DID YOU ASK A GOOD QUESTION TODAY? ALTERNATIVE COGNITIVE AND METACOGNITIVE STRATEGIES

Classroom instruction can be aided by training students in question generation. This article is directed to middle school, junior high, secondary, and postsecondary content area teachers to encourage student questioning instruction as a basis for higher level thinking about subject matter.

I am 83 years of age, and I am still learning. I am fascinated by the computer age, and I am still learning how to use some of the new technology. I just started taking water aerobics and swimming lessons last year. I ask a lot of questions during my swimming lessons. Take a deep breath! You can drown yourself with problems if you don't ask questions.

Rosa Parks (from Parks & Reed, 1996)

"Did you learn anything in school today?" asked many Brooklyn, New York, mothers when their children came home in the afternoon. But not the mother of young Isidore I. Rabi, who would become a future Nobel laureate in physics. Instead she always asked, "Did you ask a good question today?" (Sheff, 1988, p. A26). Rabi credits this difference--asking good questions--as the reason he became a scientist. Is it enough to just desire to ask a question as suggested by Rabi's mother? Researchers have identified constraints such as teacher domination, student passivity, peer pressures, and institutional barriers that are likely to impede the student questioning process (Dillon, 1988; Good, Slavings, Harel, & Emerson, 1987; Graesser & McMahen, 1993; Van der Meij, 1994).

It appears that student questioning behavior runs counter to normative conventions of classroom discourse and role relationships. In other words, teachers ask questions in class and students answer them. Yet, empirical evidence suggests that learning of technical information can be achieved by training students to ask good questions (Allison & Shrigley, 1986; Graesser & Person, 1994). Perhaps, this connection between knowledge and questioning is best expressed in the words of Aristotle from his Posterior Analytics, "these, then, are the ... kinds of questions we ask and it is in the answers to these questions that our knowledge consists" (McKeon, 1947, p. 73).

As an experienced secondary school teacher, I realized firsthand the critical role of questioning in my classroom instruction. When I became supervisor of the social studies department in an inner-city high school, I decided that one of my staff development objectives would be training teachers to teach their students to ask questions in class. What would happen if some of the classroom constraints mentioned in the literature were eliminated? Could the teachers under my supervision be trained to teach students how to ask questions at different levels of thinking in social studies when a positive and supportive climate existed? I addressed these concerns in an empirical study published in a social studies research journal (Ciardiello & Cicchelli, 1994).

The purpose of this article is to present a cognitive and metacognitive strategy for student questioning instruction. A cognitive strategy has been defined as a guided learning procedure for internalizing new information and performing higher level thinking operations (Rosenshine, Meister, & Chapman, 1996). Rigby (1978) has argued that self-questioning is among the most potent cognitive strategies for stimulating content learning, because question generation prompts learners to search for answers that they themselves want to know. This message is especially important for middle school, junior high, secondary, and postsecondary students, who can view student questioning training as an instrument for learning new content area knowledge in a given discipline.

My own experience in supervising teachers to train their students in questioning occurred within the framework of regular school subject instruction (social studies). This integrated approach tended to enhance content learning of the topic (the Great Depression) because the skill of question generation was developed authentically within the real-world context of the curriculum. Indeed, as a general cognitive strategy, student questioning can be readily applied to all content areas (Alvermann & Phelps, 1994).

Cognitive strategy research

One of the major advances in instructional methodology in the last 20 years has emerged from the research on cognitive and information processing. It derives from the effective teaching research of the 1970s, which advocated the teaching of direct or explicit instruction. Explicit instruction stresses the benefits of dividing tasks into small parts. The effective teaching literature has revealed that the most competent teachers teach new material in small steps recognizing the limitations of working memory and time needs for processing new material (Rosenshine, 1995). In addition, the development of well-connected networks of long-term memory depends on extensive, independent practice. All of these explicit teaching characteristics are applicable to cognitive strategy instruction.

Cognitive strategy instruction has combined elements of explicit teaching with scaffolding procedures (e.g., modeling, think-alouds, reciprocal teaching) and scaffolding tools such as procedural prompts and evaluation checklists. One area of cognitive strategy instruction that has received major research input is the generation of student questions (Anthony & Raphael, 1987; Davey & McBride, 1986; King, 1991; Rosenshine & Meister, 1997). Indeed, questioning strategy training has received greater impetus from direct instruction and cognitive strategy instructional models than either inquiry-based or case-based learning models (King, 1995). Research has indicated that an explicit system of training is a major requirement for successful student generation of higher level questions (King & Rosenshine, 1993; Rosenshine, Meister, & Chapman, 1996). There is a need to make these empirical findings available to teachers. A major goal of this article is to bridge the gap between the findings of student questioning research and its classroom application.

The cognitive and metacognitive nature of student questioning

One interesting result from the qualitative phase of my research related to the observation that students could indeed generate good questions after a period of training, but that they were stimulated by different sources. (The working definition of a "good question" was one incorporating any of the cognitive processes: memory, convergence, divergence, and evaluation.) The following 11th-grade student protocols reveal a number of insights about the process of student questioning behavior and the implication for literacy education (Ciardiello, 1990).

Student 1: Ever since I was small I always like to ask questions. In class I'm always raising my hand. In school, you're always used to answering questions instead of writing them. Here [during the training sessions] you have opportunities to write questions. There's always questions--everything. They'll never stop being questions with anything. Why is something named after that? How did it get it? Is God really there? There are questions that have no answers. You still ask them. You want to know even though you can't know but you still want to find out.

Student 2: (Responding to a probe about manifesting a plan in generating questions from written documents.) I tried to write questions of each type [referring to the four cognitive levels -- memory-based, convergent, divergent, and evaluative questions]. When I was thinking about one (question) another came up so I would try to write it as fast as I can. After I finished, I tried to put them in order.

Usually when I write them--the most simple would go first, the hardest would go last.

These students' protocols reflect different perspectives or dimensions of the nature of good student questioning. For student 1, good questioning is the result of an ongoing process of deep thought. This could be considered the cognitive dimension of questioning. For student 2, good questioning appears to require a form of executive decision making and strategic planning. This could be considered the metacognitive dimension of questioning.

Question generation is both a cognitive and metacognitive strategy. This is because the process of asking questions enhances comprehension through a focus on main ideas (content) and also checks understanding to see if the content is learned (Rosenshine, Meister, & Chapman, 1996). Indeed, question generation involves a kind of split focus (dual function) by getting the reader to concentrate on the material itself while constantly checking to see that one has performed the necessary processes. Palincsar and Brown (1984) describe the cognitive process in terms of comprehension-fostering and the metacognitive process in terms of comprehension-monitoring.

How is question generation a comprehension-fostering cognitive strategy? It requires students to search or inspect the text, identify main ideas, and make connections among ideas as a basis for raising a relevant question. It helps students to develop internal procedures that aid in deep processing of text (Palincsar & Brown, 1984; Rosenshine, Meister, & Chapman, 1996). Generating questions is a guide that supports learners as they develop internal cognitive processes.

Questioning is also a comprehension-monitoring and regulating process. It serves as a form of self-checking to assess if the material is understood. Flavell, Miller, and Miller (1993) describe this characteristic as metacognitive knowledge, which they define as the ability to evaluate whether the strategy that one is using is producing progress toward a goal. Research shows that self-questioning is the most effective monitoring and regulating strategy of all the various metacognitive strategies (e.g., summarizing and clarifying) in its effect on reading comprehension (King, 1994; Rosenshine, Meister, & Chapman, 1996).

Explicit student questioning strategies

Few students of all ages, even those as advanced as graduate students, ask thought-provoking or higher level cognitive questions in class (Andre & Anderson, 1978-79; Dillon, 1988; Graesser & McMahen, 1993; West & Pearson, 1994). We need to train our students how to ask knowledge-seeking and hypothesis-generating questions. These types of questions have no standard responses and can be answered in many different ways. They stimulate divergent thinking and encourage independent learning. Students require direct strategy instruction in the form of modeling and procedural prompts in order to generate high-level questions (King, 1992).

There are many constraints on student questioning behavior. Many students lack the necessary skills to ask higher level cognitive questions (Van der Meij, 1994). To address this lack, I developed an explicit instructional model to train students at an inner city high school to raise questions at four different cognitive levels of thinking using three sequential stages: identification, categorization, and construction of questions. I utilized the questioning taxonomy of Gallagher and Aschner (1963), which categorized four types of questions--memory based, convergent, divergent, and evaluative. My instructional program offered two alternative learning modules for training students. The techniques discussed below are context independent and can be adapted to any classroom learning situation.

The first procedure describes the teacher as the main agent, who structures the questioning training

through direct instruction, modeling, reinforcement, and follow-up practice. I have labeled it with the acronym TeachQuest because of the dominant role of the teacher. The second approach utilizes a collaborative teacher/student questioning training procedure based on the research of Manzo (1969, 1970). He called the method ReQuest, which is an acronym for reciprocal questioning, a procedure in which the teacher and students take turns asking and answering each other's questions about a reading or picture. Manzo's ReQuest method does not contain any provision for formal questioning training nor does it use procedural prompts such as signal words to aid in guided practice. My adaptation of ReQuest involves formal training and the use of procedural prompts in the forms of signal word cues and question type facilitators.

Each module contains specific teacher and student behaviors. A comprehensive illustrative example will be provided for the divergent question form within each of the two questioning training approaches, TeachQuest and ReQuest. The sequence of these alternative strategies follows a similar progression for each of the four question types (memory, convergent, divergent, and evaluative).

TeachQuest training model

Stage 1: Identifying divergent thinking questions

• Explain the purpose and value of asking questions in class.

• Introduce questioning strategy by establishing links between the initial process of identifying questions and the culminating process of generating questions.

• In a whole-class instruction format, explain the meaning of the term divergent by highlighting its open-ended and expansive nature.

• Review key words or question stems (provide cue cards) that can be associated with this questioning level, such as, "if ... then ... "; "suppose that ..."; "imagine ..."; " predict ..." (see Table).

• Offer review exercises in which students demonstrate ability to recognize divergent thinking questions from pool of other types of cognitive questions. Direct students to underline or highlight the signal words.

• Offer immediate, corrective feedback.

• Move to next phase of training when you assess that students are ready.

Stage 2: Classifying divergent thinking questions

• Explain how the process of classifying questions serves as a precondition for constructing questions.

• Provide array of sample questions including those representing the four different cognitive types.

• Direct formation of categories of representative questions.

• Have students identify the common characteristics of the listed divergent questions.

• Provide review exercises.

• Signal transition to next phase of questioning training stage.

Stage 3: Generating divergent thinking questions

• Model or demonstrate how to write divergent thinking questions from reading material (I used primary and secondary source documents as well as political cartoons and photographs related to the topic of the Great Depression). Use think-aloud protocols.

• Direct students to construct divergent questions as they read while simulating teacher modeling.

• Review students' questions. Provide immediate corrective feedback. Use whole class format to answer students' questions.

• Summarize objectives of the training session.

ReQuest training model

Stage 1: Identifying divergent thinking questions

• Encourage students to establish the purpose and value of generating questions.

• Elicit reasons why the process of generating questions depends on ability to identify different cognitive levels of questions.

• Call on students to brainstorm the meaning of the term divergent questions.

• Encourage students to develop list of signal words and phrases that could help in recognition of divergent questions.

• Organize the formation of small cooperative groups to work on review exercises with guided practice.

• Elicit feedback from students regarding transition to next training phase, or the need for additional review exercises.

Stage 2: Classifying divergent thinking questions

• Encourage students to explain how classifying questions can be useful as a learning event prior to generating questions.

• Provide array of cognitive questions including sample of divergent thinking questions.

• Encourage students to work together to categorize examples.

• Serve as coordinator or facilitator--review generated questions with students.

• Obtain student input regarding the need for extra review or for movement to next activity.

Stage 3: Generating divergent thinking questions

• Explain to students that they and you will take turns asking and answering divergent type questions from selected reading material.

• Allow students to decide who will initiate the question modeling.

• Proceed to read and generate questions one paragraph at a time from the text.

• Help students formulate appropriate questions whenever difficulties emerge.

• Continue reciprocal questioning until students display that they know how to generate and answer divergent thinking questions.

• Encourage students to summarize the objectives of the three training stages of identifying, classifying, and constructing divergent thinking questions.

Explanation of strategy use

TeachQuest and ReQuest are not fixed and isolated strategies but flexible and interchangeable. It is up to the teacher to decide when to use either strategy or a combination of both. In situations that call for firmer classroom management and tighter time constraints, it would be advisable to use the TeachQuest model, where the teacher has stronger control of these elements. Another consideration is the fact that some students will prefer to learn independently, which the TeachQuest structure facilitates. The ReQuest model, with its collaborative nature, offers participants the opportunity to model their questioning behavior on that of their peers. This provides benefits in terms of the shared discussion of meaning and the social construction of knowledge.

The adaptation of instructional strategies to fit changing dimensions of the teaching situation is in accord with research that suggests that both independent and group versions of questioning training manifest benefits in terms of reading comprehension (King, 1989). It also recognizes that no one model is a panacea, and that the teacher should maintain what Duffy (1997) calls "cognitive control" over learning by establishing an entrepreneurial and independent spirit to make the necessary adaptations according to situational demands. In this light, TeachQuest and ReQuest should be viewed as instructional models to be adapted rather than as scripts to be rigidly followed.

The application of TeachQuest and ReQuest cognitive strategies occurs in three separate but related stages. Each of the strategies follows the sequence of identifying, classifying, and constructing questions. This division into small, manageable steps adheres to the findings of cognitive strategy research, which claims that successful learning of new material occurs in reinforceable and incremental segments (Rosenshine, Meister, & Chapman, 1996). In addition, making connections and associations among the thinking processes of identification, classification, and generation consolidates the process of asking questions.

Cognitive strategy research indicates that this consolidation improves questioning skills (Rosenshine & Meister, 1997). Each separate strategy is introduced with a detailed explanation of the purposes, benefits, and values of question generation as an important learning and reading comprehension skill. Educators recognize the intrinsic motivation attached to what Pressley, Woloshyn, and Associates (1995) call an "informed cognitive strategy." Informing students of the rationale for using a particular strategy will enhance its effect and likely ensure continued use of the strategy (King, 1991).

In TeachQuest and ReQuest the instructional process known as cognitive apprenticeship takes place.

This is a learning structure in which teachers serve as mentors and help students develop cognitive strategies (Collins, Brown, & Newman, 1989). It is based on the theoretical work of the Russian psychologist Vygotsky (1978), who claimed that children learn new information and skills within their zone of proximal development, beyond the level of independent functioning but within reach of attainment with adult assistance. Adults provide temporary guidance in the form of hints and prompts and then gradually withdraw their influence. These mental scaffolds play a major role in question generation training.

As students progress in their ability to construct questions, the supports are gradually removed or reintroduced as necessary. Scaffolding procedures include modeling, think-aloud protocols, guided teacher practice, and independent practice, or tools such as procedural prompts (signal words and question types). The sources of information from which students generate questions are presented at increasing levels of complexity.

In this study the first selections were nonprint documents (political cartoons and photographs) followed by simple primary source documents and more complex secondary sources (textbook selections). In accordance with the principles of cognitive strategy instruction, it is more effective to reinforce the skill of question generation in a cumulative sequence. In addition, the reading material is presented in small chunks (questions are generated paragraph by paragraph) to allow for adequate processing. Cognitive researchers indicate that presenting too much new information at one time can flood or swamp short-term memory (Roehler & Duffy, 1991; Rosenshine & Meister, 1997).

Modeling

Modeling is an important part of the scaffolding procedure in both TeachQuest and ReQuest. In the former strategy, the demonstration of the student questioning procedure is teacher centered. The teacher walks students through the various phases while vocalizing his/her thoughts. Roehler and Duffy (1991) label these think-alouds as a form of "mental modeling" as the teacher describes the reasoning process while performing an instructional action. In the latter version, both teacher and students share the modeling of the question generation strategy.

As the students become more proficient they and their peers serve as the primary source of good questioning behavior. This shift in responsibility tends to remove one of the major constraints on student questioning behavior, which is fear of teacher disapproval. In addition, allowing students to determine the pace and direction of the questioning process increases their sense of agency and decision making. This ability to control one's own cognitive performance increases student motivation and interacts positively with the metacognitive element of self-questioning (King, 1994)

One can conceive of students' metacognitive skill in questioning on a continuum ranging from high to low based on the amount of control or responsibility exercised in the questioning process (Gavelek & Raphael, 1985). Due to the fact that in the TeachQuest strategy the teacher serves as a kind of metacognitive surrogate by exercising control of the questioning process, the level of the students' metacognitive skill will appear at the lower end of the continuum scale. One feature of metacognition is locus of control or the ability to assert independence in thinking and action (King, 1994). Students with low levels of independence will probably tend to prefer a structured questioning procedure such as the TeachQuest method.

The reverse process would conceivably work for the ReQuest strategy in which students take a more active role in generating questions (and are presumably in possession of a higher level of control). The autonomy afforded by the ReQuest model fosters self-regulated learning and provides for freedom of

choice within the confines of the ReQuest questioning structure. In this scenario, the students' metacognitive questioning skill will appear at the higher end of the continuum.

Guided student practice and corrective feedback

TeachQuest and ReQuest include provisions for teacher assistance as students begin their questioning training. Students are guided in using signal word prompts for the different question types (see Table). Various forms of question generation cues have been used successfully in other questioning training studies (Billingsley & Wildman, 1984; King & Rosenshine, 1993). It is important for teachers to anticipate student errors at this time. One problem encountered was that some students tended to use the signal word cues for question types in a literal way without realizing the importance of the context and source of information needed to respond appropriately to the question. For example, some students tended to think that the signal word why always cued a convergent thinking question, which could be simply a memory-level question. It is important to stress the relative and contextual nature of these cues.

In ReQuest, the reciprocal nature of the strategy largely determines the direction of the guided practice. The role of the teacher begins to shift from that of a coach to one of a collaborator and finally to that of an observer. The scaffolding starts to fade and then ultimately disappears as the students become their own mentors. It is important to note, however, that the teacher's instructional support can always be reintroduced at any stage of this process.

Immediate corrective feedback is an important phase of student question training due to the high-level cognitive processing involved in the process. In TeachQuest, the teacher monitors students' progress and determines if reinforcement activities are necessary. The traditional form of feedback generally involves verbal correction of student errors.

The collaborative social nature of the dialogue in ReQuest largely determines the nature of the feedback process. As the rotating nature of the strategy enfolds, teachers and student peers provide necessary corrections. At the beginning, students match their questioning skills against that of the teacher model, but this then begins to shift toward their peers.

Independent practice

The independent practice phase can be accomplished in several different ways. It could take the form of teacher-led practice, or be accomplished independently with a routine of specific procedures guided by prompts such as checklists, or it could occur with student cooperative practice in small groups (Rosenshine & Stevens, 1986). Both TeachQuest and ReQuest satisfy these criteria in different ways.

The separate stages of identification, categorization, and construction of questions converge during the independent practice phase. When the students begin to construct their own questions using different types and levels of materials either independently or in small groups, then the strategy has been blended into a unified whole. It is also during this phase that students develop what Rosenshine and Stevens (1986) call "automaticity," or the point at which enough guided practice has been given so that students' learning is firm, quick, and spontaneous. This is particularly important in the TeachQuest and ReQuest strategies because they are hierarchical procedures that require prerequisite learning of the processes of identifying and classifying question types before generating various levels of cognitive questions. After extended independent practice generating cognitive-type questions from primary sources and secondary sources, the students will begin to develop a sense of mastery of the new skill.

Although the TeachQuest and ReQuest methodologies are different, they share a similar orientation.

Both strategies recognize that question generation is a socially mediated strategy, and that skill development depends on the services of other individuals. TeachQuest highlights the teacher's mediating role whereas ReQuest suggests a collaborative teacher and student dialogue. In addition, these alternative strategies realize that student questioning is not a natural by-product of subject matter acquisition but a specific learning skill that needs to be taught explicitly (Ciardiello, 1990).

Questioning promotes literacy

Student questioning training offers an appropriate strategy for teaching cognitive and metacognitive skills because it is a form of language instruction that serves the expansive range of thinking processes. It also presupposes that instruction is for students of various ages and abilities. All students have the potential to learn how to think, reflect, and question in a competent manner. At-risk students can benefit from questioning training as well as their more successful peers. Too often these students have been instructed with a narrow questioning perspective--focusing on lower level basic skills instruction and autonomous learning. Cognitive strategy research has indicated that this reductionist view of learning is too limited (Palincsar & Klenk, 1991). Student questioning training offers a counterbalance to this narrow perspective. It reflects the constructivist view that learning occurs in goal-embedded contexts and is reconstructed through the reciprocal exchange of views and experiences between teachers and students, and students and peers. Training students how to generate questions is an important strategic plan for helping all students think and communicate.

A popular idea in educational training institutions at the beginning of the 20th century was that "skill in the art of questioning lies at the basis of all good teaching" (Betts, 1910, p. 55). This could be rephrased in the form of an adage "that to know how to question is to know how to teach." As we approach the 21st century, this adage still has validity but it has to be expanded in the light of a century of educational practice and research in social psychology and cognitive science informing how students learn. Perhaps a more relevant proposition would be: To know how to question is to know how to become literate.

Cue cards for question types

Memory questions

Signal words: who, what, where, when

Cognitive operations: naming, defining, identifying, designating, yes or no responses

Examples:

Naming: What is a synonym for democracy?

Defining: Where is the 38th parallel in Korea?

Identifying: Who is Andrew Jackson?

Designating: When does the 21st century officially begin?

Yes or no: Are 18-year-olds allowed to vote in the U.S.?

Convergent thinking questions

Signal words/short question stems: why, how, in what ways?

Cognitive operations: explaining, stating relationships, comparing and contrasting

Examples:

Explaining: Why was U.S. President Andrew Johnson impeached?

Stating relationships: How was the invasion of Grenada a modern day example of the Monroe Doctrine in action?

Comparing and contrasting: In what ways is the anti-apartheid movement in South Africa similar to the civil rights movement in the United States?

Divergent thinking questions

Signal words/short question stems: imagine, suppose, predict; If ... then ... , How might ... , Can you create ... , What are some possible consequences...

Cognitive operations: predicting, hypothesizing, inferring, reconstructing

Examples:

Predicting: What predictions can you make regarding the budget surplus in the year 2000?

Hypothesizing: How might life have been different in the United States if the South had won the Civil War?

Inferring: What are some possible consequences of the fall of communism in Eastern Europe?

Reconstructing: Can you create a new amendment granting equal rights to women?

Evaluative thinking

Signal words/short question stems: defend, judge, justify/What do you think ..., What is your opinion ...?

Cognitive operations: Valuing, judging, defending, justifying choices

Valuing: How do you feel about abortion for teenagers?

Judging: What do you think of capital punishment for drug dealers?

Defending: Why did you vote for Bill Clinton?

Justifying choices: Why would you prefer to live in the suburbs?

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Source: Journal of Adolescent & Adult Literacy, Nov98, Vol. 42 Issue 3, p210, 10p.
Item Number: 1235755
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