EXAMPLE OF A THEORETICAL FRAMEWORK

Title:
Efficacy of Explicit, Implicit and Schema Type Questions on the Retention of Social Studies Material Among Malaysian Students of Different Ability Levels

Purpose of the Study:
The purpose of this investigation was to examine the effects of three types of adjunct postquestions; text-explicit (factual), text-implicit (text based inferences) and schema-based (beyond text inferences) questions on learners’ processing of and learning of social studies text materials. Subjects selected for the study were high, middle and low ability Malaysian students from three secondary schools.

THEORETICAL EXPLANATIONS FOR THR EFFECTIVENESS OF ADJUNCT POSTQUESTIONS

Reviewing the literature on the facilitative effects of oral questions on learning, Dillon (1982) expressed dismay at the “lack of theory and conceptual explanation on the effects of teachers’ oral questions on students’ thought processes and achievement” (p. 154). However, in relation to written adjunct questions, the situation is somewhat less disappointing. Accompanying the large body of empirical investigations into the facilitative effects of written adjunct questions, a few researchers have been actively involved in developing theoretical explanations for their findings.

(a) The Mathemagenic Hypothesis

An early explanation for the effects of adjunct questions in facilitating recall of information (Anderson and Biddle, 1975; Faw and Waller, 1976; Duchastel, 1983) was given by
Rothkopf (1966) in the form of the Mathemagenic Hypothesis. “Mathemagenic” was coined by Rothkopf to mean those activities that “give birth to learning,” i.e. those kinds of actions or “inspection” behaviors executed by the learner while reading a piece of text that lead to the achievement of specified instructional objectives. Rothkopf’s main contention was that these mathemagenic activities could be “brought under control by test-like events such as questions which occur in conjunction with reading materials” (ibid. p.325).

According to Rothkopf, questions are posited to modify mathemagenic activities in two ways: by directing intent and directing search. When a question is inserted after a segment of text, the learner, being unable to anticipate what will be asked, will have to study the entire segment. If the question is answered satisfactorily then the next segment of text will be read using similar processing activities. In other words, questions inserted after a portion of the “cue or elicit previously learned reading skills appropriate to the requirements of the task” (Frase, 1968, p.181). but if the learner is not able to provide a satisfactory answer to the question, then the relevant mathemagenic activities will have to be modified in accordance with task demands.

Questions are hypothesized to exert a “backward” effect by encouraging learners to rehearse and review only the information in the reader’s memory that pertains to the question-answering skills for specific types of questions, and these practiced skills give subjects an advantage in answering identical and similar questions in the past test (McGraw and Groteleuschen, 1972). Questions also exert a “forward” influence by optimizing mathemagenic behaviors (Frase, 1967) and establishing a certain learning set or strategy that is applied to subsequent reading (McConkie, 1973; Mayer, 1975).

However, Rothkopf stresses that the critical factors in prose learning are not so much the adjunct questions per se but not to much the or processing strategies that are instantiated during reading. So questions merely serve to confirm or disconfirm the usefulness of previously employed mathemagenic activities. But Moeser (1978) notes that what precisely these mathemagenic strategies constitute has never been clearly determined.

Rickards (1979) agrees with Moeser that the term mathemagenic is too “amorphous”, and inadequately explains hoe different types of questions (as specified by the taxonomies of

(b) The Directed Attention Model

The Directed Attention Model proposed by Andre (1979) was an attempt to explain how different types of questions affect prose learning. Some of the earlier studies on adjunct questions (Rothkopf and Bisbiscos,1967; Allen,1970; watts and Anderson,1973; had reported that the experimental group provided with “higher-order” questions recalled more information than the group with “low-order” questions. Andre attributes this to the “directed attention effect” where

One effect of higher-level adjunct questions is to direct student to attend to more of the material and thus, to recall information directly related to the information needed to answer the questions” (Andre,1979,p.287).

“Attention” according to the Directed Attention Model is the processing of information to form a “unified mental structure that combine the elements attended to” (p.289). Higher-order questions encourage learners to attend and semantically encode more information and thus facilitate the recall of more information. But this effect, according to the model will be at its maximum only is the learner sees his or her task as one of “principle of least effort.” In other words, the learner has only a “finite amount of processing capacity and thus is using only a few strategies” (p.293) as specified by the question. Hence, higher order questions will be most effective in enhancing recall especially among low ability and less mature learners.

However, if the learner perceives his or her task to be one of learning as much as possible from the material (as the case would be with high ability and mature learners), then higher order questions may not make a difference i.e. the directed attention effect will not operate. Since, higher ability and mature learners tend to process all sorts of information using multiple strategies, the attempt by higher order questions to facilitate comprehension is greatly reduced.

Basically, the Directed Attention Model postulates that different types of question when inserted in text, cue learners to adopt different strategies when encoding information.
Andre illustrates this with a story about four men (Ed, Sam, Bill and John) who are different ages and have different occupations. A question like ‘What are the occupations of the men in the story?’ (a factual question) would prompt a learning strategy in which “occupations” is the cue for selecting and encoding information (see Figure 1).

**Figure 1: Memory Representation Generated by the Question**

“What were the occupations of the men in the story?”

**Figure 2: Memory Representation Generated by the Question**

“Which man is too old for his job?”
But, if the question were to be ‘Which man is too old for his job?’ (an evaluative question), the learner uses “story characteristics” as a cue to select and encode information (see Figure 2). In this latter encoding the retrieval cue “story characteristics” involves facts such as names of the men, their occupations and ages i.e. more information is encoded. Thus, when asked specific information in a posttest such as ‘How old is Bill?’, the learner would be able to answer this question given the second encoding but not the first.

Therefore, the effect of higher order questions is to direct the reader’s attention to more of the material in the text. Having to attend to more, the reader is able to recall more facts than those who have to answer lower order or factual level questions that focus on specific items only.

(c) The Elaboration Hypothesis

While accepting the view that higher order questions direct learners to more text information, Anderson and Reder (1979), present an alternative view in describing the facilitative role of such questions. They argue that “meaning is not simply processed as either all or none as dictated by the orienting task. Instead meaning is processed as a continuum of elaborations, and retention is determined by the number and type of elaborations performed on the information” (p.387). Elaboration is the process of adding to the information being learned. The addition could be a logical inference, an extension, an example or illustration, a detail or anything else that serves to connect information (Gagne, 1985).

The basic assumption of the Elaboration Hypothesis is that information is represented in long-term memory as a network of interconnected propositions (Anderson, 1967). As a learner encounters information, new propositions are added to this memory network that can vary in richness and redundancy. At the time of recall only a portion of these propositions will be active. But,

if a person’s memory of the item rested on the minimum propositions principle, poor memory would be the result. However, if the subject encoded multiple propositions that were partially redundant with the to-be-remembered
information, he or she would have a better chance of recalling it at time of test (Anderson and Reder, 1979, p.388).

For example, Palmer, Benton, Glover and Brunning (1983), found that learners who were required to make more elaborations of the main idea during study by encoding a greater number of subordinate sentences, recalled more of the main idea. Apparently, there is a relationship between the number of elaborations learners make about specific information during encoding and the subsequent memorability of that information. According to Palmer et al., “elaborations may be viewed as relevant propositions that provide multiple encoding of the to-be-remembered information” (p.105).

When processing text, identifying the connection among sentences is crucial. In connected discourse there is much left unstated as there is directly stated (Anderson and Reder, 1979). Therefore in comprehending prose material, learners make many connecting inferences. By making elaborations, inferences are generated that help connect what is explicitly stated in the text with the learner’s background experience. Kintsch (1979) argues that it is the type and amount of inferences made while reading that determines recall of information.

The elaboration perspective seems to lead itself very well to predicting the effects of adjunct questions on memory for prose. For example, subject asked inferential questions during reading recalled more text information compared to subjects given factual/verbatim questions (Frase, 1971; Friedman and Rickards, 1980; Wixson, 1983). It may be argued that inferential questions which required learners to “read between the lines” as well as “read beyond the lines” caused them to process passage material by relating it to their existing cognitive structure, hence resulting in a deeper level of processing than that produced by factual/verbatim questions.

Anderson and Reder (1979) further emphasize that learners vary in their ability at making elaborations while studying text material. Learners’ elaborative abilities are dependent on their real-world or background experience and ability to activate and link relevant schema or scripts with incoming information (Weinstein, 1978).
(d) The Difficulty of Decision Hypothesis

While agreeing that elaboration is important in determining recall, John-Laird and Bethel-Fox (1978) proposed a variant of the Elaboration Hypothesis. They reasoned that “the number of decisions about an item that yield pertinent information to the task at hand” (p.374) was equally important in determining recall of information. In their study, Johnson-Laird and Bethel-Fox (1978) and later supported by Ross (1981), found that the memorability of words was strongly affected by the number of decisions made about the word. In general, as the number of decisions increased, so did the recall of the to-be-remembered words.

The number of decisions concept was extended to complex and educationally relevant materials by Glover, Plake & Zimmer (1982), and Benton, Glover & Bruning (1983), and operationalized as the difficulty level of text. The difficulty of Decision Hypothesis was based on Glover et al., and Benton et al. ‘s, interpretation of the “distinctiveness of encoding” (Jacoby and Craik, 1979, p.3) concept.

The notion of distinctiveness differs slightly from the concept of elaboration in that, emphasis is on the contrastive value of one memory record as opposed to others. The memorability of verbal material is determined at least in part by the distinctiveness of encoding or the extent to which a particular event or piece of information is easily discriminable from “some background of commonality” (ibid. p.3).

For instance, the learner required to make difficult decisions at the time of encoding will have to initiate extensive processing of the information and

this more extensive analysis is reflected in a richer, more distinctive memory record of the event. The distinctive record, in turn is highly discriminable from other memory traces and retrieved with relative ease (Jacoby, Craik and Begg, 1979, p.596).

Auble and her associates (Auble and Franks, 1978; Auble, Franks & Soraci, 1979), for example, found that learners recalled more of such sentences than learners given less difficult or more comprehensible sentences. They concluded that “effort toward elaboration” was the major
variable affecting recall. In other words, as the effort to understand text information increases, so would the memorability of that information (Glover, Bruning & Plake, 1981).

But, it should be realized that distinctiveness is context-relative. “A description that is highly distinctive for a particular set of alternatives is not necessarily distinctive for other set” (Jacoby and Craik, 1979, p. 5). In other words, formation of a distinctive memorial record is relative to its background or the other events it has been contrasted with. It is likely that if drastic changes are made to the background events, the previously distinctive memorial event may not be distinctive in the modified context.

Extending the hypothesis to prose material, Glover, Plake and Zimmer (1981) found that subjects recalled significantly greater number of idea units from the materials that required difficult decisions than from materials that required easier decisions. Also, distinctiveness was shown to be dependent on context. For example, in the absence of cues (i.e. definitions made available to subjects during decision making) on which decisions may be eased, no differences were observed between items on either labeling or recall.

The Difficulty of Decision Hypothesis when applied to the adjunct questions are more difficult than lower order questions. Higher order questions have been shown to result in greater levels of factual recall than lower order questions (Frase, 1968; Allen, 1970; Rickards and DiVesta, 1974; Watts, 1973). The position than higher order questions are more difficult than lower order questions receives its support from the assumptions underlying the classifications of cognitive operations typified in the taxonomies of Bloom (1956), Guszak (1967), Barrett (1976), and Johnson and Pearson (1978) to name a few. For example, Bloom’s Taxonomy is assumed to represent levels of cognition that become successively more extensive and complex. If subjects can be successfully oriented to study material at both high and low taxonomic levels, then the resultant memory byproducts of the cognitive analyses should be more durable following high-rather than low level questions (Kunen, Cohen & Solman, 1981, p.204).

However, it should be acknowledge that while many studies have attempted to validate the psychological properties of Bloom’s taxonomy, the findings are still uncertain.