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**AIR FORCE**



**THE EFFECTS OF PACING AND MODE OF ADJUNCT  
QUESTIONS ON SHORT AND LONG TERM RETENTION  
OF WRITTEN MATERIALS**

By  
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**TECHNICAL TRAINING DIVISION  
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## SUMMARY

### Problem

Much of the current emphasis on improvement of instruction involves the careful analysis of training objectives and the restructuring of instructional materials to improve learning. Although this approach is effective, it requires considerable manpower and additional resources which in some cases are beyond the immediate capabilities of local training organizations. An alternate approach, where applicable, is to augment existing training materials with adjunct questions designed to promote more focused study and provide improved informational feedback to the student. This study was conducted to determine the effectiveness of this adjunct programming approach in learning a regularly taught ROTC subject, and to determine whether varying the format of the adjunct questions produced differential effects on learning and retention. More specifically, the purpose of this study was to: (1) investigate the effectiveness of adjunct questions, presented within the context of adjunct programming, in enhancing general retention of written materials, and (2) explore the differential effects of adjunct question mode (multiple choice versus constructed response) and adjunct question pacing (by the page versus by the chapter) on short and long term retention when reading time is held constant.

### Approach

The approach involved three major steps: (1) literature review, (2) development of adjunct program booklets, and (3) experimental evaluation.

*Literature review.* The literature review indicated that there have been two main categories of relevant research: (1) that dealing with the overall effectiveness of adjunct programming which consisted of adjunct questions with provisions for immediate feedback, and (2) that dealing with how adjunct questions influence reading behavior which in turn contributes to learning.

The review revealed that previous demonstrations of the usefulness of adjunct programming involved the use of mechanical or other specially constructed devices to provide immediate knowledge-of-results. The approach in the present study was to provide knowledge-of-results by simply printing the answer on the page immediately following the adjunct question.

The previous research, dealing with how adjunct questions influence reading behavior, has been typified by variations of adjunct question position, mode, pacing, etc., under carefully controlled laboratory conditions using short term retention tests. Students were allowed to read the materials only once, resulting in different lengths of time spent by experimental and control groups in studying the materials. The approach taken in this study was to control "time-to-study" in a realistic classroom environment, using both immediate and delayed retention measures.

As a result of the review of literature, the answers to the following questions were sought under the conditions of a realistic classroom environment, equal "time-to-study" and simple instructional feedback.

- (1) Do adjunct questions enhance general retention of written materials?
- (2) Do adjunct questions enhance relevant learning?
- (3) Do adjunct questions enhance incidental learning?
- (4) Does adjunct question mode or pacing affect retention?
- (5) Does adjunct question mode affect performance as a function of the question mode of the criterion test?
- (6) Are there differences in the effects of the above variables as a function of whether the test is immediate or delayed?

*Development of Adjunct Program Booklets.* Four (4) different adjunct program booklets were developed consisting of a comprehensive series of questions highlighting the major learning objectives in the text. Knowledge of results in the form of correct answers was provided on the page following each question. The 59 questions in each booklet covered the main points of an existing text used in a regularly taught ROTC subject. Two of the booklets contained multiple choice adjunct questions, while the other

two were made up of equivalent constructed response questions. In addition, two of the booklets presented questions after each page of text while the other two presented questions at the end of each chapter.

### **Experimental Evaluation**

Four experimental groups (with 29 subjects each) used one of the four adjunct program booklets while reading the basic text. A control group (n = 29) read the text without a booklet. All subjects were allowed 200 minutes to study the materials during normally scheduled classes. The 80-item criterion test consisted of five subtests. Four of the subtests varied in question mode (multiple choice versus constructed response) and question relevance (incidental versus relevant). Incidental questions were those which had not previously appeared as adjunct questions. Relevant questions were those which had been used as adjunct questions. The fifth subtest consisted of general items, designed to measure the ability of subjects to apply information learned from reading to practical situations. The total test was administered twice; one day after the last reading session and again 9 to 10 days later.

Data from the experimental evaluation were analysed separately for the short and long-term retention measures using total test scores, as well as various sub-test scores.

### **Results and Conclusions**

1. The adjunct programs in this study were an effective supplement to existing texts. The beneficial effects (as demonstrated by higher total test scores for those groups using the adjunct program booklets) held up under conditions of equal study time for control groups and the use of a simple printed knowledge-of-results approach, as opposed to a mechanical presentation device to provide instructional feedback.

2. The beneficial effects of adjunct questions were limited, in large part, to the learning of relevant materials or those materials to which a specific adjunct question had been addressed during learning.

3. There was no evidence that the adjunct questions enhanced incidental learning, under the conditions of this study.

4. There was an interaction effect between adjunct question mode and test question mode. Where the test performance required recall rather than recognition of relevant materials, constructed response adjunct questions appeared to be superior to multiple choice questions.

5. For the type of reading materials used in the present study, placement of adjunct questions at the end of the chapter was as effective as interspersing questions after each page.

6. The effects of adjunct questions remained relatively stable when measured by short and long term retention tests.

### **Implications**

1. Adjunct programs are effective in focusing attention on key points while reading, and should be considered for use to augment existing course materials.

2. Since adjunct programming does not require restructuring or re-designing basic learning materials, it is particularly suitable for enhancement of on-going courses where texts are already in existence.

3. The resources requirements and programming techniques, necessary to produce adjunct programs, are relatively simple and well within the capabilities of local training organizations.

4. Adjunct programs should include a comprehensive series of self-test questions to cover *all* materials which are to be retained. The process of identifying all major points in a text will also assist the instructor in clarifying to himself the learning objectives, which he desires the student to attain.

5. Adjunct programs appear particularly suitable for use by the student in self-study at home. This application should be investigated further.

## PREFACE

This study was performed in the Technical Training Division of the Air Force Human Resources Laboratory under Project 1121, Task 112101; Advanced Technology for Air Force Technical Training. Dr. M. R. Rockway was the project scientist.

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# THE EFFECTS OF PACING AND MODE OF ADJUNCT QUESTIONS ON SHORT AND LONG TERM RETENTION OF WRITTEN MATERIALS

## I. INTRODUCTION

In the late 1920's, Pressey (1926, 1927) first developed a simple mechanical device which administered and scored multiple choice questions automatically and also provided the student with immediate knowledge of results. He felt that this approach had the potential for not only relieving the teacher of the mundane task of scoring tests, but also for use as a self-instructional device which incorporated the basic "laws" of learning. His basic technique, consisting of the use of self-test or adjunct questions with immediate knowledge of results, is now commonly referred to as adjunct programming or adjunct autoinstruction (Briggs, 1968).

Although Pressey's concepts were demonstrated in a series of studies (Pressey, 1950), it was not until the now classic articles of Skinner (1954, 1958) that the "industrial revolution in education" envisioned by Pressey (1932) occurred. Skinner's articles precipitated a phenomenal surge in instructional technology in general, and in particular, the application of programmed instruction (PI) techniques in education and training. Briggs and Angell (1964) reported that there were almost 400 PI texts available in various subject areas in 1963. In 1970, an Air Force report (HAF-T34, 1970) listed over 700 PI texts as being available in the Air Force training environment alone.

In spite of the obvious impact of Skinner's concepts, they have not gone unchallenged, both from theoretical and practical viewpoints. Skinner's basic notions of very small steps, active response and immediate knowledge of results have generated much experimentation. Briggs and Angell (1964), Anderson (1967), and Gagne and Rohwer (1969) have summarized much of the research results. Pressey (1963, 1967) as well as others object to the fractionization of learning into small steps and advocate more meaningful groups of larger "frames" or segments of instruction. From a practical point of view, Pressey (1967) notes the expense and lack of efficiency of programmed instruction in certain applications and views adjunct autoinstruction as a worthwhile alternate.

A recent line of investigations precipitated by Rothkopf (1965) has added further support to Pressey's views on the effectiveness of using self-test or adjunct questions to enhance learning. Originating from his interest in the role of student responses in programmed instruction, Rothkopf (1963) became interested in how adjunct questions affect the inspection activities of the student while reading. On the basis of his research, Rothkopf has proposed that adjunct questions modify the student's mathemagenic activities, or those overt and covert activities of the student in the instructional setting that influence the amount learned. Mathemagenic activities may include observable behaviors beneficial to learning, such as asking questions and looking at the instructor, or it may include behaviors detrimental to learning such as yawning, daydreaming, etc. It may also involve covert activities that affect attentional or other mediating processes. These must be inferred from their effect on observable behavior. Adjunct questions or "test-like" events are considered by Rothkopf to be an environmental control which shapes a subject's mathemagenic behavior while reading, which manifests itself in modified reading behavior (Rothkopf, 1965, 1970, 1972).

Very much in consonance with Pressey's (1963) views, Rothkopf accepts instructional materials as given, within limits, and emphasis is placed on promoting those activities of the student which allow him to achieve specified objectives using available instructional materials. As Rothkopf points out: "The concept of mathemagenic activities tends to shift emphasis from investments of resources in the development of instructional materials to investment in the instructional environment. This is to a certain degree contrary to the current Zeitgeist which has been characterized by very careful design of instructional materials." (Rothkopf, 1970, p. 334.)

In addition to being of considerable theoretical interest in the understanding of the mediating processes involved in instruction, the potential of adjunct questions to enhance training has substantial practical implications. If this technique is adaptable to specified training situations using existing instructional materials, it provides a very attractive alternative to other techniques where emphasis is on restructuring of learning materials and the use of special presentation media such as programmed texts and audio visual devices.

Potential advantages of adjunct autoinstruction over programmed instruction may be summarized as follows:

1. It makes use of existing instructional materials and does not require major restructuring of subject matter.
2. It does not require that the author have extensive knowledge of instructional programming techniques.
3. It is less time consuming, both for the author in constructing the material and the student in completing the program.

### Background

*Description and Definition.* Adjunct autoinstruction or adjunct programming is basically a series of carefully sequenced "self-test" questions which are designed to elicit responses meeting stated instructional objectives. Although various formats have been used, the basic approach involves questions based on an existing text or training material, provisions for feedback, and provisions for remedial information if the initial response is incorrect. The approach normally requires that the learner: (1) read a portion of the study material, (2) answer a self-test item or series of items covering the main points of the material, (3) obtain knowledge of results regarding the correctness of the answer, (4) refer to the material (or receive the correct answer) when the initial response is incorrect, and (5) proceed to the next segment of instruction when he is able to answer all of the questions. Figure 1 depicts the adjunct autoinstruction model.

Siegel and Fischl (1966) in defining adjunct autoinstruction contrast it to conventional programmed instruction: "Adjunct autoinstruction is, as its name implies, self instruction as an adjunct to some primary teaching method. It is a form of programmed instruction in that it: (1) is self pacing, (2) keeps the learner active in the learning process, and (3) provides the learner with immediate feedback concerning his knowledge of the subject-matter. It differs from other forms of programmed instruction in that it is not intended to carry the full burden of teaching the lesson; rather, it follows the initial presentation of the lesson and treats only those parts of the lesson requiring clarification or emphasis."

*Relevant Literature.* Relevant literature pertaining to the use of adjunct questions may be generally categorized under two types: (1) that dealing with the overall effectiveness of adjunct autoinstruction as opposed to other methods, and (2) that in which the major emphasis has been the experimental manipulations of adjunct questions to determine their influence on retention. A third category of relevant literature described in this review is drawn from the area of programmed instruction.

*Effectiveness of Adjunct Autoinstruction.* The substantial number of studies, conducted by Pressey and his students, has provided data on the effectiveness of adjunct autoinstruction in teaching various college courses, using various mechanical devices and methods of providing knowledge of results. Much of this research conducted in the late 1940's is summarized by Pressey (1950).

Two earlier studies involved initial efforts in the use of mechanical devices in the classroom environment. Little (1934) conducted one of the first studies to demonstrate the effectiveness of using automatic scoring and self-testing devices in the classroom environment. The first two experimental groups used two separate types of machines. The "testing" machine automatically scored and provided the student with total score information. The "drill" machine allowed immediate knowledge of results on each question, and provided an opportunity for drill until all questions were correctly answered (retained method). A third group (control), used simple answer sheets which were graded by the instructor. For every two of 14 teaching units, 30 adjunct questions were provided. Analyses of the data revealed that the "drill" group performed better than the "test" group on both a 200 item multiple choice test and an essay examination, but that both experimental groups were better than the control group.

Peterson (1931) used a chemically treated card in conjunction with a felt pen with which the student responded. The changing color of the card, when touched by the wet felt, provided knowledge of results (blue correct, red incorrect). Adjunct questions were used as guides in reading a selected chapter in a psychology text book. The gain scores of experimental group using the chemical cards were, on the average, 2.4 to 3 times that of the control group. Additional studies conducted in the late 1940's and early 1950's investigated the use of self-test devices in a variety of applications such as teaching superior students (Briggs, 1949; Jensen, 1949), and teaching different subject matter such as Russian and English vocabulary

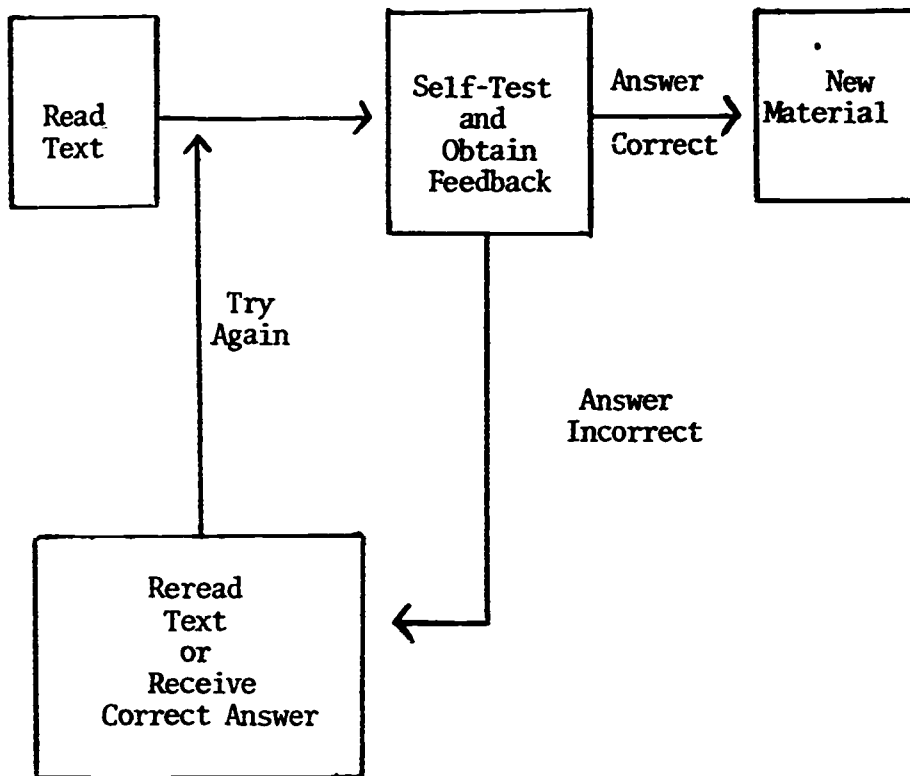


Figure 1. Adjunct programming paradigm.

(Stevens, 1953; Severin, 1955). In most applications, various procedures for providing knowledge of results (e.g., the punchboard or similar device) with self-test multiple choice questions were shown to be more effective when compared to control groups.

In a unique application, Meyer (1965) compared an adjunct self instructional program with conventional classroom instruction for refresher (review) training in aircraft weapons. Air Crews who were required to review this material periodically were used as subjects. Meyer had aircrew instructor personnel prepare a comprehensive list of multiple choice questions covering key points in an aircraft weapons manual. The questions, including a reference to the page and paragraph of the manual containing the correct answer, were printed in a self-study booklet. One group of subjects (control) received refresher training through conventional classroom instruction (1 hour, 13 minutes). The experimental group was instructed to work through the self-study booklet at least once on their own time during the 11 days scheduled for the experiment. Punchboards which provided feedback were used by the experimental group, and subjects referred to the text only if their initial response as recorded on the punchboard was incorrect. Using a 50 item multiple choice criterion test as a pre-treatment test and the same test in reverse numerical sequence as a post-treatment test, Meyer found that the experimental group obtained significantly higher gain scores than the control group, although the experimental group reported reviewing the materials on the average of 4 hours and 13 minutes. To determine whether the higher gain scores of the experimental group might be due to the disparity in time spent in studying, Meyer repeated the study holding the time factor constant. The control group was given 250 minutes of classroom instruction over 5 consecutive days. Based on data from the previous experiment, the control group was allotted 250 minutes for self study, using the booklets on their own. Under these conditions, the experimental group still scored significantly higher than the control group on the post-treatment criterion test.

In a follow-up study, Meyer (1966) compared four different student response mechanisms. Separate groups of Air Force pilots used: (1) chemically impregnated answer sheets; (2) erasable overlays; (3) machine presentation devices; and (4) the same punchboard used in the previous two experiments, in responding to multiple choice adjunct questions pertaining to a pilot's manual. He found no significant differences in gain scores and concluded that they were equally effective.

Siegel and Fischl (1966) investigated the usefulness of adjunct autoinstruction to teach various civil defense concepts to samples of male college students, housewives, and semi-skilled employed women. Two modes of presentation were used: (1) conventional reading material, and (2) pre-recorded tape which subjects heard through a telephone. Each of these modes had an experimental group (read or heard multiple choice adjunct questions after each lesson and received feedback from a chemically treated answer sheet) and a control group (received materials twice without adjunct questions). A 72 item multiple choice test was used as the criterion measure. Although the specific results were somewhat different among the three samples, those groups using adjunct autoinstructional materials under either mode of presentation performed better than the control groups. It was further found that adjunct autoinstruction was most effective for less familiar materials.

*Role of Adjunct Questions in Learning.* In contrast to the studies described in the previous section, recent investigators have become interested in the role of adjunct questions in affecting mediating processes in verbal learning. Rothkopf (1966) conducted a study to determine whether adjunct questions have a general facilitative effect (enhanced incidental learning) in addition to specific instructional effects, as demonstrated by such investigators as Hershberger (1965), and Hershberger and Terry (1965). Four experimental groups read a 5,000 word passage from Rachael Carson's *The Sea Around Us*, while answering constructed response adjunct questions which differed in location (before and after reading a section) and in whether knowledge of results was given. A fifth experimental group received all questions before reading the entire passage. The control group did not receive adjunct questions, but simply read the passage. All subjects were allowed only one reading. Two constructed response immediate retention tests were administered; one consisting of test items which were identical to those given as adjunct questions (relevant learning), and the other consisting of test questions not previously covered by adjunct questions (incidental learning). Results indicated that the placement of adjunct questions before or after the reading material produced significantly higher scores than the control group for the relevant test, but that only the group receiving questions after the written material did better on the general test. There were no differences related to whether knowledge of results was present or absent. He concluded that adjunct questions have general facilitative effects, when placed after segments of reading material. The fact that self-test questions

improved *incidental* learning is considered to be evidence that they shape effective inspection behavior while reading.

In the follow-on study, Rothkopf and Bisbicos (1967) substantiated the earlier findings in regard to the effects of constructed response adjunct question position on incidental learning (immediate retention) and provided further evidence of the differential effects of the types of adjunct questions used. Using a 9,000 word passage from the same book as in the previous study, they found that groups receiving questions after reading resulted in higher retention on incidental items, but that those receiving questions before reading did no better than the control group on either relevant or incidental items. They further found that certain types of adjunct questions such as those requiring a name or quantitative response (e.g., dates) had more influence on incidental learning than those common or non-technical word responses. The authors conclude that adjunct questions, or "test like" events, do not necessarily result in mathemagenic behaviors which are instructionally desirable.

Bruning (1968) added further evidence on the facilitative effects of adjunct questions covering a 1,500 word passage describing the characteristics of a fictitious African tribe. After each adjunct question, knowledge of results was provided. Using a 2 x 2 factorial design, he compared performance of multiple choice test-type (relevant versus incidental) and statement-type (relevant versus incidental) review item groups to a control group on a 26 item multiple choice criterion test administered immediately after reading. He found that experimental groups exposed to test-type review items did significantly better than either the statement-type review group or the control group. The relevant review group performed better than the incidental review group, but both performed better than the control group.

Bertou, Clasen, and Lambert (1972) compared the efficacy of adjunct questions (question mode not specified) with advanced organizers and post organizers in retention from a televised lecture, as well as, reading materials pertaining to atomic energy taught in a junior high school. Among the three approaches, only the adjunct questions facilitated learning as measured by a general test.

Watts and Anderson (1971) investigated three types of multiple choice adjunct questions differing in terms of the extent to which responses required application of a psychological principle, learned while reading, to a new situation. They found that the group exposed to application questions scored significantly higher on the multiple choice immediate retention criterion test for both relevant and incidental items.

Frase (1967) studied the effects of multiple choice adjunct question location (before or after), question pacing (after every 10, 20, or 40 lines), and knowledge of results (presence or absence) on the retention of information in a 2,000 word passage dealing with the life of William James. Criterion measures included question-specific and incidental-general immediate retention multiple choice tests. Results indicated that when measured by the question-specific test, questions placed after a moderate length (20 lines) passage, with knowledge of results, was most beneficial. For the incidental-general test, only the position of the question (after) was significantly related to immediate retention scores. Knowledge of results and question pacing were not significant, although a general trend was observed favoring longer passages between adjunct questions.

In another experiment using the previous reading materials, Frase (1968) varied question location, question pacing and question mode (multiple choice versus constructed response) and measured their effect on immediate retention of specific and incidental materials. He found, as did previous studies, that adjunct questions facilitated immediate retention more when they were placed after rather than before the passage and that they were more helpful in the retention of specific information than in the retention of incidental information. For adjunct questions placed after the passage, retention in general (combined scores including both relevant and incidental items) was better when questions were posed more frequently. Conversely, for those placed before the passage, retention was greatest with less frequent questions. For relevant information, retention was the same regardless of question pacing, but for incidental information retention was best with longer passages (50 lines) between adjunct questions. The implication appears to be that if incidental learning is sought (e.g., the adjunct items are merely representative of the type of information to be learned), less frequent adjunctive items may be desirable. The study results indicated no differences due to question mode, although Frase had predicted that the more difficult adjunct format (i.e., constructed response) would lead to higher retention. A plausible explanation given by Frase is that because of the nature of the question content, the two formats resulted in essentially equivalent difficulty items.



The investigations of Rothkopf and his colleagues and the formulation of the concept of mathemagenic behaviors (Rothkopf, 1965, 1970, 1972) have generated a great deal of research in replicating their findings using different stimulus materials, as well as in extending their findings by exploring various parameters influencing the effectiveness of adjunct questions. Included in this type of research are those pertaining to presentation of materials by different sense modalities; e.g., visual versus auditory, (Sanders, 1973; Rothkopf & Bloom, 1970), to various conceptual levels of questions (Allen, 1970; Watts & Anderson, 1971; Hiller & Denzel, 1973), to repetition of questions (Boyd, 1973), to individual differences (Berliner, Shavelson, Ravitch, & Loeding, 1973; Hollen, 1970), and to the effectiveness of adjunct questions under different incentive levels (Fraser, Patrick, & Schumer, 1970). Still others have compared approaches such as prompting (Keller & Cunningham, 1972) and declarative statements inserted in the text (Burning, 1968) as compared to adjunct questions.

In spite of the considerable research interest in Rothkopf's concepts of mathemagenic effects, his approach and findings have not been without their critics. Important to the demonstration of the positive mathemagenic effects of adjunct questions is their influence on incidental learning. Rothkopf's (1966) conclusions regarding the facilitating effects of adjunct questions in his original study were based on the use of multiple *t* tests between the experimental groups and the control group. Hopkins and Chadbourne (1967) questioned this approach and reanalyzed Rothkopf's data using the Newman-Keuls and Dunnett's test and found no significant differences, on incidental learning, even allowing for one-tail tests. Ladas (1973) has criticized the Rothkopf and Bisbicos (1967) study on the same grounds and provided rationale for the inappropriateness of the use of a one-tail test for their experiments.

Several studies have reported findings contradictory to those previously described regarding the positive effect of adjunct questions on incidental learning.

Wadsworth and Flagg (1971) described two studies in which elementary school subjects, who answered multiple choice adjunct questions after reading short segments dealing with Latin history, were compared to those who received no questions. Although there were significant differences in one study on relevant test items, there were no differences in the second study. In neither study were there any differences in incidental learning.

Swenson and Kulhavy (1973) investigated multiple choice adjunct question position (before or after) and question placement (after 1, 5, 10, or 20 paragraphs) on incidental and relevant learning of materials describing a fictitious tribe. Although the superiority of adjunct questions for the relevant learning was demonstrated, there were no significant differences in incidental learning.

In comparing prompting (underlining key phases) techniques and adjunct questions, Keller and Cunningham (1972) made the surprising finding that although adjunct question groups performed better on relevant test items, they in fact did worse on incidental items than the control group.

The studies cited above point out certain factors regarding the role of adjunct questions in learning from written materials. First, it appears quite clear that their use enhances learning when measured by total test scores and substantiates the earlier findings of Pressey (1950). Second, the position of the questions, before or after a reading passage, has differential effects on learning. While pre-questions appear only to effect relevant learning, post-questions, in addition to enhancing relevant learning, are the only ones shown to facilitate incidental learning.

These findings have been interpreted in terms of their role in modifying mathemagenic behaviors (Rothkopf, 1965, 1970, 1972) or attentional processes (Anderson, 1967, 1970). Pre-questions modify inspection behavior such that the reader searches for specific information within the written materials. Once found, attentional value is lessened. Thus, although specific information is retained, there is little or no incidental learning. Post-questions provide a general test-taking orientation applicable to reading of subsequent paragraphs. It serves not only as a specific review question, but also provides an anticipatory cue as to the type of material to look for in the following paragraph.

The effect of other aspects of adjunct questions is not as clear. Researchers have manipulated such variables as question pacing, question mode, question type, and knowledge of results to determine the effects on immediate retention (Rothkopf, 1966; Fraser, 1967, 1968). Rothkopf (1966) concluded that an adjunct question presented after approximately 1,000 words was optimal while Fraser (1967, 1968) found more frequent post-questions to be more effective in one study, but less effective in another. Swenson and

Kulhavy (1972) demonstrated that questions after five paragraphs (330 words) were superior to more or less frequent questions on long term retention. Pressey (1967) encourages questions after meaningful units of materials rather than after specific numbers of words or sentences and discusses the advantages of end-of-chapter questions.

The issue of question mode is equally unsettled. Frase (1968) hypothesized that constructed response adjunct questions would result in greater retention than multiple choice questions, but found no significant differences in immediate retention. However, he concluded that the nature of his items did not provide a fair test since they were essentially equal in difficulty (one word fill-in type). Skinner's (1958) requirement for constructed responses in programmed instruction has been tested with conflicting results. Evans, Glaser, and Homme (1962) found no differences in performance between overt (active response), covert ("thinking" the answer), and reading (answer filled in) modes. Wittrock (1963) found a significant interaction between response mode and mental age among children. Krumboltz and Weisman (1962) found no significant differences in immediate retention, but differences in favor of the overt response group on delayed recall. Williams (1963) compared constructed responses, multiple choice responses and a combination of the two with grammar school children. Results from a constructed response criterion test indicated a relationship between response mode during the course of learning and the use of the same mode as a criterion test. Tobias (1973) in his review of the response mode question in programmed instruction suggests that when the learning task is technical or difficult, constructed responses are superior to multiple choice responses. Holland and Kemp (1965) have offered the "black-out technique" to help explain the differences found in comparative studies of overt and covert response modes. The technique measures the extent to which the responses required in a program are dependent upon the content, and determines how much of the instructional material can be obliterated (lined-out) without affecting error rate. In comparing 12 studies of overt versus covert response modes, they demonstrated that the ones demonstrating superiority of overt responses were those which had the lowest "black-out ratio"; i.e., where the fewest obliterations could be made without affecting error rate. From the various studies cited above, it would appear the effectiveness of response mode is dependent on the learner characteristics, question difficulty, and the nature of the criterion measures.

Regarding criterion measures, Rothkopf, Frase, Bruning and others typically measured immediate retention only; i.e., experimental passages were read and criterion tests given immediately upon completion. More recent investigators have realized the utility of delayed retention measures in research involving adjunct questions. Natkin and Stahler (1969) varied subject "arousal" by manipulating the degree of pre-exposure to adjunct questions. They demonstrated rather dramatic differences in short and long term retention between various experimental groups. Swenson and Kulhavy (1973) showed that there was less of a loss in retention between immediate and long term criterion test scores for those groups exposed to medium length passages between adjunct questions rather than either short or long passages.

### Summary

There have been two broad categories of research in the use of adjunct questions in learning from written materials; that of Pressey and his students, and the work stimulated by Rothkopf's concept of mathemagenic behaviors. The research conducted by Pressey was characterized by: (1) experimentation in the classroom environment over a long period of time (e.g., semester), (2) use of self-test multiple choice questions as a test, as well as a teaching aid, and (3) use of an external or ancillary device to provide automatic testing, scoring, and immediate knowledge of results. Although little emphasis was placed on the nature of the role of the multiple choice questions themselves, Pressey established the usefulness of questions as an adjunct to normal classroom materials when used with various devices which provide knowledge of results.

Rothkopf and Frase and others have shown how adjunct questions influence the modification of mathemagenic behaviors, which in turn contribute to learning. Their research has been characterized by experimental manipulations of questions to determine their effects on verbal learning under carefully controlled short term laboratory conditions, using immediate retention tests.

Although much research has been done, there are still many unanswered issues. As Gagne and Rohwer (1969) point out: "More experimental studies are needed. The insertions of questions, or 'test-like events' into texts to be studied is a technique that suggests a variety of experimental problems which as yet are unexplored: kinds of questions, frequency of questions, amount of questioning."

## Statement of the Problem

The improvement of instruction for education and training is of continual interest to educators and psychologists. Much of the current emphasis is on the restructuring of instructional materials and presentation techniques to optimize learning. An alternate, and in many ways an equally attractive approach, is to explore means of enhancing learning by modifying learner behavior, with instructional materials as a given. This is particularly true of situations in which text books or reading materials are already in existence.

The overall usefulness of adjunct programming has been demonstrated by Pressey (1950), Meyer (1965), Siegel and Fischl (1966). However, their approaches involved the use of mechanical or other specially constructed devices (e.g., chemically treated paper) to provide immediate knowledge of results. Such devices require resources which are normally beyond the routine paper reproduction capabilities of a local level training organization. An alternative method is simply providing knowledge-of-results by printing the correct answer following a self-test or adjunct question. This approach is widely used in conventional programmed instruction, and was selected for this study to determine whether the principles of adjunct programming are still effective with this printed form of instructional feedback.

The criterion tests, typically used in adjunct programming studies, (Meyer, 1965, 1966; Siegel & Fischl, 1966) have measured what would be referred to as relevant (specific) learning. This is consistent with the current instructional systems development approach in which specific criterion objectives are established and then measured directly to assess learning. Rothkopf (1970) has advanced the notion of the positive mathemagenic effects of adjunct questions on *incidental* learning. Thus far, however, incidental learning has been demonstrated only under carefully controlled laboratory conditions. Should this phenomenon be shown in a realistic instructional environment using longer reading passages, it would represent a serendipitous benefit of adjunct programming which has not been previously advanced by its proponents.

One of the controlled variables in previous studies has been the number of exposures to stimulus materials. Almost without exception, subjects were limited to one reading. Predictably, researchers have found (e.g., Rothkopf, 1966; Meyers, 1965) that groups without adjunct questions finished reading in significantly shorter time than those using adjunct questions. Thus, as Tobias (1973) implies, the argument can be presented that the additional time spent studying by experimental groups might account for demonstrated differences in learning. The question then arises as to whether adjunct questions are still effective if "time-to-study" is held constant. Meyer (1965) has provided some data regarding this issue. However, his findings were dependent upon subjects' reports of time spent in study at home.

The unsettled issues of question pacing and question mode have implications within the context of adjunct programming. Previous researchers have manipulated question pacing in terms of the number of words or paragraphs between adjunct questions. If adjunct programming techniques are to be applied to existing texts, however, it would appear that presenting adjunct questions after each page or chapter (in a separate study guide) would require the least amount of alteration to the text.

In regard to the question mode issue, the data are equivocal. The superiority of constructed response questions (in programmed instruction and adjunct questions research) has been shown under certain conditions as a function of the time test (immediate versus delayed) and the mode of criterion test (multiple choice or constructed response).

Evidence clarifying the relationship of these two variables in an instructional environment will provide further information in regard to the utility of simple adjunct programming techniques to supplement ordinary texts.

The primary purpose of the present study is to explore the effects of three selected variables: (1) question pacing (i.e., by the chapter versus by the page), (2) question mode (i.e., constructed response versus multiple choice), and (3) criterion test mode (i.e., constructed response versus multiple choice) on immediate and long term retention. Criterion tests consist of both specific (question relevant) and general (incidental) items.

Specifically, the study is intended to gather further evidence regarding the following questions when time of exposure to stimulus material is held constant.

1. Do adjunct questions enhance general retention of written materials?
2. Do adjunct questions enhance relevant learning?
3. Do adjunct questions enhance incidental learning?
4. Does adjunct question mode affect retention?
5. Does adjunct question pacing affect retention?
6. Does adjunct question mode affect performance as a function of the question mode of the criterion test?
7. Are there differences in the effects of the above variables as a function of whether the criterion test is immediate or delayed?

Answers to these questions could provide further data regarding: (1) the role of adjunct questions in learning from reading materials, and (2) the design of adjunct programming materials for use in supplementing ordinary text.

## II. METHOD

### Subjects

The initial pool of subjects consisted of 162 male Air Force Reserve Officers Training Corps (ROTC) cadets comprising the entire senior class in a southwestern university. All subjects were enrolled in one of nine 4th year military science class sections meeting three hours per week. Four sections met for 1 hour three days per week while the other five met 1 1/2 hours two days per week. Class sizes ranged from 16 to 20 students each. Within each class, students were assigned to one of five groups (four experimental groups plus a control group). Of the 162 initial pool of subjects, 14 were eliminated from the study because they were unable to complete the reading assignment and both criterion tests for a variety of reasons (e.g., illness). Three subjects were eliminated on a random basis to equate the number of subjects in each treatment group. Thus, the number of subjects used for the final analysis was 145, 29 in each treatment group.

Three subscale scores of the Armed Forces Officer Qualification Test (AFOQT) were collected on each subject: (1) Pilot composite; (2) Verbal composite; and (3) Quantitative composite. In addition, cumulative grade point averages for all courses taken and a separate cumulative grade point average only for ROTC courses were collected.

### Stimulus Materials

*Reading Materials.* An Air Force publication entitled *The Military Justice System*, 1969 revised edition, which consisted of 56 pages of text divided into 10 chapters was used as reading material. The total manual consisted of approximately 30,000 words. Each page of the manual was in a two-column format with 300-700 words per page, depending on the presence or absence of illustrations and graphs. The manuals were unaltered for the experiment with one exception. Each of the manuals used by experimental groups exposed to an adjunct question after each page of reading were marked with a red rectangular block after each page as a reminder to refer to the adjunct booklet. Experimental groups who were exposed to adjunct questions after each chapter and the control group received manuals with the red rectangular block after each chapter. The manuals used by the control group were marked as a reminder to record the time required to read each chapter.

*Adjunct Questions (AQ's).* Questions used as adjunctive items were obtained from several sources. The majority were selected from a pool of multiple choice and constructed response questions which had been constructed in a previous study. The remainder were constructed by the present investigator to provide full coverage of the military justice manual. From the resulting pool of 150 pairs of questions covering the same content (i.e., 150 multiple choice and 150 comparable constructed response questions), 91 were selected for inclusion in the final study. Thirty-two of these 91 questions were reserved for use in the criterion test to measure incidental learning and did not appear as adjunct questions. The other 59 pairs of questions constituted the adjunct questions used while reading. Thirty-two of these were presented again

in the criterion test to measure relevant learning. The distribution of the 59 adjunct questions among the 10 chapters is given in Table 1. Although a few of the adjunct questions in constructed response format required one word responses as in the Frase (1968) study, in the majority of cases, subjects in the present study were required to make short phrase or sentence responses. Regardless of the difficulty level of the question, however, alternate modes of questions were written to cover the same reading material. The following is an example of the constructed response mode of adjunct questions.

*Table 1. Distribution of the 59 Adjunct Questions (AQs) Among Text Chapters*

Chapter	AQs	Chapter	AQs
1	5	6	7
2	6	7	5
3	8	8	7
4	5	9	6
5	5	10	5

*Example 1.*

*Multiple Choice Adjunct Question.*

Article 133 of the Uniform Code of Military Justice prescribes \_\_\_\_\_.

- a. Conduct unbecoming an officer.
- b. Conditions under which enlisted personnel may be disciplined.
- c. Dress regulations for all military personnel.
- d. What is felony as opposed to misdemeanor.

*Constructed Response Adjunct Question:*

What type of military offense is described in Article 133?

*Study Question Booklets.* Four experimental adjunct booklets consisting of 59 questions each were developed for the present study:

*Booklet 1. Multiple Choice Adjunct Questions by the Page (MCP).* This booklet consisted of multiple choice questions which were answered after reading one page of text. The booklet was designed such that after reading approximately one page in the text, the student turned to the booklet and answered questions pertaining to the reading. On the following page of the booklet, the question was repeated and the correct answer provided. In addition, reference was given to the page and column of the text where the answer could be found. The student was then referred back to the appropriate page in the text to continue reading.

*Booklet 2. Multiple Choice Adjunct Questions by the Chapter (MCC).* This booklet contained identical questions as in Booklet 1, except that the students read the entire chapter prior to answering the adjunct questions. On the following page, the question was repeated, the answer provided and the reference given to the page and column of the text where the answer could be found. Instructions then referred him back to the next chapter in the text to continue reading.

*Booklet 3. Constructed Response Adjunct Questions by Page (CRP).* This booklet was similar to Booklet 1, except that the adjunct questions were in constructed response format. The questions covered the same material in the text as Booklet 1.

*Booklet 4. Constructed Response Adjunct Questions by Chapter (CRC).* This booklet was similar to Booklet 2, except that the adjunct items were in constructed response format. The questions covered the same material in the text as Booklet 2.

To illustrate the format of the 4 booklets used in the study, chapter one of each booklet is included in Appendices A through D.

## Criterion Test

The criterion test consisted of 80 questions divided into 5 subtests of 16 items each.

*Subtest 1. Multiple Choice-Relevant (MCR).* This subtest consisted of 16 multiple choice questions which had previously appeared as adjunct questions in Booklets 1 and 2 (multiple choice adjunct questions).

*Subtest 2. Multiple Choice-Incidental (MCI).* This subtest consisted of 16 multiple choice questions which had not previously appeared in any of the study guide booklets. They covered portions of the text other than that covered by adjunct questions. For example, if an adjunct question was drawn from the first half of a page in the text, the multiple choice-incidental test question related to materials in the second half.

*Subtest 3. Constructed Response-Relevant (CRR).* This subtest consisted of 16 constructed response test items which had appeared as adjunct questions in Booklets 3 and 4 (constructed response adjunct questions).

*Subtest 4. Constructed Response-Incidental (CRI).* This subtest consisted of 16 constructed response questions not previously used in the adjunct questions. As was the case in Subtest 2 (MCI), the questions were drawn from portions in the text not covered by adjunct questions.

*Subtest 5. General Test (GT).* These 16 items were selected to test the extent to which information learned while reading could be applied to different military situations. They were not directed toward a specific portion of the text, but required general understanding of basic concepts such as the various levels of military courts, forms of restraint, etc., (Items 65-80).

These subtests collectively covered all chapters in the book and were presented as one 80-item test. Multiple choice and constructed response test items were alternated. Otherwise, test items were arranged randomly. The 80-item criterion test is included in Appendix E.

## Experimental Procedures

Prior to the first class meeting, an alphabetical class roster was obtained. Within each class, subjects were assigned to one of the five treatment groups (4 experimental groups, plus a control group) by designating a treatment to an individual, in succession, as their name appeared on the roster. A packet consisting of the instructions, study guide booklet and the appropriately marked text was assembled with the subjects name already printed on the instruction sheet. The control group received only the instructions and text.

The experiment, was conducted during the normally scheduled segments allocated for military justice. Two hundred minutes were allowed for studying the text. Because of the necessity to control the total time spent in actual study, the scheme shown in Table 2 was used to control total reading time.

Table 2. Reading Time Per Class Period

Period	4 Class Sections (Reading time in minutes)			5 Class Sections (Reading time in minutes)	
	Mon	Wed	Fri	Tues	Thurs
Week 1	20	50	50	50	75
Week 2	40	40	Test 1	75	Test 1
Week 3					
Week 4	Test 2 (9 days delay)			Test 2 (10 days delay)	

At the beginning of the first session in each of the 9 class sections, general instructions were read regarding the purpose of the study and the procedures to be followed for the military justice portion of the course. A 37-item background information questionnaire was then distributed and completed by all subjects. Upon completion of the questionnaire, each subject's packet containing special instructions, text,

and study questions booklet (experimental groups only) was distributed. Instructions to those assigned to the four experimental groups were identical and included guidance on how to use the booklets. Instructions to those in the control group were similar except that there was no reference to booklets. The general instructions which were read to all students and the special instructions for the treatment groups are included in Appendix F. All subjects were informed that they would be tested upon completion of the reading and were aware that test scores would count toward their final grade. All subjects were instructed to review materials in preparation for the test, if they completed their reading early. The same experimenter read the initial instructions and monitored the classes during the first week in the presence of regular instructors. The regular instructors then monitored the classes during the second week and administered both criterion tests.

All reading materials were distributed at the beginning and collected at the end of each class session. Since the military justice text was only available through the ROTC department, there is no reason to suspect that students had access to any of the materials to study at home.

### III. RESULTS

The results of the study are presented in two main parts. The first part discusses the overall effectiveness of adjunct questions as determined by comparison of the four experimental treatment groups with the control group using a 5 X 2 analysis of variance design with three different dependent variables. The second part deals with a series of analyses calculated to determine the differential effects of the two independent variables with selected criterion variables using a 2 X 2 X 2 X 2 within subjects design with the last two factors repeated and crossed within levels of the first two factors. Analyses were performed separately on short and long term retention. On the latter analyses, the control group scores were excluded.

#### Student Characteristics

The means and standard deviations of the five individual differences measures, by treatment groups, are given in Table 3. The first three measures were subscores of the Armed Forces Officer Qualification Test: (1) Pilot Composite (P), (2) Verbal Composite (V), and (3) Quantitative Composite (Q). The fourth was a cumulative grade point average for all courses (CGPA), and the fifth was the cumulative ROTC grade point average (CRGPA). A one way analysis of variance was calculated on each of the five measures. With the exception of the Quantitative Composite (Q) scores which approached the .10 level of significance, none approached the .25 level, indicating that the treatment groups did not significantly differ on these variables.

Table 3. Means and Standard Deviations for Individual Difference Measures by Treatment Groups

Differences Measures		Treatment Groups					F Ratio
		MCP (n=29)	MCC (n=29)	CRP (n=29)	CRC (n=29)	CG (n=29)	
P	Mean	64.66	62.76	65.86	56.03	67.76	1.06
	S.D.	23.75	22.26	24.17	22.89	24.66	
V	Mean	52.59	52.59	55.34	44.83	56.90	1.14
	S.D.	22.22	24.66	23.56	23.32	23.47	
Q	Mean	59.48	50.69	60.34	43.28	57.38	1.93
	S.D.	28.55	30.20	27.64	24.90	27.82	
CGPA	Mean	2.52	2.58	2.48	2.40	2.58	1.00
	S.D.	.38	.36	.38	.34	.50	
CRGPA	Mean	2.88	3.03	2.98	2.97	2.99	.43
	S.D.	.38	.48	.46	.46	.52	

F .10 (4,140) = 1.99

As a pre-treatment measure, a 37 item background information questionnaire was administered. Several items dealt with demographic characteristics, while others queried study and reading habits and outside interests. Preliminary analysis of the data using total test scores to dichotomize the group revealed no reliable pattern of differences in responses. For this reason, the data were not subjected to further analysis.

### Performance Results

**Total Scores.** In order to determine the effects of treatment conditions (i.e., four experimental groups plus the control group) on short and long term retention, a 5 X 2 analysis of variance with repeated measures on the last factor was calculated. The repeated measures factor consisted of the time of test (i.e., short and long term). The dependent variable was total scores on each test.

The means and standard deviations of the 5 treatment groups for both the short and long term retention tests are given in Table 4. The summary of the analysis of variance is given in Table 5. Results of the analysis indicated that both the treatment group effect ( $F = 3.18$ ,  $df = 4/140$ ) and time of test ( $F = 4.57$ ,  $df = 1/140$ ) were significant at the .05 level. Post hoc comparisons of treatment group means, for the immediate and long term retention scores combined, were made using the Newman-Keuls method (Winer, 1962). The results, as shown in Table 6, indicated that the experimental groups scores were significantly higher ( $p < .05$ ) than the control group and that the Constructed Response by Page (CRP) group scored significantly higher than the Multiple Choice by Page (MCP) group ( $p < .05$ ). Other pair-wise comparisons showed no significant differences.

**Table 4. Means and Standard Deviations for Treatment Groups by Time of Test (Total Scores)**

Time of Test		Treatment Groups				
		MCP (n=29)	MCC (n=29)	CRP (n=29)	CRC (n=29)	CG (n=29)
Short Term (T1)	Mean	44.44	47.16	47.53	45.34	41.72
	S.D.	6.86	6.67	8.73	7.58	7.07
Long Term (T2)	Mean	45.14	47.18	48.56	46.35	43.03
	S.D.	6.43	6.78	6.83	7.61	5.46
Mean T1, T2		44.79	47.17	48.04	45.85	42.37

**Table 5. Summary of the Analysis of Variance Treatment Groups x Time of Test (Total Scores)**

Source of Variation	MS	df	F
<b>Between Subjects</b>		144	
A (Treatment Groups)	283.55	4	3.18*
Subject Within Groups	88.91	140	
<b>Within Subjects</b>		145	
B (Time of Test)	47.85	1	4.57*
AB	3.52	4	.33
B x Subjects Within Groups	10.46	140	

\* $p < .05$

The time of test main effect was also significant. Inspection of the treatment group means indicated that all groups (including the control group) had higher scores on the long term retention test than the short term test. The treatment X time of test interaction was not significant ( $F = .33$ ,  $df = 4/140$ ).



Table 6. Newman-Keuls Test on Treatment Group Overall Means (Total Test Scores)

	CG V	MCP I	CRC IV	MCC II	CRP III
Ordered Means	42.37	44.79	45.85	47.17	48.04
V	--	2.42	3.48	4.80	5.67
I		--	1.06	2.38	3.25
IV			--	1.32	2.19
II				--	.87
$S_A = .78 r =$		2	3	4	5
$S_A q .99 (r, 140)$		2.84	3.21	3.43	3.59
$S_A q .95 (r, 140)$		2.16	2.58	2.83	3.01
V		*	**	**	**
I					*
IV					
II					

\*p < .05

\*\*p < .01

*Incidental Learning Scores.* In order to determine the effects of treatment conditions (i.e., four experimental groups plus the control group) on short and long term incidental retention, a 5 X 2 analysis of variance with repeated measures on the last factor was calculated. The repeated measures factor consisted of the time of test. The dependent variable in this case was the scores on the subtest which included the 32 test items which had not previously appeared as adjunct questions (i.e., MCI and CRI scores combined). The scores of the subtest consisting of general items (GT) were excluded.

The means and standard deviations of the 5 treatment groups for both the short and long term retention tests are given in Table 7. The summary of the 5 X 2 analysis of variance is given in Table 8. Results of the analysis showed that there were no significant main effects for the treatment groups ( $F = .32$ ,  $df = 4/140$ ), but that there was a significant difference in the time factor at the .01 level ( $F = 11.24$ ,  $df = 1/140$ ). For all treatment groups, the long term retention test scores were higher than the short term scores. The treatment X time of test interaction was not significant ( $F = .35$ ,  $df = 4/140$ ).

*Relevant Learning Scores.* The effect of the treatment conditions on relevant learning was determined by a treatment by time of test 5 X 2 analysis of variance with repeated measures on the last factor. The dependent variable was the scores on the 32 test items which had previously appeared as adjunct questions (i.e., MCR and CRR scores combined). The general test items were excluded.

The means and standard deviations of the 5 treatment groups for both the short and long term retention tests are given in Table 9. The summary of the 5 X 2 analysis of variance is shown in Table 10. Results showed a significant treatment groups effect ( $F = 8.18$ ,  $df = 4/140$ ). Pair-wise comparisons were made using the Newman-Keuls method and are shown in Table 11. Results indicated that scores of all experimental groups were significantly higher than the control groups at the .01 level. The Constructed Response by Page (CRP) group was significantly higher than the Multiple Choice by Page (MCP) at the .01 level, and significantly higher than the other two groups (CRC and MCC) at the .05 level.

Neither the time of test effect ( $F = .46$ ,  $df = 1/140$ ) nor the Treatment Groups X Time interaction ( $F = 1.21$ ,  $df = 4/140$ ) were significant.

#### Experimental Treatment Effects

In order to determine the differential effects of adjunct question mode (multiple choice versus constructed response) and adjunct question pacing (by the page versus by the chapter) on criterion test relevance (relevant versus incidental) and criterion test mode (multiple choice versus constructed response), a 2 X 2 X 2 X 2 analysis of variance with within-subjects measures on the last two factors was calculated separately for short term and long term retention scores. In these analyses, the control group was excluded.

**Table 7. Means and Standard Deviations for Treatment Groups by Time of Test (Incidental Learning Scores)**

Time of Test		Treatment Groups				
		MCP (n=29)	MCC (n=29)	CRP (n=29)	CRC (n=29)	CG (n=29)
Short Term (T1)	Mean	15.47	15.44	15.87	14.96	15.49
	S.D.	3.01	3.86	3.20	3.38	3.50
Long Term (T2)	Mean	15.75	15.93	16.66	15.88	16.23
	S.D.	2.99	3.54	2.47	3.39	3.04
Mean T1, T2		15.61	15.68	16.27	15.42	15.86

**Table 8. Summary of Analysis of Variance Treatment Groups x Time of Test (Incidental Learning Scores)**

Source of Variation	MS	df	F
<b>Between Subjects</b>		144	
A (Treatment Groups)	6.04	4	.32
Subjects Within Groups	18.57	140	
<b>Within Subjects</b>		145	
B (Time of Test)	29.89	1	11.24**
AB	.94	4	.35
B x Subjects Within Groups	2.66	140	

\*\*p < .01

**Table 9. Means and Standard Deviations for Treatment Groups by Time of Test (Relevant Learning Scores)**

Time of Test		Treatment Groups				
		MCP (n=29)	MCC (n=29)	CRP (n=29)	CRC (n=29)	CG (n=29)
Short Term (T1)	Mean	20.61	22.84	22.92	22.18	18.42
	S.D.	3.51	3.13	3.98	3.76	3.13
Long Term (T2)	Mean	20.95	22.00	22.96	22.86	18.56
	S.D.	3.76	3.12	3.47	3.87	3.43
Mean T1, T2		20.79	22.42	22.94	22.02	18.49

**Table 10. Summary of Analysis of Variance Treatment Groups x Time of Test (Relevant Learning Scores)**

Source of Variation	MS	df	F
<b>Between Subjects</b>		144	
A (Treatment Groups)	182.99	4	8.18**
Subjects Within Groups	22.37	140	
<b>Within Subjects</b>		145	
B (Time of Test)	1.18	1	.46
AB	3.09	4	1.21
B x Subjects Within Groups	2.55	140	

\*\*p < .01

Table 11. Newman-Keuls Tests on Treatment Groups Means (Relevant Learning Scores)

	CG V	MCP I	CRC IV	MCC II	CRP III
Order Means	18.49	20.79	22.02	22.42	22.94
V	-	2.30	3.53	3.93	4.45
I		-	1.23	1.63	2.15
IV			-	.40	.92
II				-	.52
$S_A = .39 r =$		2	3	4	5
$S_A q .99 (r, 140)$		1.41	1.61	1.72	1.79
$S_A q .95 (r, 140)$		1.08	1.29	1.42	1.51
V		**	**	**	**
I			*	*	**
IV					
II					

\* $p < .05$

\*\* $p < .01$

The first two factors were defined by the crossing of the experimental treatments (i.e., adjunct question mode X adjunct question pacing) and the last factors by the crossing of the criterion test mode (multiple choice versus constructed response) and criterion test relevance (relevant versus incidental). The latter two factors were tested within levels of the first two; thus, the design was a 2 X 2 X 2 X 2 within subjects design with the last two factors repeated and crossed within levels of the first two factors.

*Short Term Retention.* The means and standard deviations of the adjunct question mode and pacing scores by criterion test mode and test relevance are shown in Table 12. The summary of the 2 X 2 X 2 X 2 with within-subjects measures on the last two factors is given in Table 13.

Results showed that there were no significant main effects for either adjunct question mode or adjunct question pacing. The question mode X pacing interaction approached significance ( $F = 3.21$ ,  $df = 1/112$ ), but did not reach the .05 level ( $.05 < p < .10$ ).

Both within subjects main effects were highly significant ( $p < .001$ ). Mean scores on multiple choice test items ( $M = 11.76$ ) were considerably higher than on constructed response items ( $M = 7.02$ ) and mean scores on relevant test items ( $M = 11.97$ ) were higher than on incidental test items ( $M = 7.72$ ).

Two 2-way interactions were also significant. The interaction of adjunct question mode (multiple choice versus constructed response) X criterion test mode (multiple choice versus constructed response) was significant at the .01 level ( $F = 9.58$ ,  $df = 1/112$ ). This interaction, shown in Figure 2, indicated that although those subjects exposed to constructed response adjunct questions did slightly worse ( $M = 11.64$ ) than the multiple choice adjunct questions group ( $M = 11.89$ ) on multiple choice test items, they did better ( $M = 7.35$ ) than the multiple choice adjunct questions group ( $M = 6.70$ ) on constructed response test items. The interaction between test relevance (incidental versus relevant test items) and test mode (multiple choice versus constructed response) was also significant at the .01 level. The cell means and standard deviations are given in Table 14. This interaction, graphed in Figure 3, indicated that there was a greater discrepancy in the number of correct items between the multiple choice and constructed response test mode for incidental test items than there was for relevant test items.

The triple interaction between adjunct question mode X test relevance X test mode was significant at the .05 level ( $F = 5.01$ ,  $df = 1/115$ ). Cell means and standard deviations are given in Table 15. This 3-way interaction, shown in Figure 4, indicated that those subjects exposed to constructed response adjunct questions scored slightly lower on multiple choice test items for both incidental and relevant tests, than the multiple choice adjunct question group, but scored higher on constructed response test items, particularly for the relevant test.

*Long Term Retention.* The means and standard deviations of the adjunct question mode and pacing scores by criterion test mode and test relevance are shown in Table 16. The summary of the 2 X 2 X 2 X 2 with within-subjects measures on the last two factors is given in Table 17.

**Table 12. Means and Standard Deviations of Scores  
of Adjunct Question Mode and Pacing Groups on  
Criterion Test Modes and Relevance Subtests  
(Short Term Retention)**

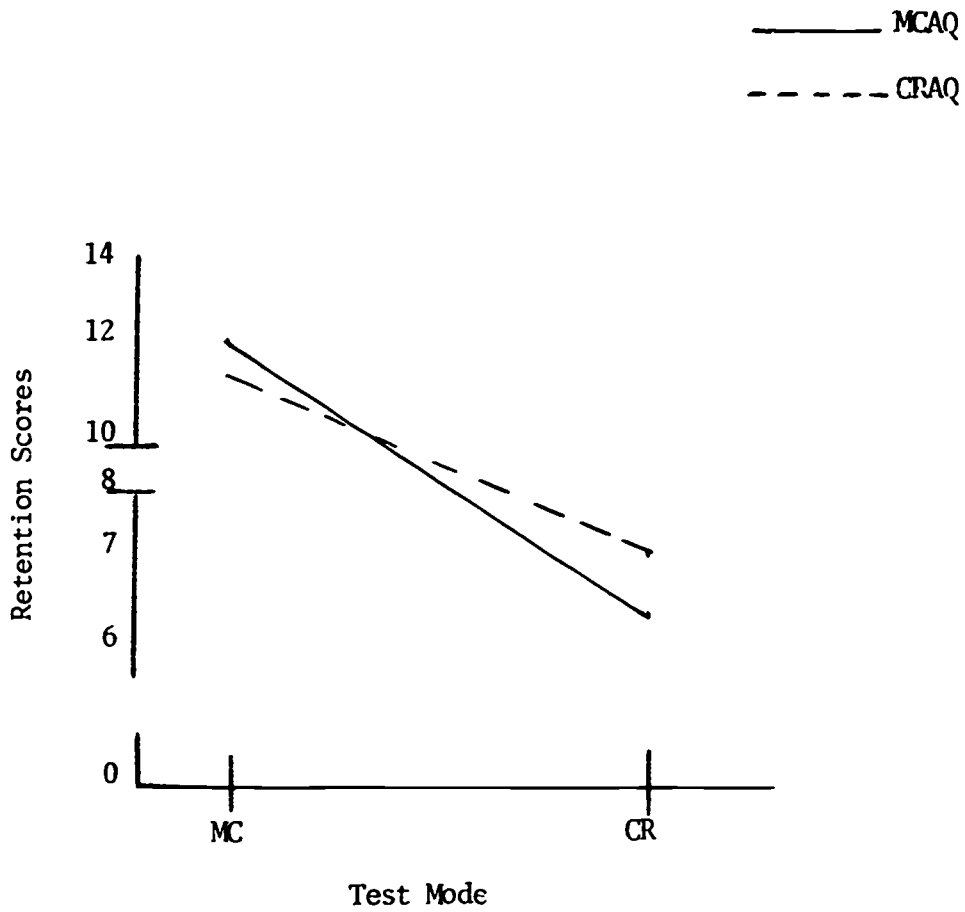
		Adjunct Question Mode		Adjunct Question Pacing	
		Multiple Choice	Constructed Response	By Page	By Chapter
<b>Test Mode</b>					
Multiple Choice	Mean	11.89	11.64	11.78	11.74
	S.D.	2.00	2.04	1.97	2.02
Constructed Response	Mean	6.70	* 7.35	6.94	7.11
	S.D.	2.01	2.14	1.97	2.15
<b>Test Relevance</b>					
Incidental	Mean	7.73	7.71	7.84	7.60
	S.D.	2.15	2.00	1.86	2.26
Relevant	Mean	10.86	11.28	10.88	11.25
	S.D.	1.86	2.16	2.08	1.92

**Table 13. Summary of the Analysis of Variance  
(Short Term Retention)**

Source of Variation	MS	df	F
<b>Between Subjects</b>		115	
A (AQ Mode)	4.54	1	.54
B (AQ Pacing)	.50	1	.06
AB	27.08	1	3.21
Subjects Within Groups	8.43	112	-
<b>Within Subjects</b>		348	
C (Test Relevance)	1,300.81	1	344.13**
AC	5.28	1	1.40
BC	10.71	1	2.83
ABC	7.78	1	2.06
C x Subjects Within Groups	3.78	112	-
D (Test Mode)	2,603.49	1	1,071.40**
AD	23.27	1	9.58**
BD	1.38	1	.57
ABD	5.41	1	2.23
D x Subjects Within Groups	2.43	112	-
CD	21.08	1	9.58**
ACD	11.02	1	5.01*
BCD	.82	1	.37
ABCD	.01	1	-
CD x Subjects Within Groups	2.20	112	-

\*p < .05

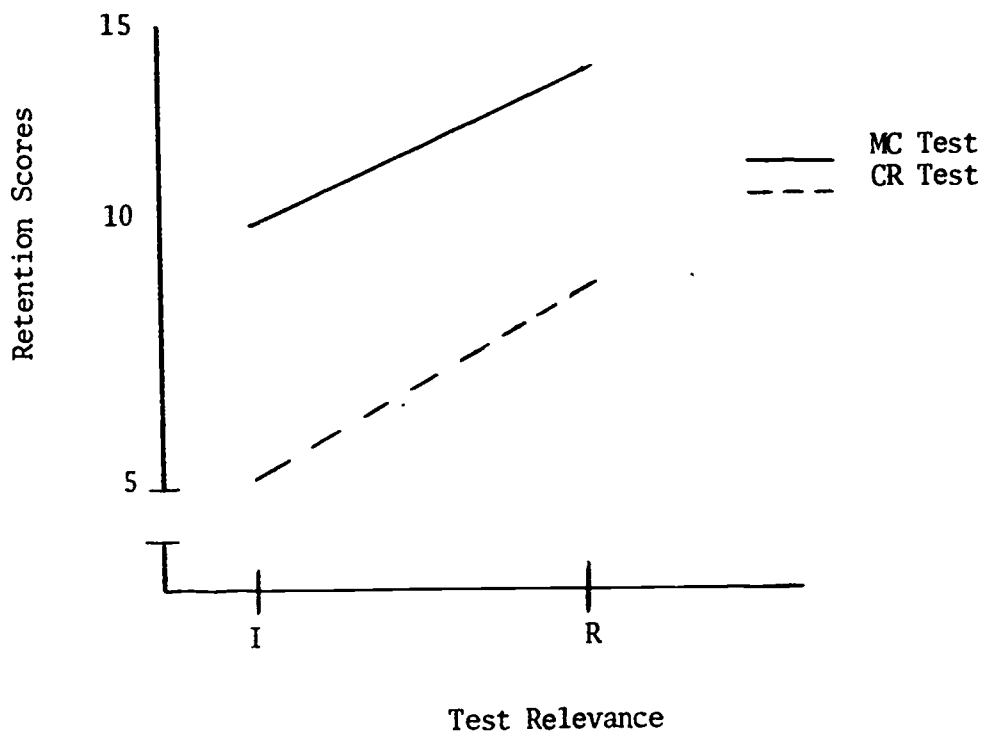
\*\*p < .01



**Figure 2. Adjunct Question Mode X Test Mode Interaction (Short Term Retention).**

**Table 14. Means and Standard Deviations for Test Relevance x Test Mode (Short Term Retention)**

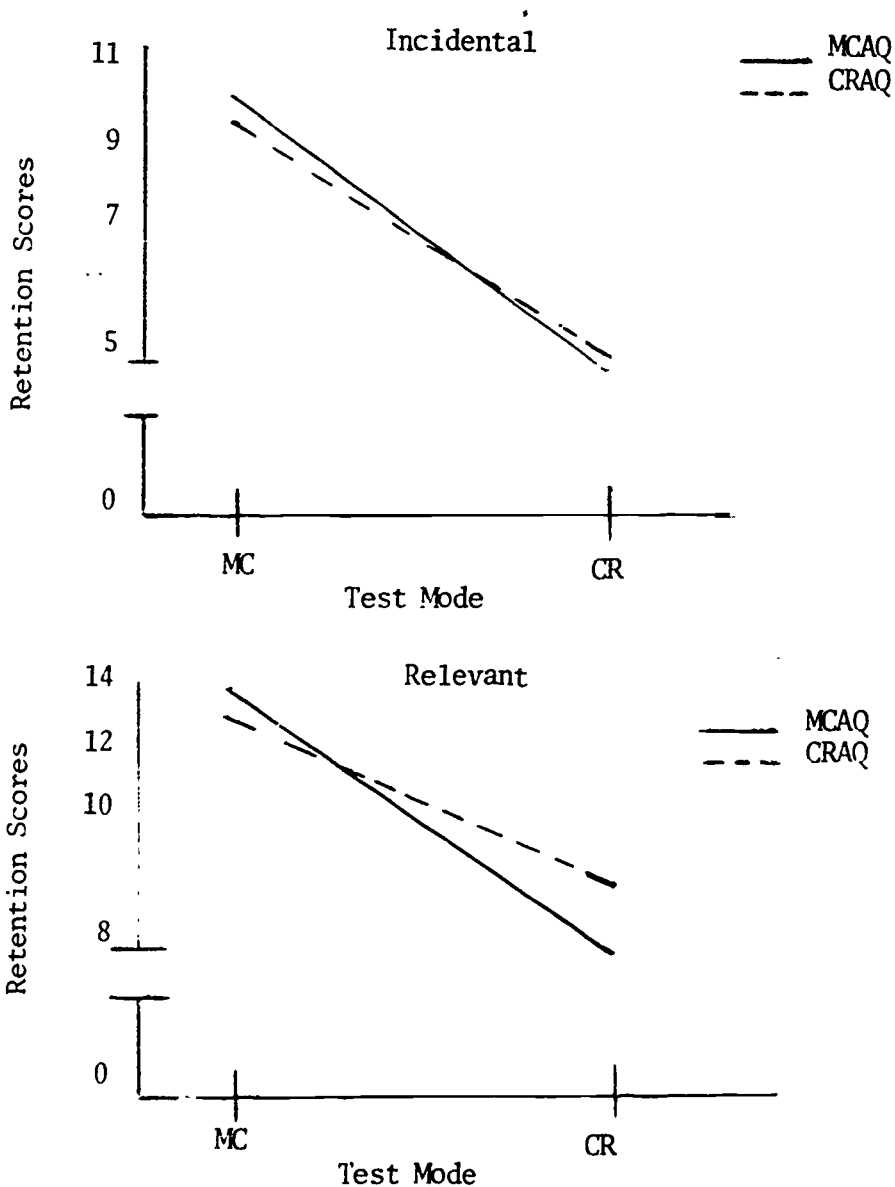
		Test Mode	
		MC	CR
I	Mean	10.30	5.14
	S.D.	2.24	1.87
R	Mean	13.22	8.92
	S.D.	1.74	2.25



**Figure 3. Test Mode X Test Relevance Interaction (Short Term Retention).**

**Table 15. Means and Standard Deviations for Adjunct Question Mode x Test Relevance and Test Mode (Short Term Retention)**

		Subtests			
		Incidental		Relevant	
		MC	CR	MC	CR
MCAQ	Mean	10.38	5.08	13.40	8.33
	S.D.	2.29	1.95	1.60	2.07
CRAQ	Mean	10.22	5.20	13.05	9.50
	S.D.	2.20	1.79	1.89	2.42



**Figure 4. Adjunct Question Mode X Test Relevance X Test Mode Interaction (Short Term Retention).**

**Table 16. Means and Standard Deviations of Scores of Adjunct Question Mode and Pacing Groups on Criterion Test Mode and Relevance Subtests (Long Term Retention)**

		Adjunct Question Mode		Adjunct Question Pacing	
		Multiple Choice	Constructed Response	By Page	By Chapter
<b>Test Mode</b>					
Multiple Choice	Mean	11.80	12.16	11.99	11.97
	S.D.	2.03	1.83	1.86	1.96
Constructed Response	Mean	6.86	7.18	7.09	6.94
	S.D.	2.25	2.13	2.18	2.20
<b>Test Relevance</b>					
Incidental	Mean	7.92	8.14	8.10	7.95
	S.D.	2.05	1.85	1.84	2.06
Relevant	Mean	10.74	11.20	10.98	10.96
	S.D.	2.19	2.11	2.20	2.10

**Table 17. Summary of the Analysis of Variance (Long Term Retention)**

Source of Variation	MS	df	F
<b>Between Subjects</b>		115	
A (AQ Mode)	13.38	1	1.63
B (AQ Pacing)	.78	1	.10
AB	17.38	1	2.12
Subjects Within Groups	8.21	112	-
<b>Within Subjects</b>		348	
C (Test Relevance)	1,005.36	1	330.71**
AC	1.76	1	.58
BC	.55	1	.18
ABC	2.55	1	.84
C x Subjects Within Groups	3.04	112	-
D (Test Mode)	2,855.17	1	739.68**
AD	.08	1	-
BD	.55	1	.14
ABD	.001	1	-
D x Subjects Within Groups	3.86	112	-
CD	65.25	1	29.79**
ACD	12.98	1	5.93*
BCD	2.07	1	.94
ABCD	6.90	1	3.15
CD x Subjects Within Groups	2.19	112	-

\*p < .05

\*\*p < .01

Results of the analyses of variance revealed no main effects for adjunct question mode ( $F = 1.63$ ,  $df = 1/112$ ) nor adjunct question pacing ( $F = .0$ ,  $df = 1/112$ ). The mode X pacing interaction was not significant ( $F = 2.12$ ,  $df = 1/112$ ).

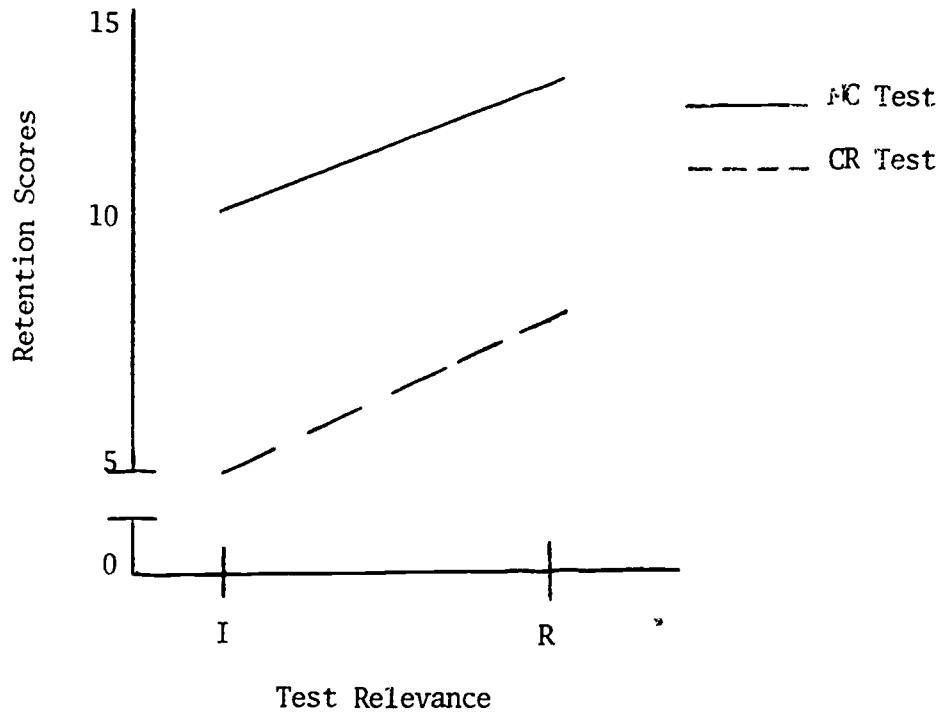


Both within subjects main effects were highly significant ( $p < .001$ ). Mean scores on multiple choice test items ( $M = 11.98$ ) were considerably higher than on constructed response items ( $M = 7.02$ ) and mean scores on relevant test items ( $M = 10.97$ ) were higher than on incidental test items ( $M = 8.03$ ).

The 2-way interaction of test relevance by test mode was significant at the .01 level. The cell means and standard deviations are given in Table 18. This interaction, shown in Figure 5, indicated the same trend observed in the analysis of short term retention. That is, there is a greater discrepancy between multiple choice and constructed response test scores for incidental test items than for relevant test items.

**Table 18. Means and Standard Deviations for Test Relevance x Test Mode (Long Term Retention)**

		Test Mode	
		MC	CR
I	Mean	10.88	5.17
	S.D.	1.94	1.96
R	Mean	13.08	8.36
	S.D.	1.88	2.42

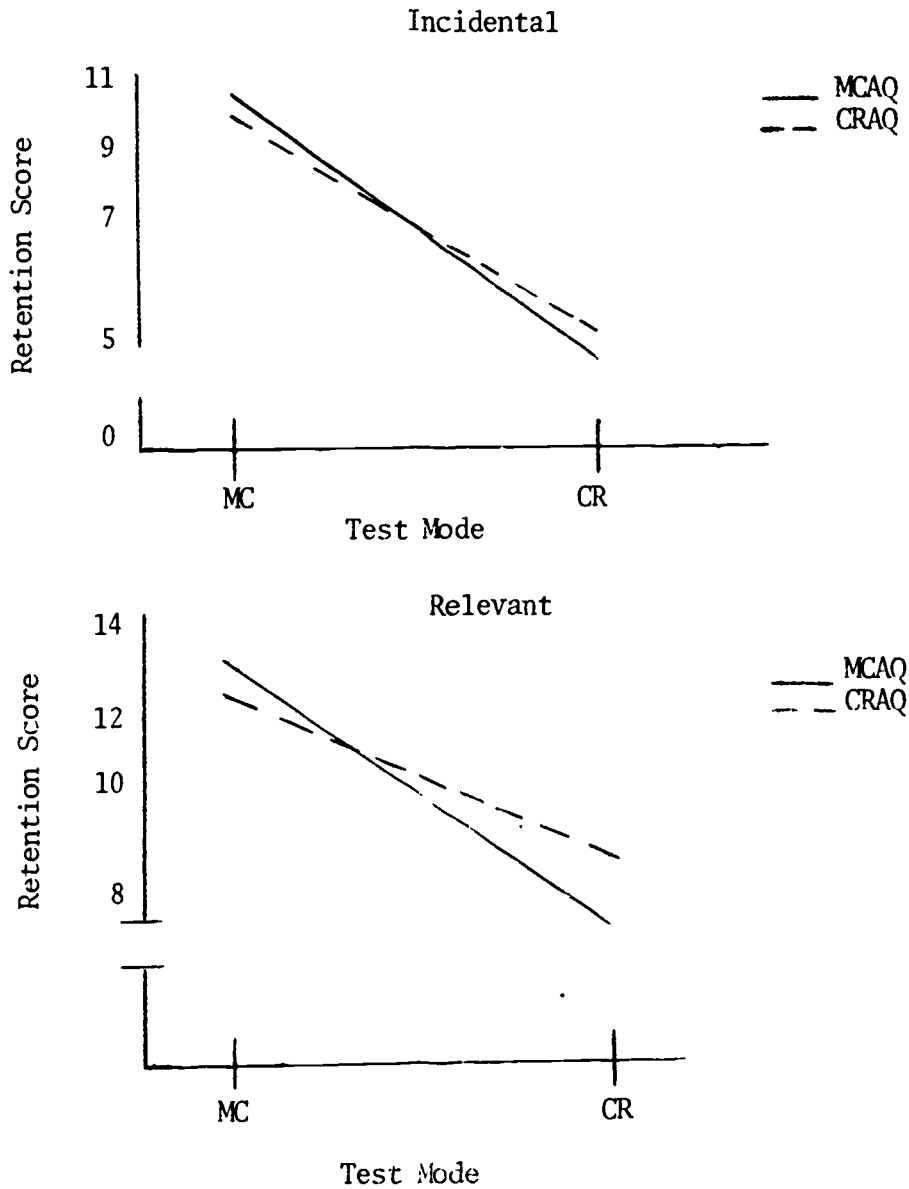


**Figure 5. Test Mode X Test Relevance Interaction (Long Term Retention).**

The 3-way interaction, between adjunct question mode X test relevance X test mode was significant at the .01 level. Cell means and standard deviations are given in Table 19. As shown in Figure 6, the interaction effects were consistent with that revealed for the short term retention test. Those subjects exposed to constructed response adjunct questions scored slightly lower on multiple choice test items for both incidental and relevant tests, but scored higher on constructed response test items, particularly for the relevant test.

**Table 19. Means and Standard Deviations for Adjunct Question Mode x Test Relevance and Test Mode (Long Term Retention)**

		Subtests			
		Incidental		Relevant	
		MCI	CRI	MCR	CRR
MCAQ	Mean	10.59	5.24	13.00	8.48
	S.D.	1.96	2.13	2.02	2.36
CRAQ	Mean	11.17	5.10	13.16	9.25
	S.D.	1.92	1.78	1.74	2.48



**Figure 6. Adjunct Question Mode X Test Relevance X Test Mode Interaction (Long Term Retention).**

### Aptitude-Treatment Interactions (ATI)

Although the investigation of possible aptitude-treatment interactions was not a specific purpose of the study, a post-hoc analysis was performed using the Verbal (V) composite scores and cumulative ROTC grade point average (CRGPA). Step-wise multiple linear regression analysis was performed; first with the V, CRGPA and membership in the control group (i.e., score 1 if in the control group, 0 otherwise) (restricted model), and second, with the addition of the V X CG and CRGPA X CG interaction terms (full model). The dependent variable was total score on the short and long term retention measures. The significance of the two interaction terms was tested using the technique described by Ward and Jennings (1973) which involves the comparison of the squared multiple correlation coefficients (RSQ's) of the full and restricted models. The resulting F statistic was evaluated for significance. The basic hypothesis being tested was that differences between total test scores of the experimental and control groups for all patterns of scores on V and CRGPA were constant.

Results indicated that the slopes of the regression of the experimental and control groups did not differ significantly for the short term retention test. Significant differences in slopes, however, were revealed for the long term retention measure. The increase in RSQ at each step in the step-wise regression analysis for the full and restricted models is given in Table 20. The differences in the slopes of the regression for the experimental and control groups as a function of three levels of verbal composite and cumulative ROTC grade point average are shown in Figure 7. The figure indicates that those in the experimental group who are high in verbal ability performed better than those in the control group, regardless of the CRGPA with total scores increasing as a function of CRGPA. Those in the experimental group who are average to low in verbal ability and have low grade point averages, scored lower on the long term retention test than those in the control group.

Table 20. Linear Regression Analysis of Slope Interactions Between Experimental and Control Groups (Long Term Retention)

Full Model		Restricted Model		df	F
Source	RSQ	Source	RSQ		
V	.1233	V	.1233	2/140	3.39*
CG X V	.2003	CG	.1891		
CRGPA	.2623	CRGPA	.2507		
CG X CRGPA	.2663				
CG	.2854				

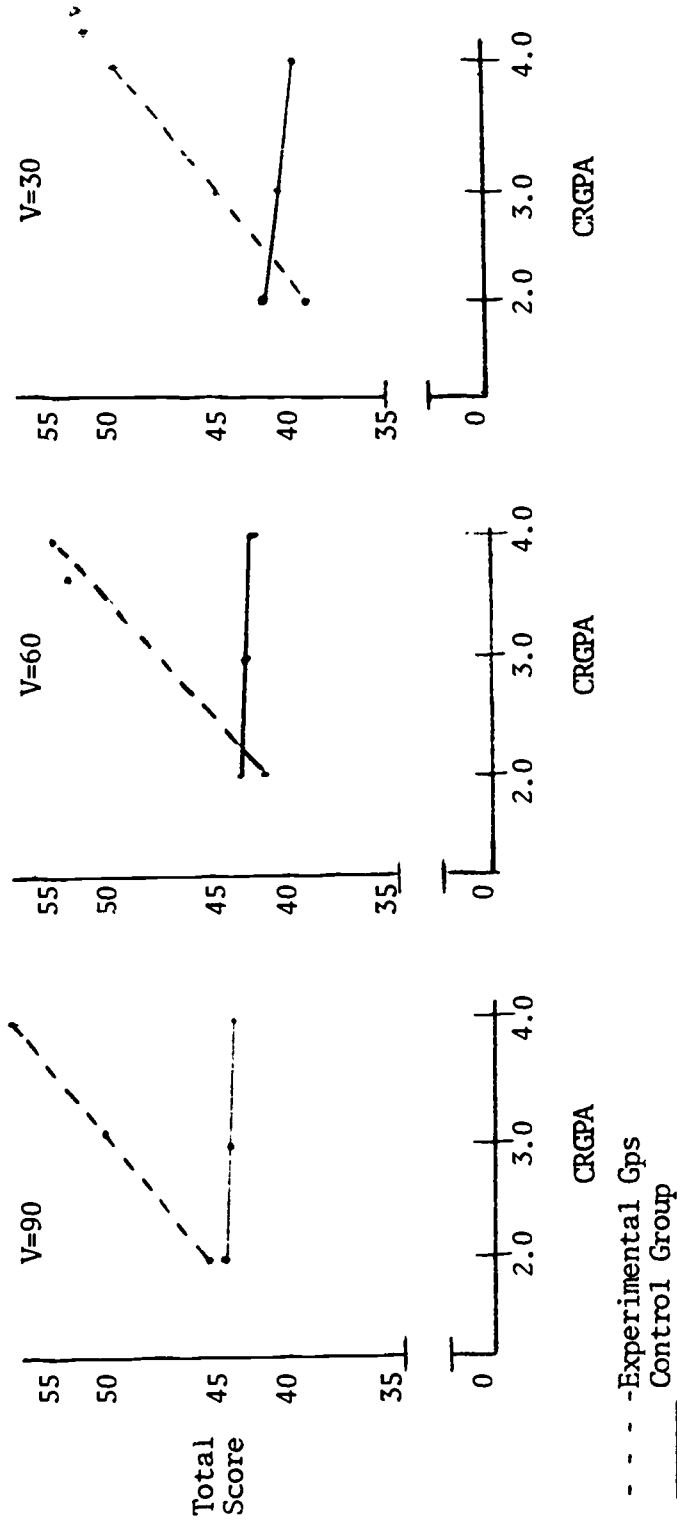
\*p < .05

### IV. DISCUSSION

The major findings of the study are discussed in two parts. The first part includes a discussion of the effectiveness of adjunct questions for short and long term overall retention, as well as for relevant and incidental retention. The second part includes a discussion of the differential effects of adjunct question mode and pacing on criterion test mode and relevance.

#### Effectiveness of Adjunct Questions

*Overall Effects.* When total test scores were used as the dependent variable, all experimental groups performed significantly better than the control group, as is apparent from the analysis of variance and follow-up Newman-Keuls test shown in Tables 5 and 6, respectively. This finding is consistent with those of previous researchers who have reported similar results and substantiates the conclusions of Pressey (1950), Meyer (1965), Siegel and Fischl (1966), and others regarding the usefulness of adjunct programming techniques. The beneficial effects of adjunct programming apparently hold up under conditions of equal study time, as well as the substitution of a simple knowledge-of-results approach (as opposed to specially constructed mechanisms, e.g., punchboards, chemically treated paper, etc.).



$$Y'_{eg} = 26.4 + .096(v) + 5.2(CRGPA)$$

$$Y'_{cg} = 40.9 + .048(v) + .2(CRGPA)$$

Figure 7. Total Scores on Long Term Retention as a Function of 3 Levels of Verbal (v) Composite Scores and Cumulative ROTC Grade Point Averages.

Although overall retention was benefited by adjunct questions, further analysis of the relevant and incidental learning scores provided additional information regarding the type of learning that was enhanced. Analysis of variance using incidental learning scores, shown in Table 8, revealed no significant differences in incidental learning between experimental groups and the control groups, while the differences in relevant learning, shown in Tables 10 and 11, were highly significant. These results indicated that although adjunct questions enhanced learning as measured by total retention scores, most, if not all, of the difference was attributable to relevant learning. Thus, the results of the present study support previous findings regarding relevant learning, but do not support previous findings (Bruning, 1968; Frase, 1967, 1968) regarding the positive effects of adjunct questions on incidental learning.

The finding that much, if not all, of the beneficial effects of adjunct questions were specific to relevant learning is not inconsistent with the views of Skinner (1958) and Pressey (1967) and the current trend in instructional design which stipulates the development of specific instructional objectives measured by direct test items. The concept advances the basic notion that if a point is important enough to be tested, it should be highlighted during learning.

Although the lack of demonstrable differences in incidental learning may appear to be in contradiction to Rothkopf's concept of mathemagenic behaviors, the differences in experimental conditions and incentives must be considered. Rothkopf (1965), Frase (1967, 1968), Bruning (1968), and others investigated the role of adjunct questions under very carefully controlled laboratory conditions and allowed subjects only one reading of the stimulus materials. In addition, subjects were normally volunteers reading neutral materials which had little incentive value since the subject's performance had no bearing on his grade. In the present investigation, conditions were quite different. All subjects were given the same amount of time to study materials covering a required academic topic. Although it was not specifically announced, subjects assumed that the test they would take would contribute to their final grade. Thus, motivation to learn was probably quite high. Frase, Patrick and Schumer (1970) have presented evidence that mathemagenic behaviors may be relatively ineffective under high motivational levels.

The significant differences in short and long term retention on total scores and incidental learning scores was to be expected. However, the fact that long term retention scores increased for all treatment groups was somewhat surprising and contrary to most previous findings, which have demonstrated significantly lower scores on long term retention measures (Sanders, 1973; Keller & Cunningham, 1972; Berliner et al., 1973).

An obvious explanation of the increase in scores is the effects of rehearsal and the opportunity to review test questions with other students after the short term test. The fact that the identical test was used twice could have provided an opportunity for practice which resulted in higher long term retention scores. This is somewhat substantiated by the fact that significantly higher long term retention effects were not revealed for relevant learning, but only for incidental learning scores. Thus, repeating items for the third time (first as an adjunct question, second as a short term retention test, and third as a long term retention test) did not increase learning. However, the fact that incidental items were initially exposed during the first test and repeated for the second time during the long term retention test, resulted in increased learning for all groups including the control group. It would appear that most of the benefits of rehearsal may be realized after one exposure.

In spite of the plausibility of the rehearsal or practice explanation, the increased scores on long term retention are still puzzling. First, the subjects in the experiment were not aware that they would be taking the criterion test twice. Further, the stimulus materials (study guide booklets and manual) used in the experiment were not available outside of the classroom. Thus, the subjects had neither the motivation nor means to review after the first test. Secondly, the length of time between the first and second test (9-10 days) was longer or as long as those in other studies (e.g., Keller and Cunningham, 5 days; Sanders, 7 days, using identical tests). In Sanders' study (1973), only one-half of the subjects took the immediate retention test and all subjects took the long term retention test. He did find rehearsal effects in that those taking the test twice had higher scores on the long term retention test than those taking only the long term retention test, but their scores were, nevertheless, lower on the delayed measure. The high motivation of the subjects in the present study and the fact that study time was equal for all groups, in addition to the rehearsal opportunity, may be partial explanations for the discrepancies between the present and previous studies. This area requires further investigation.

*Effects of Adjunct Question Mode and Pacing.* To determine the effects of adjunct question mode and pacing, analyses were made separately on short and long term retention scores, excluding the control group. The analyses are summarized in Tables 13 and 17. The lack of main effects for the independent variables indicates that under the conditions of the present study, the mode of adjunct question used (i.e., multiple choice versus constructed response format) and the pacing (i.e., presenting adjunct questions by the page or by the chapter), had little differential effects on retention. This result, when considered in light of the finding that all experimental groups performed significantly better than the control group, indicates that the presence of adjunct questions after reading enhances learning and is not greatly influenced by the mode or pacing of the questions. The implication is that, for materials of the type used in this study, multiple choice questions printed at the end of a chapter with provisions for knowledge of results are as effective for general retention as either mode of adjunct question presented at shorter intervals.

However, the interaction of adjunct question mode and criterion test mode (found in the analysis of short term retention, Table 13), indicates that constructed response adjunct questions may be superior, depending on the performance required in the criterion test. If the test performance desired is that of recall (as represented by constructed response tests) rather than recognition (as in multiple choice tests), the use of constructed response adjunct questions appears more effective. Although this interaction did not appear in the analysis of the long term measures, the three way interaction in both the short and long term analyses indicated the superiority of constructed response adjunct question groups in answering constructed response test items, particularly for relevant materials. The multiple choice adjunct question group, in all cases, performed slightly better on multiple choice test items. These findings substantiate those of Williams (1963) who found very similar results when investigating response modes in programmed instruction.

#### **Aptitude-Treatment Interactions**

The results of the step-wise multiple linear regression analysis are given in Table 20 and illustrated in Figure 7. The plot of the significant interaction indicated that regardless of the verbal ability scores, those students with higher cumulative ROTC grade point averages (CRGPA's) profited most from the use of adjunct questions. However, for those with medium to low verbal abilities who also have low CRGPA's, the use of adjunct questions appeared to be somewhat detrimental. The implication is that adjunct questions are most beneficial for those individuals whose past achievement has been relatively high. The use of adjunct questions by those who have had a record of low achievement is questionable.

These results add some further data to those reported by Hollen (1970) and Berliner et al. (1963). Hollen found that the performance of those high on associative memory was impaired by the use of adjunct questions. Berliner et al., reported data indicating that subjects with high vocabulary scores tend to perform better without adjunct questions. To the extent that CRGPA's are considered an aptitude measure, the findings of the current study are somewhat contrary to those cited above. However, an CRGPA is probably more an index of motivation and past achievement. Further exploration of the relationships between aptitude measures, past achievement and motivation as related to the use of adjunct questions would be of interest. The current findings are too preliminary to have generalizability.

#### **V. SUMMARY AND CONCLUSIONS**

The purpose of this study was to: (1) investigate the effectiveness of adjunct questions, presented within the context of adjunct programming, in enhancing general retention of written materials, and (2) explore the differential effects of adjunct question mode (multiple choice versus constructed response) and adjunct question pacing (by the page versus by the chapter) on short and long term retention when reading time is held constant.

A review of the literature indicated that there have been two main categories of relevant research: (1) that dealing with the overall effectiveness of adjunct programming, consisting basically of adjunct questions with provisions for immediate knowledge of results, using a variety of subject matter, and (2) that stimulated by the work of Rothkopf dealing with how adjunct questions influence the modification of mathemagenic behaviors, which in turn contribute to learning.

The review showed that previous demonstration of the usefulness of adjunct programming involved the use of mechanical or other specially constructed devices to provide immediate knowledge-of-results.

The approach taken in the present study was to provide knowledge-of-results by simply printing the answer and text page reference on the page immediately following the adjunct question.

The previous research on mathemagenic behaviors has been typified by the manipulation of adjunct question position, mode, pacing, etc., under carefully controlled laboratory conditions using short term retention measures. Experimental subjects were allowed only one exposure to stimulus materials resulting in different lengths of time spent by experimental and control groups in studying the materials. The approach taken in the present study was to control "time-to-study" in a realistic classroom environment using short and long term retention measures.

As a result of the review of literature, the following questions were developed for study under the conditions specified above: (1) Do adjunct questions enhance general retention of written materials? (2) Do adjunct questions enhance relevant learning? (3) Do adjunct questions enhance incidental learning? (4) Does adjunct question mode or pacing affect retention? (5) Does adjunct question mode affect performance as a function of the question mode of the criterion test? (6) Are there differences in the effects of the above variables as a function of whether the test is immediate or delayed?

To investigate these questions, 4 adjunct question booklets were developed with knowledge of results provided on the page following the adjunct question. The 59 questions in each booklet covered the main points in an existing text used in a regularly taught ROTC subject. Four experimental groups (with 29 subjects each) used the booklets while reading the basic text. A control group ( $n = 29$ ) read the text without the booklet. All subjects were allowed 200 minutes during normally scheduled classes to study the materials. The 80-item criterion test consisted of five subtests. Four of the subtests varied in question mode (multiple choice versus constructed response) and question relevance (incidental versus relevant). Incidental questions were those which had not previously appeared as adjunct questions. Relevant questions were those which had been used as adjunct questions. The fifth subtest consisted of general items designed to measure the ability of subjects to apply information learned from reading to practical situations. The total test was administered twice; one day after the last reading session and again 9 to 10 days later.

A 5 X 2 repeated measures design and a 2 X 2 X 2 X 2 within subjects design were used as the basic approaches to the analysis of the data.

The major conclusions of the study may be summarized as follows:

1. Adjunct programming is an effective technique as a supplement to existing texts. The beneficial effects apparently hold up under conditions of equal study time for control groups and the substitution of a simple knowledge-of-results approach to provide instructional feedback.
2. The beneficial effects of adjunct questions are limited, in large part, to the learning of relevant materials or those materials to which a specific adjunct question has been addressed during learning.
3. There is no evidence that adjunct questions enhance incidental learning, under the conditions of this study. Unless the beneficial effects of adjunct questions for the retention of incidental materials can be demonstrated in the classroom environment using actual teaching materials, the concept of mathemagenic behaviors is not meaningful for practical application.
4. There is an interaction effect between adjunct question mode and test question mode. If the test performance desired is that of recall rather than recognition of relevant materials, constructed response adjunct questions appear to be superior to multiple choice questions.
5. For the type of reading materials used in the present study, placement of adjunct questions at the end of the chapter is as effective as interspersing questions after each page.
6. The effects of adjunct questions remain relatively stable when measured by short and long term retention tests.

## REFERENCES

- AFROTC Publication, Air University 1969. *The military justice system*. Edited by Col Joe D. Taylor et al., October 1969.
- Allen, D.I. Some effects of advanced organizers and level of question on the learning and retention of written social studies material. *Journal of Educational Psychology*, 1970, **61**, 333-339.
- Anderson, R.C. Educational psychology. *Annual Review of Psychology*, 1967, **18**, 129-164.
- Anderson, R.C. Control of student mediating process during verbal learning and instruction. *Review of Educational Research*, 1970, **40**, 349-369.
- Berliner, D.C., Shavelson, R.J., Ravitch, M.M., & Loeding, D. Individual differences in the effects of adjunct questions on learning from prose material. Paper presented at the meeting of the American Educational Research Association, New Orleans, February 25-March 2, 1973.
- Bertou, P.D., Clasen, R.E., & Lambert, P. An analysis of the relative efficacy of advanced organizers, post organizers, interspersed questions, and combinations thereof in facilitating learning and retention from a televised lecture. *Journal of Educational Research*, 1972, **65**, 329-333.
- Boyd, W.M. Repeating questions in prose learning. *Journal of Educational Psychology*, 1973, **64**, 31-38.
- Briggs, L.J. The development and appraisal of special procedures for superior students. *Abstracts of doctoral dissertations*, 1949, **58**, 41-49. Reprinted in Lumsdaine, A.A., and Glaser, R., *Teaching machines and programmed learning*, National Education Association, 1960.
- Briggs, L.J. *Sequencing of instruction in relation to researches of competence*. American Institutes for Research, Monograph No. 3, 1968.
- Briggs, L.J., & Angell, D. Programmed instruction in science and mathematics. *Review of Educational Research*, 1964, **34**, 354-372.
- Briggs, L.J., & Hamilton, N.R. Meaningful learning and retention: practice and feedback variables. *Review of Educational Research*, 1964, **34**, 545-558.
- Bruning, R.H. Effects of review and testlike events within the learning of prose materials. *Journal of Educational Psychology*, 1968, **59**, 16-19.
- Carson, R. *The sea around us*. Oxford University, 1961.
- Evans, J.L., Glaser, R., & Homme, L.E. An investigation of "teaching machine" variables using learning programs in symbolic logic. *Journal of Educational Research*, 1962, **55**, 433-452.
- Frase, L.T. Learning from prose material: Length of passage, knowledge of results, and position of questions. *Journal of Educational Psychology*, 1967, **58**, 266-272.
- Frase, L.T. Effect of question location, pacing and mode upon retention of prose material. *Journal of Educational Psychology*, 1968, **59**, 244-249.
- Frase, L.T., Patrick, E., & Schumer, H. Effect of question position and frequency upon learning from tests under different levels of incentive. *Journal of Educational Psychology*, 1970, **61**, 52-56.
- Gagne, R.M., & Rohwer, W.D., Jr. Instructional psychology, *Annual Review of Psychology*, 1969, **20**, 381-418.
- Goldbeck, R.A., & Campbell, V.N. The effects of response mode and response difficulty on programmed learning. *Journal of Educational Psychology*, 1962, **53**, 110-119.
- HAF-T34, *Programmed learning report*, June 1970.
- Hershberger, W.A. Self-evaluational responding and typographical cueing: techniques for programming self-instructional reading materials. *Journal of Educational Psychology*, 1965, **55**, 288-296.
- Hershberger, W.A., & Terry, D.F. Delay of self-testing in three types of programmed texts. *Journal of Educational Psychology*, 1965, **56**, 22-30.



- Hiller, J.H., & Denzel, H.A. A comparison of idiosyncratic study, passive reading and inserted question treatments in learning from text. Paper presented at the annual meeting of the American Education Research Association, 1973.
- Holland, J.G., & Kemp, F.D. A measure of programming in teaching machine material. *Journal of Educational Psychology*, 1965, **56**, 264-69.
- Hollen, T., Jr. Interaction of individual abilities with the presence and position of adjunct questions in learning from prose materials. Dissertation presented at the University of Texas at Austin, August 1970.
- Hopkins, K., & Chadbourn, R.A. A scheme for proper utilization of multiple comparisons in research and a case study. *American Educational Research Journal*, 1967, **4**, 407-412.
- Jensen, B.T. An independent study laboratory using self-scoring tests. *Journal of Educational Research*, 1949, **43**, 134-137.
- Keller, D.F., & Cunningham, D.J. A comparison of prompting and adjunct questions in learning from text. *Institute for Child Study Report #102*, Indiana University, 1972.
- Kemp, F.D., & Holland, J.G. Blackout ratio and overt responses in programmed instruction: resolution of disparate results. *Journal of Educational Psychology*, 1966, **57**, 109-14.
- Krumboltz, J.D., & Weisman, R.G. The effect of overt versus covert responding to programmed instruction on immediate and delayed retention. *Journal of Educational Psychology*, 1962, **53**, 89-92.
- Ladas, H. The mathemagenic effects of factual review questions on the learning of incidental information: a critical review. *Review of Educational Research*, 1973, **43**, 71-83.
- Little, J.K. Results of use of machines for testing and for drill upon learning in educational psychology. Reprinted from *Journal of Experimental Education*, Vol 3, 1934. In Lumsdaine and Glaser, *Teaching machines and programmed instruction NEAUS*, 1960.
- Meyer, D.E. *Adjunct to self-study for aircrew refresher training under operational conditions in the Air Defense Command*. AMRL-TR-65-83, AD-617 775. Behavioral Science Laboratory, Wright-Patterson Air Force Base, Ohio, 1965.
- Meyer, D.E. *A comparison of response confirmation techniques for an adjunctive self-study program*. AMRL-TR-66-98, AD-640 503. Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio, 1966.
- Natkin, G., & Stahler, E. The effects on adjunct questions on short and long-term recall of prose materials. *American Educational Research Journal*, 1969, **6**, 425-432.
- Peterson, T.E. The value of guidance in reading for information. Reprinted from *Transactions of the Kansas Academy of Sciences*, Vol 34, 1931. In Lumsdaine and Glaser, *Teaching machine and programmed instruction NEAUS*, 1960.
- Pressey, S.L. A simple apparatus which gives tests and scores and teaches. Reprinted from *School and society*, Vol 23, No. 586, March 20, 1926. In Lumsdaine and Glaser, *Teaching machines and programmed learning, NEAUS*, 1960.
- Pressey, S.L. A machine for automatic teaching of drill material. Reprinted from *School and society*, Vol 25, No. 645, May 7, 1927. In Lumsdaine and Glaser, *Teaching machines and programmed instruction, NEAUS*, 1960.
- Pressey, S.L. A third and fourth contribution toward the coming "industrial revolution" in Education. Reprinted from *School and society*, Vol 36, No. 934, Nov 19, 1932. In Lumsdaine and Glaser, *Teaching machines and programmed instruction NEAUS*, 1960.
- Pressey, S.L. Development and appraisal of devices providing immediate automatic scoring of objective tests and concomitant self-instruction. *Journal of Psychology*, 1950, **29**, 417-447.
- Pressey, S.L. Teaching machine (and learning theory) crisis. *Journal of Psychology*, 1963, **47**, 1-6.
- Pressey, S.L., & Kinzer, J.R. Auto-elucidation without programming. *Psychology in the schools*, 1964, **4**, 359-365.

- Pressey, S.L. Re-program programming? *Psychology in the Schools*, 1967, 4, 234-239.
- Rothkopf, E.Z. Some conjectures about inspection behavior in learning from written sentences and the response mode problem in programmed self-instruction. *Journal of Programmed Instruction*, 1963, 2, 31-46.
- Rothkopf, E.Z. Some theoretical and experimental approaches to problems in written instruction. In J. D. Krumboltz, (Ed.), *Learning and the educational process*, 1965, 193-221.
- Rothkopf, E.Z. Learning from written materials; an exploration of the control of inspection behavior by test-like events. *American Research Journal*, 1966, 3, 241-49.
- Rothkopf, E.Z. Two scientific approaches to the management of instruction. In R. M. Gagne and W. J. Gephard (Ed.), *Learning research and school subjects*, Eighth annual Phi Delta Kappa Symposium on educational research. Itasia: F. E. Peacock Publishers Inc., 1968, 107-132.
- Rothkopf, E.Z. Textual constraint as function of repeated inspection. *Journal of Educational Psychology*, 1968, 59, 20-35.
- Rothkopf, E.Z. The concept of mathemagenic activities. *Review of Educational Research*, 1970, 40, 325-336.
- Rothkopf, E.Z. Experiments on mathemagenic behavior and the technology of written instruction. In E. Z. Rothkopf and P. Johnson (Eds.), *Verbal learning research and the technology of written instruction*. New York: Teachers College Press, 1972.
- Rothkopf, E.Z., & Bisbicos, E. Selective facilitive effects of interspersed questions on learning from written material. *Journal of Educational Psychology*, 1967, 58, 56-61.
- Rothkopf, E.Z., & Bloom, R.D. Effects of interpersonal interaction on the instructional value of adjunct questions in learning from written material. *Journal of Educational Psychology*, 1970, 61, 417-422.
- Rothkopf, E.Z., & Coke, E.U. Repetition interval and rehearsal method in learning equivalences from written sentences. *Journal of Verbal Learning Behavior*, 1963, 22, 406-16.
- Rothkopf, E.Z., & Coke, E.U. Variations in phrasing repetition interval and the recall of sentence material. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 86-91.
- Sanders, J.R. Retention effects of adjunct questions in written and aural discourse. *Journal of Educational Psychology*, 1973, 65, 181-186.
- Severin, D.G. Appraisal of special tests and procedures used with self-scoring instructional testing devices. *Abstracts of doctoral dissertations*, 1955, 66, 323-30. Reprinted in Lumsdaine, A. A. and Glaser, R., *Teaching machines and programmed instruction*. National Education Association, 1960.
- Siegel, A.I., & Fischl, M.A. Studies in adjunct autoinstruction. *Journal of Industrial Psychology*, 1966, 4, 1-12.
- Skinner, B.F. Science of learning and the art of teaching. *Harvard Educational Review*, 1954, 24, 86-97.
- Skinner, B.F. Teaching machines. *Science*, 1958, 128, 969-977.
- Stephens, A.L. Certain special factors involved in the effect. Reprinted from abstracts of *Doctoral Dissertations*, No. 64, 054 Press, 1953. In Lumsdaine and Glaser, *Teaching machines and programmed instruction NEAUS*, 1960.
- Swenson, I., & Kulhavy, R. Retention and item comprehension in prose as a function of question placement and pacing. Paper presented at the American Educational Research Association Meeting, 1973.
- Tobias, S. Review of the response mode issue. *Review of Educational Research*, 1973, 43, 193-204.
- Wadsworth, B., & Flagg, B. The effect of interspersed questions on learning from written materials in elementary school subjects and college students Paper presented at the American Educational Research Association Meeting, 1971.

**Ward, J.H., Jr., & Jennings, E.** *Introduction to linear models*. New Jersey: Prentice-Hall, Inc., 1973.

**Watts, G.H., & Anderson, R.C.** Effects of three types of inserted questions on learning from prose. *Journal of Educational Psychology*, 1971, **62**, 387-394.

**Williams, J.P.** Comparison of several response modes in a review program. *Journal of Educational Psychology*, 1963, **54**, 253-256.

**Winer, B.J.** *Statistical principles in experimental design*. New York: McGraw-Hill, 1962.

**Wittrock, M.C.** Response mode in the programming of Kinetic molecular theory concepts. *Journal of Educational Psychology*, 1963, **54**, 89-93.

Appendix A

Sample Study Guide Booklet. Multiple Choice  
Adjunct Questions By Chapter

NAME \_\_\_\_\_

SSN \_\_\_\_\_

CLASS & SECTION \_\_\_\_\_

COLLEGE MAJOR \_\_\_\_\_

MILITARY JUSTICE SYSTEM

STUDY QUESTIONS  
BOOKLET

CHAPTER I  
QUESTIONS AND ANSWERS

READ ALL OF CHAPTER I BEFORE  
TURNING THIS PAGE.

CHAPTER I  
(Pages 1-4)

1. The power to make rules for the government and regulation of naval forces is vested in \_\_\_\_\_.
  - a. the President.
  - b. the Congress.
  - c. the Joint Chiefs of Staff.
  - d. the Supreme Court.
  
2. The Fifth Amendment to the Constitution as interpreted by the Supreme Court holds that the only type of offenses that are subject to military law are those that are \_\_\_\_\_.
  - a. premeditated.
  - b. capital.
  - c. committed on foreign soil.
  - d. service-connected.
  
3. The U.S. Articles of War were first revised in 1874, when \_\_\_\_\_ was (were) specifically prohibited.
  - a. trying of officers by civil courts.
  - b. cruel and unusual punishment.
  - c. striking of officers by enlisted men.
  - d. all of the above.
  
4. The 1949 Manual superseded the Manuals of the 1920's, and provided for \_\_\_\_\_.
  - a. bad conduct discharges.
  - b. Judicial Councils.
  - c. defense counsels with equal or better qualifications than trial counsels.
  - d. all of the above.
  
5. Which is the best reason for a separate code of military law?
  - a. Some behaviors are considered offenses in civilian life, but not in the military.
  - b. The seriousness of a military offense depends upon the immediate situation, which is not covered in civil codes.
  - c. Military duties impose certain rules of conduct in addition to rules governing civilian conduct.
  - d. Certain persons in the Armed Forces are not subject to U.S. Civil Law.

CHECK ANSWERS  
ON NEXT PAGE

ANSWERS

1. The power to make rules for the government and regulation of naval forces is vested in the Congress (b).

Page 1, Column 1.

2. The Fifth Amendment to the Constitution as interpreted by the Supreme Court holds that the only type of offenses that are subject to military law are those that are service-connected (d).

Page 1, Column 2.

3. The U.S. Articles of War were first revised in 1874, when cruel and unusual punishment (b) were specifically prohibited.

Page 2, Column 1.

4. The 1949 Manual superseded the Manuals of the 1920's, and provided for bad conduct discharges, Judicial Councils, and defense counsels with equal or better qualifications than trial counsels (d).

Page 3, Column 1.

5. Which is the best reason for a separate code of military law?

Military duties impose certain rules of conduct in addition to rules governing civilian conduct (c).

Page 4, Column 1.

RECORD THE TIME: \_\_\_\_\_

NOW TURN TO CHAPTER 2 AND  
CONTINUE READING



Appendix B

Sample Study Guide Booklet. Multiple Choice Adjunct  
Questions By Page

NAME \_\_\_\_\_

SSN \_\_\_\_\_

CLASS & SECTION \_\_\_\_\_

COLLEGE MAJOR \_\_\_\_\_

MILITARY JUSTICE SYSTEM

STUDY QUESTIONS  
BOOKLET

CHAPTER I

START READING CHAPTER I BEFORE  
TURNING THIS PAGE

CHAPTER I  
(Page 1)

1. The power to make rules for the government and regulation of naval forces is vested in \_\_\_\_\_.
  - a. the President.
  - b. the Congress.
  - c. the Joint Chiefs of Staff.
  - d. the Supreme Court.
  
2. The Fifth Amendment to the Constitution as interpreted by the Supreme Court holds that the only type of offenses that are subject to military law are those that are \_\_\_\_\_.
  - a. premeditated.
  - b. capital.
  - c. committed on foreign soil.
  - d. service-connected.

CHECK ANSWERS  
ON NEXT PAGE.

ANSWERS

1. The power to make rules for the government and regulation of naval forces is vested in the Congress (b).

Page 1, Column 1.

2. The Fifth Amendment to the Constitution as interpreted by the Supreme Court holds that the only type of offenses that are subject to military law are those that are service-connected. (d)

Page 1, Column 2.

NOW TURN TO PAGE 2 OF THE  
MANUAL AND CONTINUE READING

CHAPTER I  
(Pages 2-4)

3. The U.S. Articles of War were first revised in 1874, when \_\_\_\_\_ was (were) specifically prohibited. \_\_\_\_\_
- a. trying of officers by civil courts.
  - b. cruel and unusual punishment.
  - c. striking of officers by enlisted men.
  - d. all of the above.
4. The 1949 Manual superseded the Manuals of the 1920's, and provided for \_\_\_\_\_.
- a. bad conduct discharges.
  - b. Judicial Councils.
  - c. defense counsels with equal or better qualifications than trial counsels.
  - d. all of the above.

CHECK ANSWERS  
ON NEXT PAGE.

ANSWERS

3. The U.S. Articles of War were first revised in 1874, when cruel and unusual punishment (b) was specifically prohibited.

Page 2, Column 1.

4. The 1949 Manual superseded the Manuals of the 1920's, and provided for bad conduct discharges, Judicial Councils, and defense counsels with equal or better qualifications than trial counsels (c).

Page 3, Column 1.

GO BACK AND READ  
IN THE TEXT (Page 4)  
BEFORE TURNING  
THIS PAGE.

CHAPTER I  
(Page 4)

5. Which is the best reason for a separate code of military law?  
\_\_\_\_\_.

- a. Some behaviors are considered offenses in civilian life, but not in the military.
- b. The seriousness of a military offense depends upon the immediate situation, which is not covered in civil codes.
- c. Military duties impose certain rules of conduct in addition to those rules governing civilian conduct.
- d. Certain persons in the Armed Forces are not subject to U.S. Civil Law.

CHECK ANSWER  
ON NEXT PAGE.



ANSWER

5. Which is the best reason for a separate code of military law?

Military duties impose certain rules of conduct in addition to those rules governing civilian conduct. (c)

Page 4, Column 1

RECORD THE TIME: \_\_\_\_\_

NOW START READING CHAPTER 2 IN THE MANUAL  
BEFORE TURNING THIS PAGE

Appendix C

Sample Study Guide Booklet. Constructed  
Response Adjunct Questions By Chapter

NAME \_\_\_\_\_

SSN \_\_\_\_\_

CLASS & SECTION \_\_\_\_\_

COLLEGE MAJOR \_\_\_\_\_

MILITARY JUSTICE SYSTEM

STUDY QUESTIONS  
BOOKLET

CHAPTER I  
QUESTIONS AND ANSWERS

READ ALL OF CHAPTER I BEFORE  
TURNING THIS PAGE.

CHAPTER I  
(Pages 1-4)

1. What power, especially important for military law, is granted to Congress under Section 8, Article I of the Constitution?
2. How does the Fifth Amendment as interpreted by the Supreme Court affect the Military Justice System?
3. Our First Articles of War (1806) were taken from the British Articles of War. What major change was made to the Articles in the 1874 revision?
4. The 1949 Manual superseded the Manuals of the 1920's, and additional changes were made in the Military Justice System. Describe at least three of the changes.
5. The Armed Forces clearly need a separate Military Justice System. One reason is that the Armed Forces operate throughout the world. What is another?

CHECK ANSWERS  
ON NEXT PAGE

ANSWERS

1. What power, especially important for military law, is granted to Congress under Section 8, Article I of the Constitution?

Answer Congress is empowered to make rules for the government and regulation of land and naval forces.

Page 1, Column 1.

2. How does the Fifth Amendment as interpreted by the Supreme Court affect the Military Justice System?

Answer The Fifth Amendment insures that only service-connected offenses in the armed forces will be subject to military law.

Page 1, Column 2.

3. Our First Articles of War (1806) were taken from the British Articles of War. What major change was made to the Articles in the 1874 revision?

Answer Cruel and unusual punishments were prohibited.

Page 2, Column 1.

4. The 1949 Manual superseded the Manuals of the 1920's, and additional changes were made in the Military Justice System. Describe at least three of the changes.

Answer Legislation provided for: (1) enlisted persons as court members in appropriate cases, (2) placed a lawyer on the court as a law member, (3) trial and defense counsels had to be similarly qualified, (4) petitions for new trials were established, (5) criticism of courts by commanders was prohibited, (6) bad conduct discharges were introduced as a type of punishment, (7) review bodies, higher than the Board of Review were established (Judicial Councils).

Page 3, Column 1

5. The Armed Forces clearly need a separate Military Justice System. One reason is that the Armed Forces operate throughout the world. What is another?

Answer Another reason is that some actions are crimes in the Armed Forces but are not crimes in civilian life.

Page 4, Column 1.

RECORD THE TIME: \_\_\_\_\_

NOW START READING CHAPTER 2

Appendix D

Sample Study Guide Booklet. Constructed  
Response Adjunct Questions by Page



NAME \_\_\_\_\_

SSN \_\_\_\_\_

CLASS & SECTION \_\_\_\_\_

COLLEGE MAJOR \_\_\_\_\_

MILITARY JUSTICE SYSTEM

STUDY QUESTIONS  
BOOKLET

CHAPTER I  
QUESTIONS AND ANSWERS

START READING CHAPTER I  
BEFORE TURNING THIS PAGE



ANSWERS

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Page 1, Column 1.

2. How does the Fifth Amendment as interpreted by the Supreme Court affect the Military Justice System?

Answer The Fifth Amendment, as interpreted by the Supreme Court, insures that only service-connected offenses in the armed forces will be subject to military law.

Page 1, Column 2.

NOW TURN TO PAGE 2 OF THE  
MANUAL AND CONTINUE READING

CHAPTER 1  
(Pages 2&3)

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CHECK ANSWERS  
ON NEXT PAGE

ANSWERS

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Page 3, Column 1

GO BACK AND READ IN THE  
MANUAL (PAGE 4) BEFORE  
TURNING THIS PAGE.

CHAPTER 1  
(Page 4)

5. The Armed Forces clearly need a separate Military Justice System. One reason is that the Armed Forces operate throughout the world. What is another?

CHECK ANSWER  
ON NEXT PAGE

ANSWER

5. The Armed Forces clearly need a separate Military Justice System. One reason is that the Armed Forces operate throughout the world. What is another?

Answer Another reason is that some actions are crimes in the Armed Forces but are not crimes in civilian life.

Page 4, Column 1

RECORD THE TIME: \_\_\_\_\_

NOW START READING CHAPTER 2  
BEFORE TURNING THIS PAGE