way to structure their response to the ambiguity and uncertainty that is a part of studying.

Planning activities

Most students indicated that they engaged in self-instructional sequences involving scheduling and distributing workload across several sessions. We hypothesize that the use of self-instructional sequences may serve to create intermediate/proximal events for students. However, our results indicate that it is not just engaging in a sequence of events that leads to higher achievement. What distinguished the higher-achieving students was the coherence and goals of these self-instructional events. Higher-achieving students' sequences showed more connections across sessions with more attention (time) given to selection activities (selecting important vs. less important information) during the initial sessions and more attention to reviewing study materials during the final sessions (just before the test). In addition, higher-achieving students reported employing understanding goals (Ames, 1984, 1992; Nolen, 1988) while lower-achieving students reported employing remembering goals that were specifically tied to retention for the test (i.e., memorizing the information for the test). The importance of self-instructional sequences to self-directed studying (in terms of coherence and elaborative connections) is not well documented in research although it appears to be a significant part of these students' studying practices. We believe that students' self-instructional sequences should be a fruitful area of future research.

We hypothesize that the self-instructional sequences and goals engaged in by higher-achieving students were more productive because the sequences were more connected and incorporated a greater variety of meaning-enhancing strategies. For example, the results indicated that higher-achieving students placed more attention on the selection of information during the initial sessions. Because self-instruction occurs across several events, spending more time identifying important information early in the sequence could result in more opportunities to build connections with that information during later sessions. The greater time spent on selecting important information would be expected to "pay off" in subsequent study sessions (e.g., cumulative reviewing). Also, because higher-achieving students use more study tactics (with an understanding goal) across these instructional episodes, they are likely to transform the previously selected information in a variety of different ways (e.g., using strategies to increase meaning). In summary, higher-achieving students may have greater achievement due to their more elaborate self-instruction and distributed practice routines. Alternatively however, it should be noted that a students' ability to successful identify and select (differentiate) important vs. less important information is, to a large degree, dependent on the quality of their domain-specific knowledge. Thus, students who display such sophisticated planning and self-instruction may be those who possess greater domain-specific knowledge.

Finally, the present results suggest that monitoring, regulating and planning activities depend heavily on students' reading proficiency. For example, students' responses in monitoring, regulating and planning activities reveal that they experience frequent difficulties sustaining concentrated reading, in adjusting to reading difficulty (length, unfamiliarity), and in estimations regarding how much time and effort they will need to complete a reading assignment. Such effort is based on beliefs about reading efficacy and metacognition. This result reinforces the widespread belief that students need extensive array of reading comprehension skills, strategies and tactics (Mayer, 1980; Pressley, Borkowski & Schneider, 1987; Snowman, 1986). The results of the present study suggest good reading strategies are foundational to students' effort management activities.

Evaluating activities

The results of the present study show that a large number of students engage in some sort of reflective analysis, self-assessment, or self-appraisal of their study efforts, a finding that replicates Warkentin, Bol, Wilson (1997). However, according to the present results it is not the frequency of evaluations that account for differences in student achievement, it is the quality of these self-evaluations. In general, higher-achieving students' evaluations exemplify more precise cognitive appraisals of the relationship between effort and achievement (i.e., they carefully analyze what worked, what accounted for achievement) (Harris, 1990). These students appear to make clearer connections between their study efforts (antecedent actions) and the result of their actions (consequences). In contrast, the lower-achieving students' evaluations are vague about what helped them learn and reveal regret, self-doubt or uncertainty about whether they studied enough or studied the right parts for the test. Thus, some evaluations are not productive. Statements that lack clarity and precision about effort and achievement and statements that reflect negative affect and worry (especially in relation to test performance) are not likely to lead to insight and improvement (Covington, 1984). Self-evaluation of one's learning is currently an important area of research (Schunk & Zimmerman, 1994). According to the present results, students need to be taught to explain their efforts clearly (articulating the connection between their effort and achievement) and be provided with situations in which they can compare how effort affects learning outcomes, for example, using attribution training and positive self-talk, training in self-observation techniques, discussion groups on strategy effectiveness, direct comparisons of strategy effectiveness, and verbal coaching (Pressley, Levin & Ghatala, 1988). In addition, for some students motivational assistance is needed to assist them cope with negative expectations and self-doubt.

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Table 1. Categories used to score students' verbal responses on effort management activities.

Evaluating Activities

Self-assessments, self-appraisals or self-reflections of the effectiveness of study efforts after study episode. Reflecting upon the connection between effort and achievement, e.g., evaluation of the effectiveness of a study strategy or tactic.

-Time: assess the effectiveness of time and achievement
-Concentration: assess the effectiveness of actions taken to sustain concentration
-Learning effectiveness: assess the effectiveness study strategies

Planning Activities

Before studying, setting up a self-instruction sequence or a procedural plan to "direct the educational experience to insure learning; designing a procedure to carry out an optimal study episode. e.g., planning where, when and how to study for a test.

-Time: schedule enough time for study
-Concentration: reserve a place ahead that is quiet and comfortable
-Learning effectiveness: plan to use a strategy to optimize a learning session

Self-Regulating Activities

Adjustments, modifications, corrections, redirections of one's effort while studying. e.g., modifying pace of a study episode; rereading a paragraph to correct an error; coping with distractions while studying.

-Time: adjust or increase time
-Concentration: redirect attention when off-task
-Learning effectiveness: correct a comprehension error; or reread a paragraph to help understand for a test.

Self-Monitoring Activities

Self-assessments of effort, concentration, time or learning effectiveness. e.g., or paying attention to one's concentration or monitoring one's comprehension while studying.

-Time: self-assessment of sufficient time devoted to studying
-Concentration: self-assessment of adequacy of attention or distractions
-Learning effectiveness; self-assessment of effort; is effort leading to achievement or test-readiness?

Appendix A

Interview questions used to investigate effort management study activities

Monitoring and Regulating Activities

1. What was most difficult part of studying or preparing for this class?
2. While studying for this class did you anything special to keep on-task, to pay attention and maintain concentration while studying?
3. Did you spend more time on particular parts of the material while studying than other parts? Why?
4. Did you ever do back to something you already studied? Why?
5. What did you do when you thought you didn't know something or were unsure of something while preparing for class?

Planning Activities

1. Did you plan for the test in any way? If so, what did you do?
2. What did you hope to accomplish while studying for the test?
3. Did you make time to prepare for the test? What did you do exactly? Give an example.
4. Did you do anything special to make your study environment productive, pleasant, comfortable?

Evaluating Activities

1. After you studied for this class, did you reflect back on your study efforts, plans, goals or accomplishments? If so, what did you think about?
2. After you studied for this class, did you ever think about how well you learned the information? For example, how well you understood, or did not understand, the material.
3. After you studied for this class, did you ever think about what helped -or did not help- you learn the material? Could you explain.

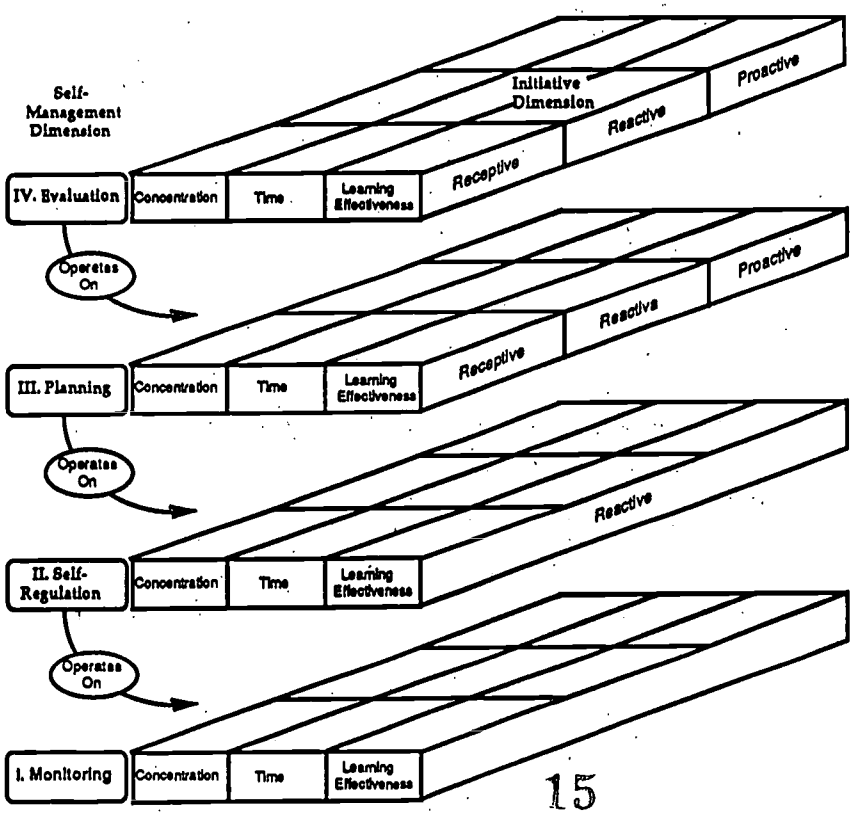

FIG. 1. Hierarchy of effort-management study activities.

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