6 Comprehension Development

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In the first edition of the Handbook, we discussed the role of comprehension strategies as they are related to the idea that: (a) strategies should have cognitive, metacognitive, and affective components; and (b) teacher-directed strategies should eventually lead to students’ use of generative strategies (Simpson & Rush, 2003; Wittrock, 1986, 1990, 1992). Generative strategies involve attention, motivation, knowledge and preconceptions, and creation (Wittrock, 1986, 1990, 1992). Thus, they consist of strategies that students can eventually create and employ on their own. As we reviewed the literature for this revised edition, we were struck by the fact that although many of the strategies have remained the same, the theoretical underpinnings that explain why these strategies are effective have been further developed. In this chapter, we discuss these advancements, including the role of domain knowledge on learning, the ways technology has impacted comprehension and strategic learning in the classroom, and the function of domain on strategy selection.

THEORETICAL RATIONALE

Comprehension strategies that lead to the use of generative strategies appear to have three major elements: metacognitive, cognitive, and affective. Each of these theoretical bases is discussed below.

Metacognitive

Although basic notions about metacognition date back over a century (e.g., Dewey, 1910; James, 1890; Thorndike, 1917), the term was not directly related to reading comprehension until the late 1970s. At that time, Flavell (1978) defined metacognition as “knowledge that takes as its subject or regulates any aspect of any cognitive endeavor” (p. 8). More recently, research on metacognition has appeared in literature spanning cognitive, developmental, and educational psychology (Hacker, 1998) and focused on self-regulated learning, cognitive development, and executive processing (Wolters, 2003). Although these research lines have led to varying definitions and distinctions of the processes and components of metacognition, we concur with Hacker’s (1998) suggestion that any definition of metacognition include “knowledge of one’s knowledge, processes, and cognitive and affective states; and the ability to consciously and deliberately monitor and regulate one’s knowledge, processes, and cognitive and affective states” (p. 11). A majority of researchers define metacognition as consisting of two
theoretically distinct components: knowledge about cognition and regulation of cognition (Baker & Brown, 1984; Martinez, 2006; Pintrich, 2002; Wolters, 2003).

The first key aspect of metacognition, knowledge about cognition, concerns what readers know about their cognitive resources and abilities, as well as the regulation of these resources (Paris, Lipson, & Wixson, 1983; Sperling, Howard, Staley, & DuBois, 2004). Regulation includes the ability to detect errors or contradictions in text, knowledge of different strategies to use with different kinds of texts, and the ability to separate important from unimportant information. Knowledge about cognition is stable, in that learners understand their own cognitive resources (Baker & Brown, 1984), including information about themselves as thinkers. It is also stateable, in that readers can reflect on their cognitive process and explain what they have done to others. Moreover, knowledge about cognition is domain specific and can differ depending on the type of material with which students are interacting (Alexander, 2005; Pintrich, 2002; Pressley, Van Etten, Yokoi, Freebern, & Van Meter, 1998). However, an individual's knowledge of cognition may also be fallible knowledge that is acquired through experiences with the learning process (Jing, 2006; Ransdell, Barbier, & Niit, 2006).

The second key aspect of metacognition is readers' ability to control or self-regulate their actions during reading. Self-regulation includes planning and monitoring, testing, revising, and evaluating the strategies employed when reading and learning from text (Sperling et al., 2004; Winne, 2005). Metacognition involves the regulation and control of learning or, more specific to this chapter, the regulation and control of the comprehension process while reading as well as the strategies employed during this process. Because of its importance, metacognition has become an integral part of models of reading, studying, and learning (See McCombs, 1996; Paris et al., 1983; Pintrich, 2004; and Thomas & Rohwer, 1986). In fact, we view metacognition as the foundation of understanding text. Students must be able to judge whether they understand the information presented in a written text, by the instructor during lecture, or some other vehicle as well as the manner in which it was presented.

Current research on metacognition has branched considerably from its predominant focus on children. Studies with college students include exploration of the differences between students who are learning disabled and those who are not (e.g., Trainin & Swanson, 2005), differences between monolingual and bilingual students (Ransdell et al., 2006), as well as measurement issues, using samples of college students enrolled in academic strategies and developmental courses versus other types of courses (Sperling et al., 2004; Taraban, Rynearson, & Kerr, 2000, 2004). Research indicates that there are major differences between the metacognitive abilities of good and poor readers (Baker, 1985; Ozgunog & Guthrie, 2004; Ransby & Swanson, 2003; Schommer & Suber, 1986; Simpson & Nist, 1997). Nowhere is this discrepancy more clearly seen than in college students who, by the time they enter college, are expected to possess metacognitive skills. Professors have little sympathy for students who say they did poorly because they thought they understood the materials but did not, studied the wrong information, or felt ready for a test when they really were not. Moreover, in an environment where 85% of all learning comes from independent reading (Nist & Simpson, 2000) and texts are central to learning (Alfassi, 2004), college students who are not metacognitively aware will probably experience academic problems (Baker & Brown, 1984; Kiewra, 2002; Maitland, 2000).

Effective use of reading and learning strategies implies metacognitive awareness, especially in students' ability to monitor their own learning (Gettinger & Seibert, 2002; Pintrich, 2004), which will enable them to achieve more effective outcomes while exhibiting more adaptive behaviors as they perform academic tasks (Kiewra, 2002; Pintrich, 2002; Wolters, 2003).
Cognitive

In addition to having a metacognitive component, generative strategies also have a cognitive component. In this section we address the issue of knowledge and the degree to which one’s knowledge influences comprehension development and strategic learning. Current views of the cognitive component focus on the interactive nature of knowledge, taking into consideration factors such as interest, strategies, domain specificity, and task. For example, recent studies examine the interaction of knowledge and task (Simpson & Nist, 1997), knowledge and beliefs (Dahl, Bals, & Turi, 2005; Mason, Scirica, & Salvi, 2006), and knowledge and strategies (Hynd-Shanahan, Holschuh, & Hubbard, 2004). Of particular importance in this chapter is the interaction between domain and strategy knowledge, which Alexander (1992) believes will help researchers better address complex problems such as how transfer can be achieved.

Cognitive strategies engage students in activities that lead to understanding, knowing, or “making cognitive progress” (Garner, 1988) and can be categorized by deep and surface approaches to learning.

Deep and surface approaches

Deep and surface approaches to learning may tie into students’ college performance because they are a result of students’ perceptions of academic tasks (Biggs, 1988; Kember, Biggs, & Leung, 2004). Students who adopt deep approaches to learning tend to personalize academic tasks and integrate information so that they can see relationships among ideas (Entwistle, 1988; Marton & Saljo, 1997). Deep approaches to learning allow the learner to build on previous knowledge in a meaningful way that facilitates long-term learning (DeJong & Ferguson-Hessler, 1996). Students who use deep approaches have been shown to be more successful at both selecting strategies and monitoring when comprehension breaks down (Holschuh, 2000; Nist, Holschuh, & Sharman, 1995).

On the other hand, students who adopt surface approaches begin a task with the sole purpose of task completion rather than learning, which leads to verbatim recall or the use of rote memorization strategies (Kember et al., 2004; Entwistle, 1988; Marton & Saljo, 1997). Research has indicated that an overemphasis on rote learning of isolated facts and concepts can impair students’ ability to interrelate concepts (Hammer, 1995; Holschuh, 2000). Surface approaches can also hinder learning because when students do not use strategies that facilitate integration of information, they may reach a point where they are unable to grasp new material (Holschuh, 2000). However, the strategies that comprise the deep and surface approaches appear to be domain dependent (Elias, 2003; Holschuh, 2000). Thus, a deep approach in one domain may not be effective in another. To provide a deeper understanding of the relationship between deep and surface approaches to learning, domain, and strategy selection, we discuss Alexander’s Model of Domain Learning.

Model of domain learning

Alexander’s (e.g., Alexander, 1997, 2003, 2005) Model of Domain Learning (MDL) focuses on the development of comprehension and knowledge over a lifespan and is categorized by three stages—acclimation, competence, and proficiency. Alexander (2005) suggests that knowledge, strategy use, and interest are intertwined and interdependently determine the level of expertise of a learner. Thus, an individual’s level of competence is not necessarily age or grade dependent (Alexander, 2005). The MDL makes a distinction between topic knowledge and domain knowledge (Alexander, 2003). Topic knowledge is the amount one knows about a specific topic within a particular domain (e.g.,
understanding cellular reproduction or photosynthesis); domain knowledge is a broader understanding about a particular field (e.g., how much one knows about biology). For one’s knowledge to progress from acclimation to proficiency, one must develop both topic and domain knowledge.

*Acclimated* learners are at the initial stage in learning about a domain. They exhibit fragmented knowledge about a subject matter, use inappropriate surface-level strategies, and show low levels of intrinsic interest (Alexander, 2005). An acclimated learner may rely mainly on situational interest as motivation for learning. Though they may have topic knowledge about particular areas of the domain, they often have difficulty discriminating between important information and supporting details (Alexander, 2003; Alexander & Jetton, 2000). If they become “hooked” by an interesting topic, learn better strategies, or gain knowledge, however, they may become competent (Murphy & Alexander, 2002).

When students reach the *competence* level, they begin to categorize information and begin to acquire enough domain-specific knowledge to understand that knowledge is interrelated (Alexander, 2005). They are less likely to focus on insignificant information than acclimated learners (Alexander & Jetton, 2000), and their knowledge becomes more cohesive (Alexander, 2003). Their strategies become a combination of deep and surface approaches and are more helpful to them, and they exhibit a moderate degree of intrinsic motivation (Alexander, 2003; Murphy & Alexander, 2002).

As knowledge, strategy use, and motivation strengthen, learners may become *proficient* or expert. At proficient levels of expertise, deep-processing strategies become automatic (Alexander & Jetton, 2000). Learners develop a knowledge base that has both breadth and depth (Alexander, 2003). Because strategy use is effective and efficient, learners can devote more energy to posing questions and investigating problems (Alexander, 2005). Learners exhibit a high degree of intrinsic motivation, and they may even contribute to knowledge production within a particular domain (Alexander, 2003).

**Domain-specific knowledge**

Alexander’s Model of Domain Learning is based on the notion that knowledge is domain specific. That is, knowledge is seen as situational and is studied within a particular context (Alexander, 1996). Because the structures of domains differ, strategies to understand information differ as well (Alexander & Judy, 1988; Holschu, 2000; Murphy & Alexander, 2002; Simpson & Nist, 1997). Researchers initially believed that if students knew some general learning strategies that they would be able to transfer these skills to a variety of domains. However, such does not seem to be the case.

Domain knowledge is viewed as a body of knowledge that is outside of an individual as an acknowledged corpus of knowledge (Alexander, 2003). As such, because it is always evolving, domain knowledge is never complete (Alexander, 2005). But domain knowledge is also defined as the declarative, conditional, and procedural knowledge that individuals have about a specific field of study (Alexander, 1992). Declarative knowledge is “knowing that,” procedural knowledge is “knowing how,” and conditional knowledge is knowing “when and where.” For example, in selecting strategies to use to learn history, declarative knowledge would be “I know that I need to mark my text in some way,” procedural knowledge would be “I know how to pull the information out in the form of a time line in the margins of my book,” and conditional knowledge would be “I know that time lines would help me learn the chronology, but I will need to select another strategy in order to see the relationships among key events.”

Thus, the cognitive component of knowledge is complex and is no longer viewed as operating independently of the affective or motivational components (Alexander, 1996). Instead, it involves the interplay of interest, domain specific knowledge, and strategy
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Affective

In addition to having metacognitive and cognitive components, generative strategies also have an affective component. Affective influences have been described as related to self-schemas, or generalized cognitive and affective characterizations individuals ascribe to themselves that are derived from past experiences (Ng, 2005; Pintrich & Garcia, 1994). Self-schemas act as a guide to processing self-related information (Petersen, Stahlberg, & Dauenhauer, 2000), and, generally, an individual strives to achieve positive self-schemas. Academic self-schemas are specifically related to an individual’s thoughts and emotions based on prior academic experiences. Therefore, self-schemas are domain specific, situation specific, and context specific (Alexander, 1997) in that individuals have varying reactions to different domain areas based on past experiences (Linnenbrink & Pintrich, 2003; Ng, 2005). For example, a student who has experienced high achievement in mathematics courses and low achievement in history will have a more positive self-schema and higher self-efficacy about mathematics. In this sense, affective influences can provide the motivation for self-regulated learning and strategy use “by providing critical feedback to the self about the self’s thoughts, intentions, and behavior” (Tangney, 2003, p. 384). Although there are many dimensions of the affective component, we will address three major influences on comprehension development that are influenced by instruction: motivation, beliefs about text, and epistemological beliefs.

Motivation

Motivation is “an internal state that arouses, directs, and sustains human behavior” (Glynn, Aultman, & Owens, 2005, p. 150). Paris and Turner (1994) have coined the term situated motivation, in which motivation is dependent on specific situations. Situated motivation is based on the framework of self-regulated learning because it involves evaluating, monitoring, and directing one’s learning. Motivation is situated based on personal beliefs, instructors, materials, and task. According to this definition, motivation, like metacognition, is unstable and domain specific because an individual’s goals are not the same in all settings and may vary as a consequence of the learner’s assessment of expectations, values, goals, and rewards in a particular setting. Thus, it is an appropriate model for college learning, where tasks, expectations, rewards, and goals vary greatly.

There are four characteristics that influence situated motivation (Paris & Turner, 1994). First, choice or intrinsic value plays a role. This is consistent with Hidi’s findings (2001), which suggest that situational and individual interest result in increased intrinsic motivation, more focused attention, higher cognitive functioning, and increased persistence. Second, challenge is important because students are not motivated when they experience success at tasks that did not require effort (Glynn et al., 2005; Turner & Meyer, 2004). A third important characteristic is control. A majority of the tasks involved in college learning are not under students’ control, nor can teachers grant total freedom or control to their students, but students do have volitional control over the strategies they choose to learn material as well as strategies to regulate their motivation (Wolters, 2003). Perry, Hladkyj, Pekrun, & Pelletier (2001) found that college students who perceived they had higher control over their learning exerted more effort, reported less boredom and anxiety, expressed greater motivation, used self-monitoring strategies more often, felt more control over their course assignments and life in general, believed they performed better at the beginning and end of their course, and obtained higher final grades (p. 785).
Finally, collaboration, or social interaction with peers, affects motivation (Paris & Paris, 2001). Social interaction is motivational because talking to peers can enhance a student’s interests. Also, feedback provided by peers is often more meaningful than the feedback provided by instructors (Paris & Turner, 1994). It is important to note that the vast majority of reading and studying in college is still completed in isolation (Winne, 1995). However, in response to research on collaborative and sociocultural theories of learning, more emphasis and energy has been aimed toward the establishment of learning communities on college campuses that encourage student motivation, co-regulation, and learning (Glynn et al., 2005).

College instructors often feel frustrated by their apparent inability to “motivate” students to learn (Hofer, 2002; Svinicki, 1994), particularly when teaching required courses where students are enrolled only to meet general education requirements (Glynn et al., 2005). By examining the relationship between motivation, cognition, strategy use, and self-regulated learning, one can draw some common conclusions about enhancing students’ motivation. First, students learn best in classrooms that encourage a mastery approach to learning, which is competency based and utilizes direct instruction to model learning outcomes (Dweck & Leggett, 1988; Linnenbrink & Pintrich, 2002). Mastery may be facilitated by more frequent, informative, and specific feedback (Hofer, 2002), which allows students to adapt their approach to learning.

Second, motivation can affect the use of effective learning strategies (Pintrich & DeGroot, 1990; Turner & Meyer, 2004). Students need to feel that the task is challenging enough to warrant strategy use; furthermore, they will use deeper processing strategies if they have a mastery approach to learning.

Third, motivation is unstable and will vary from content to content (Murphy & Alexander, 2000; Linnenbrink & Pintrich, 2002). Explicitly discussing the relevance of course content to students’ lives helps them understand the value of courses in each domain, making the content more meaningful and worthwhile (Brophy, 2004; Hofer, 2002). Students’ self-efficacy will also vary depending on content based on their perceived ability (Linnenbrink & Pintrich, 2003; Pintrich, 2003) and perceived control over their learning process and learning environment (Schunk & Ertmer, 2000; Wolters, 2003).

Finally, although research has indicated that motivation is domain-specific, studies also indicate the same motivational constructs may be useful in describing, understanding, and influencing motivation in general. Student motivation seems to be based on the factors of goal orientation, use of effective strategies, and self-regulated learning (McCombs, 1996; Pintrich, 2000). Acknowledging that motivation is multidimensional and is influenced by characteristics of the learner, the instructor, the course, and the task allows us to recognize there are many pathways to increasing student motivation.

**Beliefs about text**

The idea that students bring to a learning situation an array of beliefs about specific concepts or even complete domains is not particularly new. We know that students’ prior knowledge, of which beliefs are a part, influences comprehension at all levels. Some students believe that everything they read in text is truth, and even if we know better, it is somehow difficult to avoid being drawn into the printed page (Murphy, Holleran, Long, & Zeruth, 2005). How such beliefs influence students’ interactions with text is currently a topic of interest to researchers and practitioners alike.

Several generalizations can be made about what research has shown about text beliefs. First, epistemological beliefs seem to influence beliefs about text (Hynd-Shanahan et al., 2004; Schommer, 1994a). Whether or not beliefs cut across texts within domains or
the domains themselves is of continuing interest to researchers (e.g., Jehng, Johnson, & Anderson, 1993; Schommer-Aikens, Duell, & Barker, 2003). Second, mature learners approach texts from different disciplines in different ways (Carson, Chase, & Gibson, 1992). That is, effective learners believe that science text is approached differently than, say, history text (Nist & Holschuh, 2005). Third, even when text is persuasive, it is very difficult to change one's beliefs (Murphy et al., 2005). Finally, experts and novices have beliefs about text that cause them to respond to and interpret text in different ways (Hynd-Shanahan et al., 2004; Wineburg, 1991).

Wineburg's (1991) research concerning students' beliefs about history text suggests that subtexts, or underlying texts, supplement the more explicit meaning of the text. Wineberg had college history professors and bright college-bound high school seniors think aloud as they read seven different historical texts, asking both groups to verbalize their thought about the content (not the processes). Although his results were not particularly shocking—historians knew more history than did the students—students rarely saw the subtexts in what they were reading. Wineburg suggests that this inability to understand a writer's point of view is based on what he calls "an epistemology of text" (p. 510). That is, in order to be able to detect subtexts, students must believe that they actually exist. Hynd-Shanahan et al. (2004) found that students were able to change the way they read as a result of the types of reading assigned and the nature of engaging multiple texts. They attribute this change to a transformation in the purpose for reading history—from fact gathering to making decisions on what to believe about a historical event. Thus, reading multiple texts required students to make sense of the subtexts both within and across texts.

Beliefs about text impact text understanding and approaches that students use to comprehend text information. Moreover, such beliefs seem to spill over into strategies that students select to learn text information as well as the more general beliefs that students possess about what constitutes knowledge and learning (Hynd-Shanahan et al., 2004).

**Epistemological beliefs**

Beliefs about knowledge also play a role in the affective component. Termed epistemological beliefs, they are an individual's set of beliefs about the nature of knowledge (Hofer & Pintrich, 2002) and the process of knowing (Schommer 1994a; 1994b). Because there is a growing body of research suggesting their influence on comprehension, thinking, and reasoning (Hofer & Pintrich, 2002; Schommer 1994b), epistemological beliefs have current interest to educators.

Historically, epistemological beliefs were thought of as a system of complex unidimensional beliefs. Perry (1970) believed that students progressed through fixed stages of development. The college student begins in a naïve position and moves through a series of nine fixed positions on the way to a mature cognitive understanding. In the initial position, called basic dualism, the student views the world in polar terms: right or wrong, good or bad. Right answers exist for every question, and a teacher's role is to fill students' minds with those answers. The student then moves through a series of middle positions to a position of multiplicity, in which a student begins to understand that answers may be more opinion than fact and that not all answers can be handed down by authority. From this position, a student may move to a position of relativism. In this position, a student understands that truth is relative and that it depends on the context and the learner. A student who has moved to the position of relativism believes that knowledge is constructed.

More recently, Schommer's research has examined a system of more or less independent, multi-dimensional epistemological beliefs that may influence students' performance
Schommer-Aikins, 2002; Schommer, 1994b; Schommer & Walker, 1995). Schommer and others have defined epistemological beliefs about learning as an individual’s beliefs about the certainty of knowledge, the organization of knowledge, and the control of knowledge acquisition (Schoenfeld, 1988; Schommer-Aikins, 2002). Moreover, these beliefs are thought to develop over time and can change depending on content, experience, and task (Schommer-Aikins, 2002). The way instructors teach also has an impact on student beliefs. Hofer (2004) found that students who held a belief in the simplicity of knowledge struggled when the way an instructor taught implied that knowledge was simple, but the exams indicated that knowledge was complex.

There is evidence that epistemological beliefs may also affect the depth to which students learn (Schommer, 1990; Schreiber & Shinn, 2003). Students who hold strong beliefs in certain or simple knowledge tend to use more surface-level strategies, while those holding beliefs in the uncertainty and complexity of knowledge tend to use deep-level strategies for learning (Holschuh, 2000; Schreiber & Shinn, 2003). Research has indicated that students’ epistemological beliefs are most obvious in higher-order thinking, because students need to take on multiple perspectives and process information deeply rather than memorize information (Hynd-Shanahan et al., 2004; Schommer & Hutter, 1995).

Of current interest to researchers is the issue of domain specificity on epistemological beliefs. Some researchers have found differences in beliefs depending upon domain (Palmer & Marra, 2004; Schommer-Aikins et al., 2003) while others (Buel, Alexander, & Murphy, 2002) found some evidence of both domain specificity and generality in student epistemological beliefs. However, despite these conflicting results, it appears that academic discipline and domain do impact students’ beliefs about knowledge.

Current research suggests that there is a relationship between students’ beliefs and their comprehension of text. With guidance, it appears that students begin to change their own beliefs when they have professors who communicate more sophisticated ways of knowing (Hofer, 2004; Nist & Holschuh, 2005). Thus, based on our current understanding of both epistemological beliefs and strategy use, one way both can be enhanced is through direct instruction.

**Direct instruction**

The relevance of direct instruction emerged from the teacher effectiveness research that received attention in the late 1970s and early 1980s (Berliner, 1981; Rosenshine, 1979). The emergence in the early 1970s of cognitive psychology, which emphasized the reading process rather than the product, also has contributed to recognition of the important role direct instruction plays in the comprehension process. As a result, educators have realized that when students get 5 out of 10 items correct, it does not necessarily mean that they know only 50% of the information. It means that instruction should consider the kinds of items students are missing and why they are missing them. These ideas are continuing to penetrate college reading programs and general college classrooms today.

Alfassi (2004) suggests, "As students advance in their studies, they need to be able to rely on their ability to independently understand and use information gleaned from text. Text becomes the major, if not the primary, source of knowledge..." (p. 171). Hence, students need to be taught explicitly a repertoire of strategies and to receive instruction on how to apply them (Paris, Byrnes, & Paris, 2001; Pintrich, 2002; Pressley, 2000; Simpson & Nist, 2000). This includes modeling and instruction of comprehension strategies that acknowledge new definitions of literacy, including both print and digital text (Schmar-Dobler, 2003). Most students, however, do not receive direct training in com-
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prehension strategies nor in the application of them (Cornford, 2002; Langer, 2001; Pressley, Wharton-McDonald, Mistretta-Hampston, & Echevarria, 1998). Pintrich (2002) stated, “In our work with college students we are continually surprised at the number of students who come to college having very little metacognitive knowledge; knowledge about different strategies, different cognitive tasks, and particularly, accurate knowledge about themselves” (p. 223).

Therefore, it is ironic that multiple studies indicate that students who receive direct strategy instruction perform better than students who do not, revealing a disconnect between research and practice (Alfassi, 2004). For example, Falk-Ross (2002) found that students who received direct instruction in prereading, note taking, annotating, and summarizing exhibited improved critical thinking, increased comprehension, and more effective contributions to classroom discourse. In addition, Friend (2001) found that students taught to write summaries using direct instruction with explanation, modeling, and guided practice were more successful in learning to write summaries than students who did not receive explicit instruction. It appears, then, that direct instruction can do more than just improve recall of information; it can show students ways to enhance their own knowledge.

Several researchers suggest that strategy training should include three components (Paris & Paris, 2001). First, students should become familiar with a definition or description of the strategy. The researchers believe that it is important to give a concrete and complete explanation of the strategy at the onset of training, because students will be more likely to use the strategies effectively if they understand what the strategies are and why they work (Paris & Paris, 2001; Simpson & Nist, 2000). Second, an explanation of why the strategy should be learned must be addressed, because providing this explanation is important for facilitating students’ self-control of the strategy (Boekaerts & Corno, 2005; Paris & Paris, 2001). Moreover, students will apply the strategy more effectively if they understand why it is important (Paris & Paris, 2001; Simpson & Nist, 2000). Third, providing instruction on how to use a strategy, including both teacher modeling and direct instruction, as well as observational and participatory learning with peers, will help facilitate learning (Boekaerts & Corno, 2005; Paris & Paris, 2001; Simpson & Nist, 2000).

Direct instruction includes the following interrelated steps:

1. **Modeling the process.** The instructor must show the “how” of learning. Instructors think aloud, showing students how a mature learner thinks through an idea or solves a problem. Modeling the strategy should be done through concrete examples and explicit verbal elaboration. Teacher modeling of strategy and self-regulated use of the strategy are what constitutes good instruction (Pintrich, 2002; Pressley, Graham, & Harris, 2006; Taraban, Kerr, & Rynearson, 2004).

2. **Providing Examples.** During this phase, the instructor shows students examples of how the strategy has been used in a variety of contexts. Providing examples of the strategy helps students understand how the strategy works (Alfassi, 2004).

3. **Practicing Strategy Use.** Strategy practice should be guided at first where students repeat the instructor’s strategy with new situations or problems. Instructors should be available to help students and to provide feedback. Eventually, students should practice independently outside the classroom (Alfassi, 2004; Pressley et al., 2006).

4. **Evaluating Strategy Use.** Evaluation that includes both teacher-provided feedback and self-monitoring techniques will help students become independent learners (Alfassi, 2004; Paris & Paris, 2001). In addition, students need to become familiar with the appropriate circumstances for strategy use.
A second model of direct instruction is the "cognitive apprenticeship" method (Boekaerts & Corno, 2005; Brown, Collins, & Duguid, 1989; Clark & Graves, 2005). In this model the instructor (a) models the strategy in an authentic activity, (b) supports the students doing the task through scaffolding, (c) allows the students to articulate their knowledge and monitor the effectiveness of the strategy on their learning, and (d) gradually fades or withdraws support as students become proficient.

With each of these models for direct instruction, the responsibility for learning shifts from the instructor to the student. It is once students become responsible for their own learning that transfer of strategic knowledge occurs. In one study, Simpson and Rush (2003) found that after being taught various strategies—including problem solving, note taking, test preparation, planning and goal setting, and reviewing and rehearsal strategies—students tended to transfer strategies related to planning and distributing study time.

Every college reading instructor strives to get students to the point of transfer, but this is a difficult goal to accomplish. Research on strategy instruction offers substantial evidence that students, especially at-risk learners, need direct instruction on strategy selection and use. The next section discusses comprehension strategies that can be used to help students on the road to becoming self-regulated learners and being able to transfer information to new learning situations.

Strategies

In this section we discuss teacher-directed comprehension strategies that lead toward generative use. The strategies we present have metacognitive, cognitive, and affective components. All the strategies require purposeful effort, and students generate meaning by building relations between the text and what they already know. Thus, the mind is not passive while reading; rather it is intentionally organizing, isolating, and elaborating on key information (Hadwin & Winne, 1996; Wittrock, 1990).

We also focus on strategies that are flexible. Strategies should be flexible in order to be utilized in a variety of contexts and must eventually be self-selected by the learner to attain a specific goal (Simpson & Nist, 2000; Weinstein, 1994). Effective comprehension strategies should allow students to actively interact, elaborate, and rehearse the text information in order to retain it for later use (Nist & Simpson, 1988). In addition, strategy selection necessitates a deliberate decision and effort by the learner (Hadwin & Winne, 1996; Paris et al., 1983). However, before they are able to self-select appropriate learning strategies, many students need a good deal of direct instruction and scaffolding. The ultimate goal is for students to use the strategy or modifications of a strategy without guidance from the instructor.

We need to make one final comment about strategy use. The results of research examining the efficacy of strategy use have not been consistent (Hadwin & Winne, 1996). Many studies did not allow students to self-select strategies; instead, the studies focused on comparing one strategy with another in a "horse race"—the best strategy wins in the end. Another reason for inconsistent results is because, by imposing time constraints or by employing extremely short, easy passages, the studies often did not portray normal reading/studying conditions (Wade & Trathen, 1989). In addition, many strategies used in college reading classes do not have support in research. Instead, these strategies are found in content-reading texts or other "methods" resources.

For these reasons we concentrate on the processes underlying strategy and we offer suggestions of strategies that embody those processes. Where possible we cite research that has been used with high school and college students. We narrowed our focus to those strategies that met three basic criteria. First, the strategies had to possess metacog-
nitive, cognitive, and affective components. Second, they had to be strategies that can be scaffolded. Third, all strategies permit students to self-test on the information, whether individually or cooperatively. Too often, the first indication of gaps in comprehension is a low test score. Self-testing allows students to determine whether or not they are comprehending information so that they can modify their strategies if necessary before formal assessment (Weinstein, 1994).

In other words, they must be strategies that students can eventually generate themselves and strategies that allow students to check their knowledge and comprehension. We discuss specific strategies within the processes of organizing information, isolating key ideas, and elaborating on information.

Organizing strategies

The purpose of organizing strategies is to build and activate students' background knowledge, cue awareness of the quality and quantity of that knowledge, and focus attention before reading. Many types of organizing activities are presented in content area reading texts, but only some of these strategies are generative in nature and have cognitive, metacognitive, and affective elements. For example, early work in organizing strategies focused on advanced organizers (Ausbel, 1963, 1968), which would not be considered generative. However, teaching students how to create graphic organizers, how to use concept maps, and how to preview texts would be generative because students would be able to eventually use these strategies on their own.

Graphic organizers

Graphic organizers (Barron, 1969; also called structured overviews) are hierarchically arranged tree diagrams of a text's key terms and concepts. In a revealing meta-analysis, Moore and Readence (1984) found that graphic organizers were more effective than the advance organizers from which they derive. Graphic organizers are generative in that they can be used in a variety of learning and studying situations. Although they were originally used as teacher-directed prereading activities, and can be introduced as such, the effectiveness of graphic organizers tends to be more pronounced when students devise them as a post-reading strategy, expanding them to take the form of concept maps (Moore & Readence, 1984). Teaching college students to use graphic organizers in a generative way can begin with instructors, themselves, using graphic organizers as an overview of a text or to introduce new vocabulary or terms. Instruction can also show students how graphic organizers can be useful in helping to visualize text structure by indicating cause/effect, problems/solution, compare/contrast, chronology, and other patterns (Readence, Bean, & Baldwin, 1985). Hence, graphic organizers contain strong cognitive and metacognitive elements. Visual representations of key concepts often enable students to see organizational patterns, thus making the text's structure more explicit. They encourage students to see how knowledge in a particular domain is structured and can provide students with a guide as they talk through text information.

One of the drawbacks of graphic organizers is that students may need strong verbal skills for the graphic organizer to be effective, especially as a pre-reading strategy (Tierney & Cunningham, 1984). On the positive side, the form that graphic organizers take can be varied according to the desired purpose. In addition, training in this strategy may indeed facilitate transfer to new texts (Dansereau, Holley, & Collins, 1980). Moreover, more recent studies on mapping, a type of graphic organizer (Hay, 2007; Nesbit & Adescope, 2006), conclude that mapping can be effective, especially in classes where synthesis, rather than memorization of facts, is required.
Concept mapping

Concept maps allow students to create a visual representation of information (Hay, 2007). Much of the current research focuses on the use of technology to create concept maps (e.g., Cheung, 2006; Perry & Winne, 2006). For example, Perry and Winne (2006) include concept mapping in their gStudy software as a means to promote self-regulated learning from text. Maps can look like flow charts, depicting a hierarchy or linear relationship, or they can be created in such a way as to represent complex interrelationships among ideas. Mapping helps students link concepts together and also helps their metacognitive awareness of their comprehension of text information (Nesbit & Adescope, 2007). Mapping has been shown to facilitate learning in many content areas because this strategy helps students organize information, relate it to their prior knowledge, and elaborate on the relationships between ideas by providing personal examples (Lipson, 1995). Lipson (1995) describes mapping in the following manner. First, students identify key concepts; then they identify supporting concepts; then they identify relationships between the key and supporting concepts.

One of the benefits of concept mapping is that it helps students identify relationships among ideas (Lipson, 1995). In addition, concept mapping will help students process information at deeper levels. However, students must have fairly well-honed metacognitive skills in order to organize the relationships between and among ideas. Research has indicated that students with low content knowledge may feel insecure about concept mapping (Hadwin & Winne, 1996). Therefore, in order for graphic organizers to be generative, instructors need to provide students with a great deal of direct instruction, practice, and feedback initially. Then, instruction will need to be scaffolded as students grapple with more lengthy texts, become familiar with various organizational patterns, and detect key concepts and their interrelationships.

Previews

Another organizer that can become generative in nature with scaffolding is the preview (Graves & Cooke, 1980). Previews are more than just introductory statements. Rather they are somewhat lengthy descriptions that provide upcoming information about a piece of text students will read. The major purposes of previewing are to activate knowledge, to aid in organization, and to provide purposes for reading. In addition, previewing allows time for reflection on what is to be read (Nist & Holschuh, 2006). As such, previewing also has metacognitive, cognitive, and affective components.

Initially, instructors might try to link students’ existing knowledge with new information that will be encountered. McCruden, Schraw, and Hartley (2006) found that students who received instructions to link their knowledge to the text learned more deeply without an increase in reading time. Previewing allows instructors to “plant” purpose-setting questions and thoughts to give students direction and encourage reading goals (McCruden et al., 2006). Finally, because previewing allows for reflection, it can also lead to increased metacognitive awareness.

Although some research exists that validates the effectiveness of previewing, especially with difficult materials (Alvarez, 1983; Graves & Prenn, 1984; McCruden et al., 2006; Risko & Alvarez, 1986), much of what has been written about the process is written in college reading and studying texts (e.g., Nist & Holschuh, 2006; Nist & Simpson, 1996; Pauk, 1989). Such texts provide students with guidelines on how to preview and the role that previewing plays in overall text understanding. Yet, our own experience has shown that it is difficult to get students to take this step on their own before they begin to interact with text. Thus, getting college students to the point where they have the will to engage in previewing on their own, although they might have obtained the skill, can be a difficult challenge.
Isolating key information

In addition to organizing, students must also be able to isolate key information. The purpose of isolating key information is to reduce the amount of information that a student must remember. Thus, teaching students to isolate is both crucial and difficult because the inability to identify important information can lead to academic frustration and failure.

Research has indicated that many students encounter difficulty in isolating important material (Anderson & Armbuster, 1984; Nist & Simpson, 2000). That is, many students are unable to distinguish between important and unimportant information. Some of the most widely used strategies for isolating key ideas are text marking strategies. As students read and mark, they isolate and concentrate on the information at the time of reading, thereby engaging in deeper processing of the information (Nist & Hogrebe, 1987). However, many students come to college without appropriate text marking strategies and will not be able to use these strategies effectively without explicit training (Nist & Simpson, 2000).

Underlining and highlighting

Although the research on underlining and highlighting is extensive, the findings are very inconsistent. Some researchers found no difference when comparing underlining with other strategies (Hoon, 1974; Stordahl & Christensen, 1956). Other researchers found underlining less effective than other strategies, such as note taking (Kulhavy, Dyer, & Silver, 1975). Still other studies found underlining to be more effective compared with other text marking techniques, such as starring key ideas or bracketing important concepts (Rickards & August, 1975). Although underlining and highlighting are popular methods of isolating information, they do not meet Wittrock's (1990) definition of generative learning because they do not require students to organize, transform, or elaborate on the material. We include them here, however, because instructors can teach these strategies as a beginning point, moving on to more generative strategies such as annotation.

One of the drawbacks of underlining or highlighting is that neither method actively engages students in selecting the key ideas. In other words, underlining is passive. Students will often mark text that appears to be important but may not be (Nist & Kirby, 1989). In addition, because students need fairly well developed metacognitive skills to be able to monitor their understanding as they underline, many simply underline or highlight material that they do not even comprehend. But underlining does have its benefits. It can help students attend to the text, and it is a strategy that students spontaneously select and, thus, is one that they will be likely to transfer to many different learning situations.

Annotation

Another text marking strategy for isolating key ideas is text annotation. Annotation is generative in nature and has metacognitive, cognitive, and affective components. Annotation is a logical “next step” or additional step in teaching students how to isolate key information. Annotating text includes the following components: (a) writing brief summaries in the text margins in the students’ own words; (b) enumerating multiple ideas (e.g., cause-and-effect relations, characteristics); (c) noting examples in the margins; (d) putting information on graphs and charts if appropriate; (e) marking possible test questions; (f) noting confusing ideas with a question mark in the margins; and (g) selectively underlining key words or phrases (Simpson & Nist, 1990). Students are responsible for pulling out not only the main points of the text, but also the other key information (e.g.,
examples and details) that they will need to rehearse for exams. In this way annotation goes beyond the process of isolation. Students are actually transforming information by changing or personalizing it in some way.

Much of the current research focuses on creating or using software programs for text annotation (e.g., Perry & Winne, 2006; Wentling, Park, & Peiper, 2007; Wolfe & Neuwirth, 2001). Wentling et al. (2006) found that students who used annotation software scored higher than students who did not on each of three exams. This line of research offers a promising glimpse into the future of annotation as more course materials are offered online.

The benefits of annotation are numerous. First, students are actively reading and monitoring their understanding. When students encounter information that they cannot put into their own words, they know that they do not comprehend the information. Second, students using annotation are actively constructing ideas and making connections to what they know (Simpson & Nist, 1990). In this way, the strategy is flexible (Nist et al., 1995) and should facilitate deeper processing (Anderson & Armbruster, 1984) and metacognitive awareness. Third, annotation can be motivating for students because they are approaching the text with a purpose (Nist & Holschuh, 2006). Fourth, annotating helps students organize the information so that they can see links between the main points and supporting details.

But annotation does have drawbacks. One possible drawback is that its usefulness depends on the depth of processing. If students are simply copying the text verbatim, then there will not be much benefit (Anderson & Armbruster, 1984; Liu, 2006). For deeper processing and comprehension, students must annotate in their own words (Simpson & Nist, 1990; Strode, 1991). Another drawback, especially from the student's perspective, is that it takes longer to read and interact with texts. This may be especially troublesome for at-risk learners who may already read laboriously. Finally, as previously mentioned, annotation instruction also takes a good deal of time. Research has indicated that mastering this strategy may necessitate more than one semester of instruction and practice (Holschuh, 1995; Mealey & Frazier, 1992).

**Elaborating**

Although organizing and isolating key information are important elements of academic success, students also need to know and use elaborative strategies. Of the three strategic processes, elaboration is the final step. In other words, students cannot elaborate on information without first organizing and isolating key information in some way. College students are often in learning situations where they are required to synthesize and analyze information, situations where rote memorization strategies will not suffice (Nist & Simpson, 2000; Pressley, Ghatala, Woloshyn, & Pirie, 1990). Moreover, tasks that require elaboration of information across texts, including electronic sources and Web sites, are frequently assigned in college courses (Dornisch & Sperling, 2004) and often cause frustration (Simpson, 1994; Simpson, Stahl & Francis, 2004).

Elaborative strategies allow students to relate new information to what they already know (Ozgunor & Guthrie, 2004; Wittrock, 1986). When students elaborate, they add information that is not explicit in the text they are studying (Hamilton, 1997; Ozgunor & Guthrie, 2004; Simpson, Olejnik, Tam, & Supattatham, 1994). The use of elaborative strategies often distinguishes successful learners from unsuccessful learners (Willoughby, Wood, and Kraftcheck, 2003). There are many different strategies students can use to go about the difficult task of elaboration. These comprehension strategies include elaborative interrogation and elaborative verbal rehearsals.
Elaborative interrogation

Educational researchers (Menke & Pressley, 1994; Pressley et al., 1992; Willoughby, Wood, & Kahn, 1994; Willoughby, Wood, & Krafczak, 2003) posit that using elaborative interrogation, by inserting "why" questions into text, enhances student learning because it encourages students to use their prior knowledge to make relationships between ideas. Elaborative interrogation is related to schema theory because the student is tying existing knowledge with new information (Ozgungor & Guthrie, 2004; Dornisch & Sperling, 2006; Willoughby et al., 1994). Questions are constructed by the instructor, who must be careful to pose questions that support the ideas that students need to learn (Menke & Pressley, 1994). In previous research, this strategy has been found to be most effective when students already have some knowledge about a topic, because when students are faced with unfamiliar material, they are likely to access inappropriate schemata (Willoughby et al., 1994). However, recent research, moving from the use of shorter prose or factual paragraphs to more ecologically valid longer passages, has suggested the process of elaborative interrogation to be more advantageous for less knowledgeable students (Dornisch & Sperling, 2006; Knapp, 2004). Furthermore, elaborative interrogation was also of greater benefit for students who had low interest in the topic of the text (Ozgungor & Guthrie, 2004). Because the instructor is responsible for inserting the elaborative questions, this strategy does not meet Wittrock's definition of a generative strategy. However, elaborative questions can be the basis for students to learn the types of questions they should be asking themselves as they read. By making explicit ties between elaborative questions used in class and how students should ask themselves questions when they read on their own, instructors can help students monitor their understanding of text.

Self-questioning has many purposes as a way of elaborating on information, from prompting the retrieval of prior knowledge and focusing attention to checking comprehension of information and predicting possible test items. Self-questioning has been shown to improve comprehension and performance on exams (Gettinger & Seibert, 2002; King, 1992; Taraban et al., 2004; Tierney & Cunningham, 1984). The ability to construct questions that tap into higher level thinking—as opposed to factual questions that encourage only shallow processing—is beneficial to deeper comprehension (Graesser & Olde, 2003). Even though teaching students how to question is often difficult, it is imperative because students need to be instructed as to what types of questions are effective.

Elaborative verbal rehearsals

Elaborative Verbal Rehearsal, or a talk-through, is a strategy that provides an important means of monitoring understanding of text (Nist & Diehl, 1998). This strategy has been shown to have an impact on at-risk students' exam performance (Simpson et al., 1994). When students use this strategy, they are rehearsing aloud the important information as if they were teaching it to an audience (Simpson, 1994; Nist & Simpson, 2000). A good talk-through consists of the following processes: (a) relating ideas across text and to prior knowledge, (b) incorporating personal reactions or opinions about the ideas, (c) summarizing key ideas in students' own words, (d) including appropriate text examples, and (e) including appropriate text examples (Simpson, 1994). Research has indicated that the quality of the talk-through played a major role in its effectiveness, so students will need explicit instruction on how to conduct an effective elaborative verbal rehearsal (Simpson et al., 1994). This instruction should include modeling a good example, explaining the rationale for strategy use, and providing feedback on students' use of the strategy (Simpson et al, 1994). Elaborative verbal rehearsals are
metacognitive because they help students distinguish what they know from what they do not know.

One of the drawbacks is that students must have a good understanding of the information before elaborative verbal rehearsal can be used. Simpson (1994) suggests that this strategy only be used by students who can decode the text material. One of the benefits of this strategy is that it facilitates students' active and elaborative comprehension of text information.

CONCLUSIONS

Because we know that studying is usually an isolated activity (Thomas & Rohwer, 1986), we need to arm college students, particularly at-risk college students, with generative strategies that they can use independently. Unless college students can move beyond teacher dependence and apply strategies on their own, they will have a difficult time being academically successful in college.

One of the most important elements of developing comprehension strategies is to make students aware of how to select task-appropriate strategies. This can be accomplished by modeling the strategy in a variety of contexts and through discussions with peer groups. Students should be encouraged to modify strategies in such a way that they have "ownership" in the strategy. In addition to providing scaffolding on strategy use so that students can eventually use the strategy on their own, instructors should be sure that the strategy possesses metacognitive, cognitive, and affective elements.

Research on comprehension strategies and their use has progressed dramatically in the past two decades, from a focus on specific strategies to more of a focus on the processes involved in strategy use. Thus, currently, it is perhaps safe to conclude that it is not so much the strategy itself that makes the difference, but the processes that underlie that strategy.

RECOMMENDATIONS

In this chapter, we have taken the stance that every strategy presented to students should have the potential of becoming generative in nature. For example, when teaching organizing strategies, instructors may begin by introducing the idea of graphic overviews or teacher-directed prereading activities. But instruction does not stop here. Instructors need to scaffold instruction to the point where students can create concept maps or engage in a variety of useful prereading activities independently, as a way of generatively processing information and creating meaning by building relationships between parts of the text (Wittrock, 1990).

Because we seem to be moving in the direction of a better understanding of the processes that underlie effective strategy use, it is important for instructors to explain these processes to students so that they can make decisions about which strategies might meet their needs. Rather than solely teaching specific strategies, teaching students about the processes that underlie strategy use seems to be more worthwhile. Also, making sure that students understand the declarative, procedural, and conditional knowledge about a strategy leads to greater transfer. This means that students will need to know a wide repertoire of strategies, understand why those strategies work, and have an understanding when to select the strategies for a given domain. We believe that students need to understand how tasks may be domain specific because of the level of thinking required by a particular domain. This means that a multiple-
choice exam may not be the same task in chemistry as it is in psychology, nor may it require the same strategies. Additionally, the strategies students select will be based on both the domain and the task.

We have also suggested that the ability to transfer strategies to new situations takes time. This is partially because many students are at the point of acclimation each time they encounter a new domain. The specific comprehension strategies discussed in this chapter rely heavily on initial teacher instruction and direction, but then allow students to modify the strategies for any number of situations. We have found that it is helpful for students to have ample opportunity to try out each of the strategies and time to discuss the modifications they made with other students.

In addition, we believe that knowledge about affect is important in strategy use. Students must possess not only the skill, but the will to use a variety of strategies (Weinstein, 1997). Successful strategy use depends on students’ understanding of how their affective behaviors impact learning. Because they need to have the will to make deliberate choices about which strategies to use and follow through with their use as they learn, study, and prepare for exams, we believe it is important that students learn about their own affective stances as they learn comprehension strategies.

Finally, in order to stay on top of the tasks students encounter in their courses, we believe that instructors need to take note of the increasing role of technology in current college courses in order to help students learn strategies to organize, isolate, and elaborate this information as well.

**FUTURE AVENUES**

Our review of the theory and research related to comprehension strategies at the college level points to several future directions. First, because of the factors that impact learning, research needs to further examine the roles of domain, context, and task on strategy selection and usage. Research conducted across domains and across various groups of learners will add to the literature on comprehension development and strategy use.

Second, more long-term studies need to be conducted that focus on a variety of questions: Just how much scaffolding is necessary in order for transfer to occur? Should both narrow and broad conceptualizations of transfer be considered in these studies? How much and what kind of instruction leads to transfer? How can we get students to “buy into” strategy use? Because much of the research on specific strategies, especially those that have traditionally been termed “teacher-directed,” has been short in duration, there are many questions left to answer.

Third, examining the role of technology and the Internet in college courses can help researchers gain greater insight into students’ learning tasks. Accessing appropriate information, evaluating the information, and synthesizing the information from various print and digital texts can be daunting for students. Several studies with an eye toward developing new methods for strategy use are pioneering new and fertile grounds for research.

Finally, the dynamic and complex nature of the development and use of comprehension strategies calls for more research that takes together the cognitive and affective components. Research that investigates how the affective component can be used to engage students in strategy selection and use is needed. As we previously mentioned, students must have not only the skill, but also the will to engage in strategy use. The more we understand about the underlying processes and factors that impact learning and strategy use, the greater the opportunity students have to generate and use appropriate strategies as independent learners.
REFERENCES AND SELECTED READINGS


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