TEACHERS, QUESTIONS, and COGNITION

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A CLASSROOM without questions is as hard to conceive as Santa Claus without children or Independence Day without flags. Since the time of Socrates, questions have been recognized as the indispensable tools of educators. In the setting of the classroom, questions posed by teachers and children are foremost among the stimuli which trigger thinking and thus set the tone of cognition.

Yet is the potential of the question being fully exploited? Although they have the capability of initiating critical and creative thinking, many questions focus upon memory of specific facts. Research examining this phase of the teaching-learning process indicates that the predominant emphasis of teachers' questions searches out a knowledge of facts—a regurgitated recall-of-textbook information (5: 96; 8: 254; 13: 83-84; 15: 147; 16: 418).

Findings which proclaim the significance of questions, yet indicate the discrepancy between purpose and practice, imply a need for specific instruction in question-asking techniques for both prospective and in-service teachers. Perhaps the ease with which teachers employ questioning techniques has led to the neglect of this behavior in methods classes and in-service workshops; however, teachers cannot employ comprehensive questioning patterns without an awareness of techniques for lifting levels of thought and expanding and using learners' ideas (4: 547; 12: 228). Time spent in instructing in both purposes and types of questions can pay rich dividends in all curricular areas.

Questioning Strategies

What types of questioning strategies do teachers need to employ to enable pupils to develop higher levels of cognitive behavior? Many scholars have reflected an obsession with questions as they relate to hierarchies. The survey of classification systems presented in Figure 1 mirrors a concern for the role played by varying levels of cognitive behavior in the teaching-learning situation. The systems also illustrate a range in detail while dealing with comparable levels.

Other scholars have devised comprehensive analyses of questions according to their cognitive functions. Smith and Meux's criteria for classifying questions include "defining," "describing," "resignaling," "stating," "reporting," "substituting," "evaluating," "opining," "classifying," "comparing and contrasting," "conditional inferring," "explaining," and "directing" (19: 211-27). Batchelder, McGlasson, and Schorling, too, formulated a descriptive functional classification system of questions: "comparison or contrast," "decision for or against," "appli-

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Minor (14: 539)	Fraenkel (9: 199-200)	Clements (5: 93-94)	Douglass (7: 175)	Gallagher (10: 52-53)	Guilford (11: 267-93)	Sanders (17: 3)	Bloom (2: 62-196)	Crump (6: 40)
				Evaluative thinking	Evaluative thinking	Evaluation	Evaluation	Valuation
						Synthesis	Synthesis	
Real questions	"What if" questions	Questions with no answers	Problems to be discovered	Divergent thinking	Divergent thinking	Analysis	Analysis	Reflection
	"Why" questions					Application	Application	
		Questions with many acceptable answers	Problems in reasoning			Interpretation		
				Convergent thinking	Convergent thinking	Translation	Comprehension	Translation
Synthetic questions	"Who," "what," "when" questions	Questions with one acceptable answer	Problems of retrieval	Cognitive memory	Recall	Memory	Knowledge	Reproduction
					Recognition			

Figure 1. Levels of Questions and Cognition

cation in new situations," "classification," "relationships," "example or illustration," "statement of aim," "criticism," "inferences," "discussion," "outline," "definition and explanation," "recall," "summary," "observation," and "formulation of new questions" (1: 173-75).

A further review of the many tasks assigned to the question by the classroom teacher also illustrates its centrality to the teaching-learning process. Questions are utilized to arouse interest, to provoke thought, to guide thinking, to stimulate creativity, to direct research, to assess background information, to review, to clarify, to relate detail, to draw conclusions and generalizations, to support findings, to probe beliefs and values, to diagnose pupil difficulties, to determine grades, and to measure teaching effectiveness.

An assessment of the levels and functions reveals many types of questions which should be tapped to ensure variety in cognitive operations and purpose.

Instruction in Question-Asking Practices

The author (6) recently conducted a study to determine if behavioral change in questioning techniques could be effected through programmed materials designed for independent study by the teacher. The instrument—entitled *Self-Instruction in the Art of Questioning*—overtly involved teachers in responding to examples of social studies questions and excerpts of classroom dialogue and in reacting to guidelines for composing good questions and eliminating poor ones. The text was structured around a simple hierarchy of four levels of questions—reproduction, translation, reflection, and valuation.

The first two categories—convergent in nature—checked factual recall and recognition, or the "reproduction" of information, and the "translation" of original meaning into another form:

When did Columbus discover America? (recall)

Farmers in northeastern Maine grow large quantities of

a. Potatoes
b. Wheat
c. Corn. (recognition)

Prepare a timeline for the Valley Civilizations listing major events and eras between 3000 B.C. and 500 B.C. (translation)

The more divergent "reflection" and "valuation" questions produced answers beyond the information given in the form of analysis, synthesis, application, hypothesis, prediction, and generalization, as well as those dealing with matters of rating, value, and judgment:

The Navaho Indians need additional water to improve agriculture on the reservations. De-

scribe as many ways as you can by which water might be supplied. (reflection)

What do the facts relating to the environment of the Navaho Indians indicate about their ways of making a living? (reflection)

Why is life for Egyptians today better or worse than it was for ancient Egyptians? (valuation)

Figure 2 describes the categories of questioning presented in the programmed text in more detail.

Categories of Questions	Convergent Questions		Divergent Questions	
	Reproduction	Translation	Reflection	Valuation
Characteristics of answers	Predictable One right answer Closed answers	Predictable Few acceptable answers Closed answers	Less predictable Many correct answers More open-ended	Unpredictable No "definably" correct answer Controversial Open-ended
Cognitive processes	Recognize Recall Cite Quote Recount Review Name List Define Recapitulate Retrieve	Translate Interpret Illustrate Rephrase Restate Outline Summarize Explain in own words	Generalize Discover Extrapolate Apply Predict Analyze Hypothesize Theorize Synthesize Compare Contrast Show relations Infer Conjecture Create Deduce Solve Conclude	Judge Weigh Appraise Criticize Value Rate Evaluate Defend State preference Make decision for or against Note: All of above with **reasons why**

Figure 2. Categories of Questioning

An examination of 3,289 oral and written questions drawn from the pre- and post-instruction periods for the participating teachers indicated that self-instruction, that is, study without the intercession of a live instructor, resulted in increased numbers of questions drawn from higher cognitive levels. Pre-instruction oral and written questions were dominated by reproduction and translation questions (89.1 percent); the convergent-type questions continued to dominate, but to a lesser degree, in the post-instruction period (73.4 percent).

After studying the same questioning book, a group of social studies methods students planned question sequences and made presentations to peers who, in turn, contributed "instructional" criticism from a playback of the taped lessons. Although the independent study by the original group was effective, the reinforcement provided by discussing tapes with others resulted in more substantial gains toward divergency.

Recommendations

In view of findings which show an imbalance in favor of the reproduction-type question, it can be inferred that most teachers would benefit from an instructional program designed to improve their questioning strategies. Therefore, the following are recommendations directed to those responsible for preservice and in-service instruction of teachers:

1. Teachers should be acquainted with a means of classifying questions, by either levels or functions, to ensure that higher cognitive powers are tapped through oral and written questioning procedures. Teachers may profit from devising their own questioning models, similar to a technique developed by Schreiber (18), or may utilize classification systems such as those reviewed in Figures 1 and 2.

2. Varied means of developing and encouraging effective questioning practices among teachers should be communicated in the context of question-answer responses on audio tapes, video tapes, and films and through demonstrations, micro-teaching, and actual classroom experience. A study of suggested questions in teachers' manuals also provides a basis for instruction.

3. Since questions are a key tool utilized by teachers in most aspects of the curriculum, instruction in questioning should cut across all subject matter areas.

4. Variety is the spice of good questioning techniques. Teachers should be instructed

to search for a balance of factual and "give-it-back" questions with thought-provoking reasoning questions, as well as snappy rapid-fire questions interspersed with those that elicit sustained responses.

5. Teachers should learn to be comfortable with "reflection" silence, that is, throw out the question, pause, and call for responses after several volunteer.

6. Teachers should develop a proficiency in utilizing "crossfire" discussion techniques by referring questions and answers to others: "What do you think?" "Why do you think so?" "How would you have answered that?" "How can you prove that?" "What is your opinion of that answer?"

7. Teachers should give attention to phrasing concise questions and eliminating the practice of repeating questions and answers, a time-consuming habit which encourages bad listening habits and limited interaction.

8. Teachers should recognize the importance of planning pivotal questions—those which raise thinking above the factual recall level and direct it toward overarching principles and understandings.

9. For reinforcement of concepts and continued growth, instruction in questioning should be scheduled at regular intervals.

According to Campion (3: 49), the right question adroitly wielded at the right time magically unlocks the floodgates of communication and thought. With the mounting evidence that intelligence can be created, perhaps we need to direct more attention to the relation of IQ to TQ (teacher's questions).

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