

RESEARCH INTO QUESTIONING STRATEGIES AND UNDERSTANDING TEXT

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Can the use of teacher led “why” questioning techniques improve student learning of texts in K-12 educational settings? Much of the educational reform movement seeks to deemphasize the centrality of the teacher in leading classroom discussions in favor of more ‘student-centered’ approaches (Bransford, Brown & Cocking, 1999, Hirsch 1996), but research in this line seems both appropriate and necessary. While orientations toward decentralization of teacher authority reflect an interpretation of constructivism that sees student activity and ownership of educational activities as key components in learning, it is important to note that teacher led questioning is quite compatible with all but the most extreme variants of constructivism. Moreover, such teacher-centered approaches may ultimately prove more practicable in that they require less wholesale change of teacher beliefs and practices than more centralized approaches.

The prominent role of teacher as mediator plays a vital part in the Vygotskyian sociocultural framework. According to this brand of constructivism, the teacher functions as an important middle person in students’ acquisition of new knowledge and skills. Even NeoPiagetians, modern proponents of the theories advanced by Piaget (generally characterized as advocating the most extreme of discovery constructivism) point to the potential inefficiency of pure discovery teasing out the role that the

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instructor can play in pushing development forward. While these strands of constructivism all deny that understandings can be imposed as such on students, they also realize that the timely presentation of educational stimuli in an organized manner can drive learning. Children still do the constructing, but teachers can provide the bricks and the model. From this perspective the proper use of questions may well allow teachers to be effective mediators in aiding students’ construction of knowledge and understanding.

The Role Adjunct Questions in Text Processing

Rothkopf et al (1967) showed that interspersing questions within written materials positively effected recall of facts among school aged children (10, 11, 12 graders) compared to treatment groups that saw no interspersed questions. This research spearheaded a strand of research that has consistently found positive effects of ‘adjunct questions’ on both recall of facts and generating deeper understanding of texts. The overall argument advanced by Rothkopf was that increased exposure to questions in the experimental conditions increased the likelihood that successful mnemonic behaviors are employed. The question of the proposed research can be interpreted as asking whether these results are

generalizable to teacher directed verbal questioning techniques.

Higher Order Teacher Questioning Research

There is surprisingly little current research on the impact of teacher directed questioning on student learning outcomes. This dearth of current research stands in marked contrast to the bloom of studies that the 1960s and 70s on the topic motivated in part by the taxonomic systems such as those put forth by Bloom and Kohlberg. Unfortunately, it seems much of that research lacked adequate control necessary to shed much light on the potential impact of such teacher led questioning techniques. The three major meta-analytic studies discussed below on the topic are contradictory and do little more than show that the extant data from the time period is inconclusive and in need of further investigation.

Winne's (1979) review of teachers' uses of 'higher cognitive questions' highlights many of the problems endemic to past studies of teacher use of questioning techniques. He reviewed 18 studies that sought to determine the differential effects of higher cognitive questions versus fact questions on student achievement. Fact questions were defined as questions that call for simple recall of material previously read or taught whereas higher cognitive questions were defined as asking students to mentally manipulate bits of information previously learned to create an answer.

Winne ultimately found that he "could offer no sturdy conclusion" about the relative effectiveness of higher cognitive questions due to a general lack of experimental rigor in the studies under review. Of the 18 studies under review, 11 failed to meet significant standards for internal validity. The most prominent problems included failure to document that teachers used questions in the manner prescribed by experimenters' operational definitions

of treatments and a general failure to define constructs, obscuring whether or not independent variables were equivalent.

Two such later reviews prompted by Winne came to findings contradictory to each other, but reached similar conclusions about the overall lack of experimental rigor. Redfield and Rousseau (1981) reexamined the 18 studies reviewed by Winne and one additional study (for a total of 19 studies under review) and found an effect size of .7292 for high cognitive questions as compared to low level fact questions. In contrast, Samson et al. (1987) reviewed a larger data set (that still included all of the studies from the Redfield and Rousseau study) and



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found a mean effect size of .26. Differences in effect sizes found reflect both the methodological differences of the respective reviewers and the somewhat different samples under review. While the studies offered starkly different measures of experi-

mental effect, it is noteworthy that both concluded that a majority of studies under review failed to meet standards for internal validity.

The lack of agreement on effect size and the generally held view that studies on the subject were largely invalid means that we must look to new, more tightly controlled investigations to resolve the issue. It should also be noted that this research was often concerned with the effects of higher order versus lower order questioning as opposed to questioning per se, and did not pay explicit attention to overall number and frequency of questioning. Insofar as they investigated the effects of the levels of questioning in classrooms, the studies reviewed are related to the generalizability of adjunct question use to teacher directed verbal settings, but the failure to investigate the effects of questions per se seems to be a significant gap that needs to be bridged.

Lab Studies Using Adjunct Prompting

While the extant studies on teacher questioning

fail to provide unequivocal conclusions on the use of higher order 'why' questions, two current parallel strands of research seem relevant: Pressley's work on elaborative interrogation and Chi's work on self-explanations. Both lines of work document the efficacy of interspersing prompts for elaboration which seem ostensibly equivalent to 'why' questions¹ among texts in promoting comprehension. When viewed in relation to the studies examined by Winne, Redfield & Rousseau, and Samson et al., these studies compare favorably in that they do investigate the effects of questions per se and are experimentally rigorous. Many of the treatments investigated however, involves written questions or instructions for students to self-question instead of verbal questioning prompts. When they do involve verbal prompts, it is always in a one-to-one experimenter to subject setting instead of a teacher to class setting. Hence, much of the goal of the current experiment to investigate whether such effects are generalizable to teacher directed questions in classroom settings.

Pressley's studies on interpretive elaboration were designed to test the theory that prompting self-generated elaborations might prove a more potent aid to learning than providing precise elaborations to learners (Pressley et al 1987). For these studies, students in the experimental condition are instructed to read factual statements and to immediately ask themselves "Why is that fact true?" while subjects in the control condition are instructed to merely read the factual statements repeatedly. This research has consistently found that elaborative interrogations have facilitated memory of facts presented in text for populations ranging from primary school students to

college students. Effects are large: ~1.07 for the studies summarized in Pressley et al. (1992) and between .40 and 1.44 (with a half of contrasts >1 SD) for the experiments in Woloshyn et al. (1994). Impressively, Woloshyn et al. included a 75-day and a 180-day recognition test, and showed that gains proved durable for 6 months (F= Effects 98.58). It was also found that the quality of answer given for 'why' questions generally did not affect memory for factual information (Woloshyn et al. 1994). Instead, it was the elaborative effect per se again, arguably the effect of questioning per se that caused the difference.



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In parallel to Pressley's work on the role that elaborations play in facilitating memory, Chi et al. (1994) demonstrated the facilitative effects of self-explanations on somewhat deeper learning from expository texts. In this study, students were provided with a passage about the human circulatory system taken from a popular school textbook. The experimental group was prompted in general terms to explain, after each sentence, what they knew about that sentence. If what they stated was vague, students were given an additional verbal prompt for clarification. Additionally, a set of specific function prompts was periodically employed after self-explanations. Unprompted control students were asked to read each sentence twice. The posttest included 4 different sets of questions to test both what was learned from the passage and students use of newly acquired knowledge in a transfer condition asking about health-related questions.

Chi et al. found that the prompted students' gains from pretest to posttest was significantly higher than the gains of the controls. The authors also found an

interactive effect in which the prompted group's relative gains on more difficult questions were even more impressive. An additional measure in this experiment examined the accuracy of students' mental models of the circulatory system and found that they were more improved for the prompted group. In accord with the findings of Woloshyn (1994), Chi et al found that effects were attributed to the explanation prompt per se, independently of students' prior knowledge or individual tendencies to explain.

An Argument for Frequency

While the studies reviewed above provide arguments that suggest that we might suspect an effect from a question qua prompt for explanation, there is a further argument that the frequency of questioning should be taken into account. Rickards and DiVesta (1974) investigated the effects of both frequency and type of questioning on college sophomores' processing of textual materials. Subjects were either given one question after every two paragraphs of text or given two questions after every four paragraphs of text. This arrangement maintained the same overall number of questions while varying the frequency of questioning events.

The authors found that inserting questions about the text aided recall significantly. Importantly, they found a strong frequency X question type interaction in which meaningful questions produced significantly more total recall than other types of questions when asked after every two paragraphs. When asked after every four paragraphs, however, meaningful questions were no more effective than irrelevant control questions. In sum, the data indicated that the effects of meaningful questions were only apparent when such questions were asked relatively frequently. The authors offered the explanation "that placing meaningful-learning questions relatively far apart may have overtaxed the subjects' processing capacity, that is,



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produced excessive ‘cognitive strain’..”

While the data from Rickards & DiVesta (1974) were collected from college sophomores, the studies on interpretive elaboration and self-explanation offer some oblique support for the prospect of generalization to students in grades K-12. The methods involved in these studies seem to have implicitly taken such frequency considerations into account: both interpretive elaborations and self-explanations are prompted after each individual sentence. Chi et al (1994) explicitly state “learning involves the integration of new knowledge with old knowledge,

and such integration is best carried out in a more minute and ongoing fashion.”

The above quote is but part of the authors' general claim that generating more self-explanations promotes greater learning, with the implication being that more prompts can promote more self-explanations.

All told, the laboratory studies

on interpretive interrogation and self-explanation and Rickards and DiVesta suggest that we should pay close attention to the frequency of the use of ‘why’ questions in the current design.

The Case for Investigating Teacher Led Questioning

The earlier research on teacher led questioning was largely inconclusive, due to lack of experimental rigor. It should be emphasized that an inconclusive group of studies is a far cry from a group of studies that show no effects. From a purely practical point of view, a more rigorous reinvestigation of the effects of effective teacher centered instructional techniques seems to hold much promise for the simple reason that many teachers have problems employing more radical decentralized techniques. Teacher led questioning, if proven effective, stands to be potentially more practicable in that it may allow teachers to be more effective without requiring the amount of change demanded from more decentralized techniques.

The studies above show evidence in strong support for the positive effects of prompts for explanation or elaboration in the recall and comprehension of information presented in texts. Moreover, they suggest that the frequency of such questioning might prove to be a major mediating factor for those effects. Because teacher led 'why' questioning could presumably mimic explanatory questions

interspersed within texts with the added potential for posing prompts for additional elaboration, ipso facto, there seems to be a strong case for more rigorous investigation of the extent to which teacher led 'why' questioning can generate effects similar to those found in the studies reviewed. The currently proposed project will contribute to the field by rigorously pursuing the answer to this important question.

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Footnotes

- ¹ Often, the prompts are explicitly worded as 'why' questions. In Pressley et al (1987), for example, all questions about presented facts are modeled on questions like, "Why did that particular man do that?" For Chi et al (1994), the prompt to explain what a sentence means could presumably be reformulated in many cases as a 'why' question.

