A Comparison of the Effects of Student-Generated Versus Instructor-Generated Questions on the Comprehension of Written Material

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Twelve college students volunteered to participate in a special section of an introductory psychology course at Western Michigan University. A multiple baseline design across groups was used to assess differences in reading comprehension between students who received study objectives written by the instructor and students trained to write their own study objectives. Quizzes and examinations were used to assess students' reading comprehension of course materials. A comparison of pre- and post-test scores on the Nelson-Denny Reading Comprehension Test was used to determine whether students had acquired skills which aided their comprehension of other materials. Results indicated no statistically significant differences between groups on quizzes, examinations or on the pre/post-test measures. However, students scoring below the 50th percentile on the comprehension pre-test showed significant gains on the post-test, $t(7) = -5.801, p < .05$, suggesting acquisition of general reading comprehension skills.
ACKNOWLEDGEMENTS

Many thanks to my advisor, R. Wayne Fuqua, Ph.D. for all the support and guidance he has given. A special thank you to Dr. Richard Malott for his support while Dr. Fuqua was on sabbatical and to Dr. Chris Koronakos, my husband and children for their help.

Helen Diann Pratt
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A COMPARISON OF THE EFFECTS OF STUDENT-GENERATED VERSUS INSTRUCTOR-GENERATED QUESTIONS ON THE COMPREHENSION OF WRITTEN MATERIAL

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CHAPTER I

INTRODUCTION

Student attrition has become a major problem for colleges and universities. Many students drop out of school because they are unable to maintain adequate grade point averages. The national average of students who do not return to school because of poor grades during the first year of college is 33% (Office of Institutional Research, 1980). As presently understood, academic ability is a composite of discrete skills, most of which are teachable (Devine, 1981). Educational psychologists, reading specialists and behavioral psychologists have developed teaching programs and adjunct study aids to help students acquire such skills.

Comprehension of written course materials is a logical prerequisite to successful academic performance in most schools. There is some disagreement on the definition and assessment of reading comprehension. Levin (1973) states that "comprehension involves complex organizational strategies on the part of the reader, through which he detects meaning and interrelationships of the substantive material within the passage" (p. 19). Another reading specialist suggests that "comprehension has two distinct aspects: the identification of words comprising the message and the 'organization' of these words into patterns or units" (Oakan, Wierner, & Cromer, 1973, p. 73). Gibson and Levin (1975) state that "We comprehend the meaning of a word, the meaning of a sentence, or the meaning of a passage of discourse when
we apprehend the intention of the writer and succeed in relating his meaning to the larger context of our own system of knowledge" (p. 400). Devine (1981) contended that this could never fully be done; no one but the author can accurately know what the author meant when the passage was written, therefore, he says, comprehension is a guessing game. Perhaps the most operational definition of reading comprehension is the ability of a person to read a passage and provide correct written answers to related questions over that passage (Oakan, Wiener, & Cromer, 1973; Semb, Hopkins, & Hursh, 1973) and will be adopted as a definition of reading comprehension for the purposes of this study.

Previous Research

A review of the literature suggests that several component skills are necessary to improve reading comprehension. The most common ones are:


2. The generation of questions from those points (Devine, 1981; Greiner & Karoly, 1976; Sappington et al., 1980).

3. The generation of correct responses to questions based on those critical points (Devine, 1981; Greiner & Karoly, 1976; Rothkopf & Billington, 1974; Sappington et al., 1980; Singer & Dolan, 1982).

4. The anticipation of which of those questions will appear on quizzes and/or examinations (Robinson, 1970; Sappington et al., 1980).

A number of techniques, referred to as adjunct aids, have been evaluated for their effects on reading comprehension. Study objectives and study questions are frequently used to improve reading comprehension and usually consist of questions based on textual materials. Study questions are typically presented in one of two arrangements: providing students with study questions generated by the instructor or teaching students to generate their own study questions. Rickards and Denner (1978) concluded that the area of question generation, instructor-generated or student-generated, holds great promise as a means of helping students derive instructionally relevant meaning from written materials. There is some controversy about which presentation format produces the greater impact on comprehension.

Much of the literature on study questions relies on measures of academic performance instead of formal measures of reading comprehension. Since such measures are closely related to operational definitions of reading comprehension, that literature is relevant to reading comprehension.

The facilitative effects of instructor-generated questions on student test performance is widely supported in the literature (e.g., Friedman & Rickards, 1981; Jenkins & Neisworth, 1973; Johnson & Ruskín, 1977; Miles, Kibler, & Pettigrew, 1967; Rickards & DiVesta, 1974; Rothkopf & Bisbicos, 1967; Watts & Anderson, 1971). Semb, Hopkins and Hursh (1973), for example, studied the effects of instructor-generated study questions and contingent grades on academic performance. The difficulty of questions was matched for each quiz and
examination; questions were randomly distributed over tests. The results supported the use of study questions. Students showed a substantial increase in test performance on test items covered in study objectives when compared with test items not covered in those objectives. Similar benefits of study questions were attained when course grades were made contingent on test performance and when course grades were delivered in a non-contingent fashion. Additionally, similar increases in test performance were attained using study objectives for which the instructor supplied the answer and objectives left unanswered. As expected, grade contingencies were important to improved academic performance. Ninety-two percent of the students performed better on quizzes during the grade-contingent phases, 4% remained at baseline levels, and 4% did slightly better. The results of this study and several others suggest that the addition of instructor-generated study questions can statistically improve quiz scores.

When students are required to read a passage and then generate relevant questions over that material, the process is labeled student question generation. The effectiveness of this second method of question generation in improving academic performance is also supported in the literature. Student question generation may also teach the previously desired skills posited to improve reading comprehension and academic performance (Devine, 1981; Karlin, 1969; Mayfield, 1977; McPhail, 1977; Rauch & Fillenworth, 1980; Rickards & Denner, 1978; Rickards & Hatcher, 1978; Robinson, 1970; Sappington et al., 1980; Swenson & Kulhavy, 1974).

Frase and Schwartz (1975), for example, explored the effects of
question production and answering in the recall of written material. In Experiment 1, students were divided into pairs with one of each pair being told to ask questions over the reading assignment while the other student answered questions. They were not given instructions as to the type of questions to ask. Students who generated questions did not show significant differences in performance on quizzes from students who answered questions. Academic improvements were generally small. Experiment 2 was designed to see if the results obtained in Experiment 1 could be replicated when students studied alone as opposed to studying in pairs. The results suggested that engaging in question production whether individually or in tutorial pairs, facilitated better recall than just studying. Furthermore, recall was improved when students were required to write more study questions. The results of this study were limited by the small number of questions students were required to write over written materials and because recall was tested over verbatim questions only.

The literature on the effects of study questions on reading comprehension has several limitations. First, textual materials are often used which are unrelated to the content of the course in which subjects are enrolled. Even when course materials are used, grades have frequently been assigned on a credit/no credit basis; this further compromises students' motivation to comprehend the assigned readings. Students show improved quiz scores when grades are contingent on performance (Glover et al., 1980; Mayfield, 1977; Semb et al., 1973). Research on study questions has typically relied on study questions demanding rote memorization and verbatim answers, thus calling into
question the impact on conceptual learning. Finally, it is unclear whether study questions improve comprehension of only those textual materials for which questions are inserted or whether such training might have a more general effect on reading comprehension.

The present study compared the effects of student-generated and instructor-generated study questions on the reading comprehension and test performance of college students. Several dependent variables were measured including performance on tests covering the textual material in which study questions were inserted.
CHAPTER II

METHOD

Subjects and Setting

Twelve college students, one junior, one sophomore, and ten freshmen participated in the study. The subjects were enrolled in a three-credit-hour introductory psychology course at Western Michigan University in Kalamazoo, Michigan. They each volunteered to be in a special section of that course. Subjects included eight females, four males, of which one was Chinese American, two were Black Americans, and nine were Caucasian; the average age of the group was 18 years.

Materials

Course materials consisted of photocopies of text materials (Fulton, Schlinger, & Armstrong, 1983; Martin & Pear, 1983) and a textbook, *Three psychologies: Perspectives from Freud, Skinner, & Rogers* (Nye, 1981), Forms E and F of the Nelson-Denny Reading Comprehension Test, test booklets, answer keys and sheets, a pool of instructor-generated questions with answer keys and a pool of quiz and examination questions. Instructor-generated questions were given to students prior to reading the materials; the page, paragraph and line where answers for each question could be found were included within each set of objectives.
Intergrader Agreement

An independent observer selected 20% of the quizzes from each unit and regraded them. Reliability was computed by dividing agreements on the grading of each quiz answer by disagreements plus agreements; the result was multiplied by 100. The mean intergrader agreement averaged across quizzes and students was 91%.

Procedure

Students were given the Nelson-Denny Reading Comprehension Test as a pre-test measure. Based on their percentile ranking on that test, students were divided into matched pairs. One member of each pair was assigned to the student-generated objectives group and the other was assigned to the instructor-generated objectives group. The student-generated objectives group was further divided into two groups with three members of the original six labeled as Group 1 and the remaining three labeled as Group 2. The instructor-generated objectives group was also divided into two sub-groups. Three students were assigned to Group 3 and the last three were assigned to Group 4.

Students in Groups 1 and 2 (student-generated) were required to write their own study questions and answers. They were required to write an equal number of verbatim and conceptual questions as the instructor wrote. Students were trained to write study objectives. Training consisted of giving each student a sample passage to read. Two examples of study objectives were provided. This was done for
both conceptual and verbatim questions. Each student had to write a similar objective. This process was repeated, using novel textual material, until students could consistently write study objectives that were similar to those provided by the instructor. Students were given general instructions on how to write study questions from a passage of text. Two class periods were required to train all students. During the experimental phases, these students also received instructions as to the number of verbatim and conceptual questions to write but were not told at what points in the text to write those questions. Students in the instructor-generated groups were not given any special training but were given study objectives which included the page and paragraph where appropriate answers for each question could be located.

Students were required to attend class to obtain study materials. During experimental phases, they were required to remain in class until they answered or had written and answered their study questions. Students were allowed to study with each other, or as partners, within their respective assigned groups. They were asked not to share answers or discuss course materials outside of their assigned groups, except during general class discussions.

Study materials were given out on Wednesdays and Fridays. Quizzes were given on Mondays, unless class was not scheduled. Students were allowed to take study materials home at the end of each class period providing they had completed their objectives and/or read the materials. Students received points for turning in their objectives on time. They received half-credit for late assignments. Copies of
completed objectives were given to the instructor at the end of each class period during experimental phases. The objectives were checked to insure that students were providing accurate answers to instructor-generated objectives and to assess whether students in the student-generated groups continued to provide correct numbers and examples of verbatim and conceptual questions.

The distribution of weekly quiz questions over course materials was as follows for both groups. Three questions were drawn from the instructor-generated study objectives; three were drawn from the study objectives generated by students; three were drawn from material which was not covered in study objectives. One question was always a review question over previously tested materials.

A mid-term and final examination were administered to meet University requirements. Each examination consisted of 20 questions, 8 of which were review questions from previous quizzes based on instructor-generated questions. Eight were repeats from previous quizzes based on student-generated objectives; two were based on objectives not previously tested (one instructor-generated and one student-generated), and two were based on material not covered by previous objectives or tests. The mid-term examination covered material from the first half of the semester and the final examination covered material from the last half of the semester.

Experimental Design

A multiple baseline design across groups was used (see Figure 1). Students were matched based on their Nelson-Denny pre-test scores with
Figure 1. Experimental Design
one of each pair being assigned to either the student-generated or instructor-generated question condition. Students within these groups were randomly assigned to early and late intervention sub-groups to meet the demands for a staggered intervention in the multiple baseline design. This design was used because it allowed for replication of experimental effects with a small number of subjects. A control group was not used because the multiple baseline design contained baseline measures for comparing with academic measures after intervention.

Experimental Conditions

**Baseline**

Subjects were assigned reading material and took quizzes over course material without written objectives. They were allowed to ask questions over course materials prior to taking each quiz. Baseline lasted the first five units of course materials associated with quizzes for Groups 1 and 3 and seven units for Groups 2 and 4.

**Instructor-Generated Questions**

Students in Groups 3 and 4 were given instructor-generated objectives and required to provide written answers for each question in the space provided on the handout. This condition lasted four units of course materials associated with quizzes for Group 3 and three units for Group 4.
Student-Generated Questions

Students were required to write study questions and provide written answers to those questions on a separate sheet of paper. This condition lasted four units of course materials associated with quizzes for Group 1 and three units for Group 2.

No Objectives (Return to Baseline)

Students were told objectives were no longer required. This condition lasted three sessions for Groups 1 and 3 and two units of course materials associated with quizzes for Groups 2 and 4. This condition was conducted to assess whether or not there was any performance differences between groups that would be maintained after objectives were no longer required.
CHAPTER III

RESULTS

Students' quiz scores did not appear to be differentially affected across groups by the use of study objectives as shown in Figures 2 and 3. The mean quiz scores per phase for all groups increased with the introduction of study objectives. The increase in mean quiz scores for the two student-generated questions groups was 1.1 and 5.5 for Groups 1 and 2, respectively. The increases for the instructor-generated questions groups were 2.5 and 3.2 for Groups 3 and 4, respectively. The return to baseline had minor but variable effects ranging from a .64 point increase over the intervention phase for Group 2 to a 1.3 decrease for Group 1.

Comparisons of reading-comprehension pre-test and post-test scores yielded no statistically significant improvements between groups, \( t(10) = -0.021, p > .05 \). A comparison of pre- and post-test scores for the student-generated groups proved statistically non-significant, \( t(4) = 0.272, p > .05 \); a similar comparison for the instructor-generated groups proved non-significant, \( t(4) = -0.374, p > .05 \). However, there was a significant gain on the post-test for students who scored below the 50th percentile on the comprehension pre-test, \( t(7) = -5.801, p < .05 \), with a mean gain of 14 percentile points. The group of students who scored above the 50th percentile showed a mean loss of 7.5 percentile points on the post-test which was statistically non-significant, \( t(3) = 1.804, p > .05 \). Figure 4
Figure 2. Student-Generated Questions
Figure 3. Instructor-generated Questions
Figure 4. A Comparison of Comprehension Post-Test Percentile Gains as a Function of Pre-Test Percentile Ranking.
shows student gain scores on the post-test as a function of their pre-test percentile rankings.
Students showed little gain on quiz scores as a result of intervention. There were no statistically significant differences between the instructor-generated groups and the student-generated groups on quiz performance. There were also no statistically significant differences between groups on the pre/post-reading comprehension tests; however, there were significant gains on the post-test for those students who scored below the 50th percentile on the reading comprehension pre-test. These findings support Frase and Schwartz's (1975) conclusions that students who answer study questions generated by other students comprehend as much as students who generate their own study objectives but are not required to answer them. The present findings also support Rickards and Denner's (1978) conclusions in that poor comprehenders showed greater improvement from using adjunct aids than good comprehenders.

The lack of differences between groups on quizzes is in agreement with Frase and Schwartz (1975) who compared the effects of question production and answering on the comprehension of students and suggests that it makes no difference whether we provide students with study questions or teach them to generate their own. They will comprehend more than they would have without the aid of objectives.

The failure of study questions to produce statistically significant increases on quiz scores was surprising given prior reports by
Semb et al. (1973) and Rickards and Denner (1978). Several problems may have obscured any effects of study questions on quiz scores. First, quiz scores were high during baseline for some students, thus limiting the gains which could be observed. Second, there may be other factors, such as motivational differences and academic histories, which were more important to quiz scores than the behaviors affected by study questions. Third, there was never a real return to baseline condition; students did not stop writing objectives after the intervention phase ended. Some of the students in the instructor-generated objectives groups began to write their own study questions. Finally, the initial baseline may have been elevated since students read in class. If study questions affect academic performance by increasing contact with course materials, one would expect study objectives to produce little if any increase in academic performance of students who were already reading during baseline for other reasons.

Future research should assess changes in the amount of studying as a result of using study objectives. Nevertheless, all groups showed some gains as a result of the addition of study questions, suggesting that study objectives are a useful adjunct aid as other researchers have suggested.

The significant gains in percentile rankings on the reading comprehension tests by poor comprehenders suggest that those students may have acquired some study skills; however, it is unclear whether the gains were a result of this study or related to factors outside this Psychology course.

It might be beneficial if future research assessed the effects of
question generation on students with poor comprehension and poor grades and the relation to their comprehension skills. Secondly, the issue of how study questions help students increase academic skills should be resolved. Is the effect merely a result of increased reading of textual materials? Third, future researchers might ask what are some other study skills that might be useful in improving academic skills. Finally, the issue of maintenance and generalization of study skills should be addressed.
APPENDIX

CONSENT FORM

My name is Helen Pratt. I am a graduate student in the Psychology Department. As part of my thesis requirements, I am asking for your participation in a research project. I will be looking at your quizzes and exams and recording information from these papers. I need your permission to use this information; no names will be used.

The information, if used, will be written in my thesis in the form of numerical data, not names.

You will be asked to follow certain instructions which will serve to help you with your course work. You may withdraw from the study at any time without penalty to you. If you choose to participate, you will earn two bonus points at the end of the semester.

If you have any questions, please feel free to contact me. My home phone is 345-8764 or you may leave a message in the Psychology Office.

If you agree to participate, please sign this form with your name and Social Security number. For purposes of identification, I will use the last four digits of your Social Security number.

I, ____________________________ SS# ______________________ agree to participate in this study. I may withdraw at any time by writing Helen a note, dating it, and identifying myself with the last four digits of my Social Security number.

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