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ABSTRACT

The purpose of this study was to measure the influence of prior knowledge on reading comprehension. Twenty second-graders who were reading at, or not more than one year above, grade level were pretested to determine the extent of their prior knowledge about the topic they would be reading. Based on their pretest scores, the students were divided into two groups: one group had weak prior knowledge and the other had extensive prior knowledge of the topic. It was hypothesized that the group with more extensive prior knowledge would achieve better comprehension results. The study also investigated the possible influence of explicit and implicit questions on comprehension; half of the posttest questions were explicit and the others implicit. It was hypothesized that the implicit questions would be more difficult for both groups of students. Both hypotheses were substantiated. In addition, it was found that the ability to answer explicit questions did not differ significantly between the two groups of students, but those with greater prior knowledge were better at answering the implicit questions. (Author/MAI)

Effect of Background Knowledge

On

Silent Reading Comprehension

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Many factors such as memory, reasoning ability, facility with language, decoding ability, setting of purposes prior to reading, and background experience, have been postulated as influencing reading comprehension. This study was designed to investigate the effect of one of these factors, background experience, on reading comprehension. A second purpose of the study was to determine the relative difficulty of explicit (literal) and implicit (inferential) comprehension questions.

No definition of reading comprehension acceptable to specialists in the reading field appears to have been offered in the literature to date. However, attempts to determine the nature of reading have led to the formulation of various models, some of which stress skills, others which stress process.

Barrett (Clymer, 1968, p. 19) developed a skills taxonomy which divided reading comprehension into five major skill levels: a) literal comprehension, b) reorganization, c) inferential comprehension, d) evaluation, and e) appreciation. However, he acknowledged that these levels of comprehension interacted with a) the selection, b) the questions, and c) the reader's background. Barrett cautioned that his taxonomy could not take into account the background a reader brought to the comprehension task even though he emphasized that background, in many cases, could be the deciding factor affecting comprehension.

Bormuth (1968) contended that the skills which constitute reading comprehension correspond to language skills. In an attempt to propose a more adequate conceptualization of comprehension he presented a method for writing operational definitions for literal comprehension questions by performing transformations on sentences. He then suggested that it would be possible to write operational definitions for any type of comprehension question; the operational definition of an inferential question would need to account for information beyond that explicitly stated in the text.

The importance of background information has found its way into recent models of comprehension that focus on process rather than skills. In attempts to define the process of comprehension, more than one model has been hypothesized for the organization of the mind. Lindsay and Norman (1972) and Fredrickson (1975) hypothesize that the brain is organized into semantic networks that allow various concepts to be connected to one another by relational links, such as class inclusion (A belongs to class B), example (A is an example of B), attribute (A is an attribute of B), cause (A caused B to occur), etc. This type of model involves using prior knowledge, predictions, context, and task demands in combination with textual structure to determine the level of comprehension.

Thinking regarding the importance of experience to comprehension was quantified by Schank (1973) and Lehnert (1975) working in the area of artificial intelligence. Computers were able to answer only questions based on text because they lacked information to make even the simplest inferences based upon previous experience. Consequently, scripts were devised to serve as standardized, stereotyped memory units that contained information and expectations on any particular topic. For example, there could have been a restaurant script, a spider script, or a skiing script. Whenever experiential background was required for the comprehension of a story, the computer called up the appropriate script. Lehnert hypothesizes that people acquire similar scripts through reading and vicarious experiences and use them operationally in real life situations and cognitively as in comprehending stories. Scripts are dynamic, and various scripts are connected to, superimposed upon, and couched within other scripts.

Pearson and Nicholson (1976) believe that comprehension of any new material is facilitated when a person approaches what is written from what is already known. They found the script metaphor useful in constructing their framework for comprehension. They classified question/answer relations in terms of the source of the information utilized to derive the answer. They labelled textually explicit the type of comprehension that requires responses directly from the text. In order to more clearly define implicit comprehension, Pearson and Nicholson established two categories. They labelled textually implicit the type of comprehension that occurs when the answer to the question is expressed in the text, though is not directly accessible because some sort of inference is necessary for the response, however minor the inference might be. They labelled their final category scriptally implicit. In this category the relation between the question and response is related to the story but the only way a reader can generate a response is to access his or her previous knowledge. Such responses represent an integration of textual and scriptal data.

Tanner (1976) in an attempt to provide additional insight into the explicit/implicit aspects of comprehension tested whether fifth grade children were equally proficient in answering three types of questions: literal, inference, and script. Her results supported the following hierarchy of questions in descending order of difficulty: script, literal and inference. A close examination of Tanner's questions revealed, however, that her script questions did not follow her own definition; she stated that the script questions required the reader to relate previous experience to the text in order to answer the questions, but the vast majority of her script questions were not passage dependent and could be answered from script alone.

The present study was designed to investigate further the influence of prior knowledge on comprehension and to further investigate the hierarchical relationship between explicit and implicit questions. This study differs from previous studies in several ways. First, second grade children were used in the study in an effort to ascertain the relative influence of scripts on reading comprehension at primary grade levels. Second, children of equal reading ability were blocked on the basis of previous background information about the topic. Such blocking eliminated

reading ability as a factor influencing comprehension and allowed the focus to be on the amount of prior knowledge. Third, only two (rather than three) categories of questions were implemented. These were the textually explicit and scriptally implicit questions described earlier (Pearson and Nicholson, 1976). The scriptally implicit were written in a format that ensured both passage dependency and script dependency. Fourth, Bormuth's suggestion of applying operational definitions to both literal and inferential comprehension questions was employed in the formulation of the textually explicit as well as scriptally implicit questions.

It was hypothesized that students with a stronger script would score higher in reading comprehension than children with a weaker script. It was also hypothesized that implicit questions would be more difficult to answer than explicit questions, thus supporting Barrett's hierarchy of comprehension skills but not replicating Tanner's results. Further, the ability to answer explict and implicit questions would differ between the strong and weak script groups; the implicit questions would be even more difficult for the weak script group because inferences on the basis of prior knowledge would be required.

Method

Subjects

The subjects were second grade students who were reading approximately at or within one year above grade level. All had attained grade equivalent scores within a range of 2.5 - 3.7 on the Metropolitan Achievement Test, Form A, in September. Since standardized tests often yield frustration rather than instructional reading levels (Farr and Anastasiow, 1969), the September range was interpreted to be between grades 1.9 - 3.1. Assuming 8 months growth between September and the time of testing in May, the grade equivalent range of the students was deducted to be 2.7 - 3.9.

The students were selected from four classrooms, two classrooms in each of two schools in a middle class suburb of St. Paul, Minnesota. Twenty-five students were given a pretest on knowledge about spiders. Then the 10 with the highest and the 10 with the lowest scores were selected to participate in the experiment. The 10 lowest (the weak script group) received scores of 2 or 3 on the 8 pretest questions. The 10 highest (the strong script group) received scores of either 5, 6, or 7. The mean number of correct responses given by the group with the weak scripts was 2.7 (SD = .81); the mean number correct for the strong script group was 5.8 (SD=.63). This difference was significant, $t(18)=9.09$, $p < .001$. The difference between the two groups on the reading subtest of the Metropolitan Achievement Test was not significant. The mean for the weak script group was 3.13 and for the strong script group was 3.32, $t(18)=.909$, $p > .05$. It was therefore confirmed that the two groups, though different in amount of background information on spiders, were similar in reading ability. The difference between the two groups on I.Q. was also not significant. The mean I.Q. for the weak script group was 114.80 and for the strong script group was 120.40, $t(18)= -1.36$, $p > .05$.

Materials

A list of 8 pretest questions was prepared to assess the students' background knowledge of spiders. A basal reader selection on spiders (Fay, Ross, & LaPray, 1972) was rewritten to include additional information on spiders and a narrative line. The readability level of the revised selection was computed to be 2.8 by applying the Spache Readability Formula. The selection was typed on a primary typewriter. A list of 12 posttest questions (6 textually explicit and 6 scriptally implicit) was prepared. The explicit questions were written by applying the rote wh- operational definition proposed by Bormuth (1968). On the basis of some of Bormuth's criteria, a new question type was designed for the six scriptally implicit questions. Although the questions were passage dependent, they could not be answered on the basis of the text alone. Background experience was necessary in order to make the required inferences.

Procedure

The pretests were administered individually over a one-week period in April. Prior to administering the pretest questions the following directions were given to the students:

> I have eight questions to ask you. I'll ask you each question and you tell me the answer so I can write it down. Some of the questions are hard so just tell me what you think is correct. Some of them you may not know, so then tell me you don't know. The first question is:

The questions were then administered orally. One follow-up query was allowed per answer if the correctness of the answer was not clear. All of the oral responses were recorded verbatim and scored later. Responses were classified independently by each experimenter. There were no disagreements.

After a one week interval, the students read the actual selection. A small vacant room in each school was used to test the students individually. The following directions were given:

> Read this story to yourself. Read it just once. Read it carefully and don't hurry. If you meet some words you don't know, pronounce them to yourself as best you can and then go on. When you have finished reading, return the story to me. Then I'll ask you some questions about the story.

The 12 posttest questions were presented orally in an order that followed the story sequence; the 6 implicit and 6 explicit questions were interspersed. Again, responses were scored independently by each experimenter; there were no disagreements.

Results

The posttest results for the two prior knowledge groups and for both question types are reported in Table 1.

Insert Table 1 about here

The strong script group (M=7.50) performed significantly better than the weak script group (M=4.80) overall, $F(1,18)=8.40$, $p < .01$. Post hoc Scheffe contrasts indicated a significant difference between the groups on implicit questions, $F(1,18)=7.46$, $p < .025$, but not on explicit questions, $F(1,18)=1.87$, $p > .10$.

There was a significant within subjects main effect for question type, $F(1,18)=30.32$, $p < .01$ indicating that explicit questions (M=4.25) were easier than implicit questions (M=1.90). The prior knowledge by question type interaction was not significant, $F(1,18)=1.13$, $p > .05$.

As hypothesized, the strong script group outperformed the weak group. These findings support the hypothesis that information brought to the text by the reader facilitates comprehension of material read. Further, prior knowledge seems to be more helpful in drawing inferences between textual information and prior knowledge than in comprehending the explicit message in the text, even though explicit questions were easier for all students.

The correlation matrix, in Table 2, accents the findings from the analysis of variance. Both implicit question scores (r=.57, $p < .05$) and explicit question scores (r=.39, $p < .05$) were significantly correlated with pretest (prior knowledge) scores. A test of differences between correlations revealed no significant differences between these two correlations, i.e., pretest with explicit versus pretest with implicit, (z=-.67, $p > .05$). However, implicit and explicit question scores were not significantly correlated (r=.25, $p > .05$).

Insert Table 2 about here

Even though the ranges of I.Q. scores and standardized reading scores were purposely narrow, some interesting correlations resulted. I.Q. correlated significantly with implicit scores (r=.46, $p < .05$), but not with explicit scores (r=.12, $p > .05$). However, reading scores correlated significantly and about equally with implicit (r=.39) and explicit scores (r=.40). Not surprisingly, I.Q. was also significantly correlated with pretest scores (r=.39, $p < .05$).

Discussion

The findings in the present study support the intuitively sensible, but largely unsubstantiated, contention that the background experiences readers bring to a selection affect the depth to which they can understand it. The finding of a main effect for prior knowledge and the lack of an interaction between prior knowledge and question type suggest that the effect of prior knowledge is comparable for both explicit and implicit questions. However, post hoc Scheffe tests indicate that the effect of prior knowledge is more pronounced for implicit (requiring an integration of textual and scriptal information) than for explicit questions. The correlations among these variables support such an interpretation.

In terms of schema theory, the findings support the notion of comprehension as a process of integrating novel information into pre-existing schemata. First, if the schemata are weakly developed (e.g., weak script group) comprehension requiring integration of new and known information (implicit questions) is difficult. Second, comprehension of totally new information (explicit) is slightly, but not significantly facilitated when schemata are strong.

These results suggest two possible implications for teaching. First, to ensure more thorough comprehension, teachers could spend time developing students' background information on a topic. An adequate store of knowledge which can be drawn upon during the reading situation and in response to questions should first be established. Second, scriptally implicit (inferential) questions appear to be more difficult than explicit (literal) questions. Students in general appear to require much guidance in their ability to draw inferences. Because the inference questions used required the extra cognitive dimension of relating a portion of the text to previous knowledge, they involved more complex processing of information. Even with an adequate background of experience (strong script), the implicit questions presented more difficulties to the children than the explicit questions. The suggestion of teacher guidance for such questions, both for specific content and in general, seems reasonable. However, both of these suggestions are empirically resolvable issues and deserve to be answered through experimentation rather than speculation.

Table 1

Mean Number of Correct Responses on Posttest

	Question Types		
Prior Knowledge	Explicit	Implicit	Total
Groups,			
Strong Script	4.70 (1.16)[a]	2.80 (1.62)	7.50 (1.80)
Weak Script	3.80 (1.69)	1.00 (1.05)	4.80 (2.30
Total	4.25 (1.48	1.90 (1.02)	—

[a]numbers in parentheses are standard deviations

Table 2

Correlations Among All Variables

	Total Pre	Total Exp	Total Imp	Total Post	I.Q.	Reading
Total Pre	1.00	.40*	.57**	.61**	.39*	.23
Total Exp	-	1.00	.25	.77**	.12	.40*
Total Imp	-	-	1.00	.81**	.47*	.39*
Total Post	-	-	-	1.00	.38*	.50*
I.Q.	-	-	-	-	1.00	.15
Reading	-	-	-	-	-	1.00

* $p < .05$

** $p < .01$

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