

AN INVESTIGATION  
INTO THE EFFECTS OF INSTRUCTIONAL OBJECTIVES  
AND QUESTIONS ON LEARNING FROM PROSE

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ABSTRACT

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Seventy-two pre-university students between the ages of 16-19 years willingly participated in an experiment to determine the relative effectiveness of orienting stimuli i.e., (a) objectives, (b) questions and (c) objectives and questions used together. The Ss were divided into four groups: Three groups using orienting stimuli and one group without.

Performances on immediate free-recall and recognition tests failed to reflect significant differences, although the group using both inserted objectives and questions scored better than all other groups. Under delayed free-recall testing, however, the Ss using both objectives and questions performed significantly better ( $p < .05$ ) than the Ss without orienting stimuli. In fact, the significant difference was maintained even at the  $\alpha = .005$  level. All other orienting stimuli groups performed better than the group without such stimuli, but not significantly better.

Findings from a questionnaire completed after the immediate testing offered support to the conclusion that the significant effects were the result of the experimental treatments. Instructional objectives and questions used in conjunction proved to be more effective than either objectives or questions used alone.

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## CHAPTER I

### INTRODUCTION

The search for a maximum strategy for ordering text materials poses a solid challenge to instructional designers who seek the best situation which will produce the most learning by students.

Prior to 1960 the difficulties posed in learning from prose were hardly challenged even though they were recognized very early by Huey (1903) and by Germane (1929).

With the advent of Ausubel's (1963) concern for the psychology of meaningful verbal learning and Rothkopf's (1965, 1970) concept of mathemagenic stimuli the area of research in learning from text or prose materials was put in a more favourable light; that is, some theory as well as methodology was offered as a framework in which to study the phenomenon.

Ausubel's (1963, 1968) theory that advanced organizers help the learner to assimilate the materials to be learned has not met with much success primarily because a specific definition of what constitutes an advanced organizer is lacking. Furthermore, the advanced organizers are usually constructed from an intuitive basis and may or may not be appropriate to the entering competencies of the potential learners. There are, nevertheless, some

research studies giving support to the notion that the use of an expository text can influence the acquisition of a subsequent related text (Clawson, 1973; Schumacher, et al., 1974; Papay, 1971).

Rothkopf (1970) used the term 'mathemagenic behavior' to describe attending behaviors that give birth to learning. Questions stimulate such behaviors. The effects of questions (pre-, post-, and inserted) and their mathemagenic influence on learning from prose have been investigated in studies by Rothkopf (1966), Rothkopf and Bisbicos (1967), Frase (1967, 1968), McGaw, et al., (1972), Hiller (1974), Shavelson (1974), Boker (1974) and Richards and DiVesta (1974) and in most cases significant facilitative effects were obtained, especially for inserted post-questions (See Carver, 1970, for a good review).

Behavioral objectives have been proposed as a means for improving student learning (See Bloom (Ed.), 1956; Mager, 1962; and Walbesser, 1971) and many researchers have been investigating the proposed facilitative effects (See Duchastel & Merrill, 1973; and Lawson, 1974 for good reviews). The effects were not always statistically significant, but were generally always helpful.

Other investigators have looked at alternative ways for ordering the contents of text materials that may improve learning and retention of the information. Some have tried to order learning according to hierarchical structures, that is, arranging texts or lessons from simple



intellectual levels to higher order rule application and inferences. (Gagné, 1965, 1968; Gagné and Briggs, 1974) which if practised often enough will cause the learners to develop certain intellectual skills which can act as a cognitive strategy for ordering the information that the Ss must process while studying from a text. To be more explicit, a cognitive strategy implies that ability by which an individual directs his own thought process which eventually leads to learning. Gagné calls the conditions that foster cognitive process and increased learning -- 'favourable conditions'. Studies in the area of prose learning may be termed, Investigations into 'favourable conditions' that affect prose learning.

Although the structure of the text may influence the way the Ss study the information. (Fraser, 1969, 1973; Segal, 1969; Meyers, et al., 1973; Friedman and Greitzer, 1974; Schultz and DiVesta, 1972; Perlmutter and Royer, 1972; and, Duchastel and Gonzalez, 1974), only the external aspects of the text are taken into account. The matter of internal structure which may dispose the learners to make certain kinds of errors of over- or under-generalization is in most cases not adequately controlled (Fraser, 1974). The variable "personal characteristics" may affect what students retain from textual materials (Cook, 1969; Kueter, 1970; Nelson, 1970; and Merrill and Towle, 1971).

It becomes obvious that the number of variables

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influencing the learning and retention from prose materials is very large. Ebel (1967, p. 17) so succinctly expresses that observation with this statement: "learned behavior is a resultant of very many antecedent and concomitant factors which are completely interrelated". One of the great problems inherent in that statement, nevertheless, is that of isolating those variables that are most important. Tukey (1969) suggests that the most important ones seem to be: (1) the difficulty of the material (readability) (See Guthrie, 1973; Bormuth, 1970; Aquino, 1969; Dale & Chall, 1948); (2) the ability of the individual with respect to the use of language; (3) the amount of time engaged in learning or studying the text; and (4) the strategy used by the individual when studying the prose material (See Carver, 1970, for further discussion).

Learning from prose materials is very important to the full functioning of individuals in a print-dependent society and so research in the area is relevant to textual material development. There are ways of directing students' attention to particular aspects of a text by giving directions which suggest strategies that the readers may use while studying, but which are the most effective ways?

For the purpose of studying from text, objectives and questions have proved to be successful but they have never been used to this researcher's knowledge in the same study to ascertain the interaction effects that are possible. The purpose of this study, therefore, is to investigate the

effects of inserted pre-instructional objectives and post-questions upon the learning of Ss from prose materials.

#### Relevance to Educational Technology

The thesis is relevant to the intent of Educational Technology in as much as it deals with the needs of the learners and the duties of the teachers, that is, greater effectiveness and efficiency of the teaching-learning process (Instructional Technology).

The manipulation of the study and its rationale places it in the field of Educational Psychology (Psychology of learning and teaching). This type of study attempts to maximize instruction in the area of learning from prose and the results will probably be of help in the compilation of textbooks and other, written instructional materials.

By exploring and applying the information that has been the results of basic and applied research in Educational Psychology an attempt is being made to create software using learning objectives and questions to stimulate learning.

The results of this study hopefully will verify certain theoretical hypotheses about the use of objectives and questions in a teaching-learning situation and add to the development of instructional techniques used to improve human learning. The needs of the learner to know what is expected to be retained from written materials will be somewhat satisfied; and the need for the teacher to know

what areas to test in an attempt to verify student learning will also be partially satisfied because it should not be assumed that all that the Ss learn can be monitored or even tested, at least not in the researcher's opinion.

The most that can be expected is that the manipulation of the objectives and questions within the text can provide favourable conditions which will greatly affect the internally generated processes that influence learning.

It is of greater probability, therefore, that effectiveness and efficiency of written instructional materials can be improved through the planned application of available information and the fuller use of the human resources involved.

This chapter has placed the problem into context and projected its relevance to Educational Technology (Instructional Technology). Chapter II will discuss experimental studies relevant to the purpose of this study. Chapter III will discuss the method of the experiment and the procedure followed in administering the treatments. In Chapter IV the results of the treatments will be stated and those results and their implications will be discussed in Chapter V.

## CHAPTER II

### REVIEW OF THE LITERATURE

The effectiveness of Behavioral Objectives in instruction will be discussed in the following areas: (1) Objectives vs. no objectives; (2) Specific objectives vs. General objectives; (3) Placement of objectives; (4) Intentional and incidental learning.

With respect to the use of questions, the discussion will follow these lines: (1) The use of Questions; (2) Position of questions; and (3) Intentional and incidental learning as a result of using questions.

The formulation of behavioral objectives is generally accepted today as a basic component in Instructional Design. Behavioral objectives are meaningful statements of intent which describe the proposed changes that the learner should demonstrate as proof of his learning a particular unit of instruction. Behavioral objectives, it is suggested, will provide directions or guidelines for the development and evaluation of curriculum in the areas of educational planning, classroom teaching and instructional product development (Bloom, Hastings and Madaus, 1971; Merrill, 1971; Davies, 1971; Gagné and Briggs, 1974; The Educational Technology Review Series, No. 7, 1973).

In the area of classroom teaching, the use of behavioral objectives has been found to facilitate student retention in only about half of the studies available on the subject. Another half has failed to demonstrate significant facilitative effects. (Duchastel and Merrill, 1973; Lawson, 1974).

The studies discussed in both reviews dealt with the idea of providing students with objectives prior to or in conjunction with other instructional materials and do not directly concern or detract from the importance of behavioral objectives to other areas of curriculum development and Educational planning and Evaluation.

Concerning the use in classroom teaching or for use in instructional prose material this researcher prefers to use the term Instructional Objectives. Throughout the discussion that follows the terms behavioral and instructional objectives will be used interchangeably.

Since Franklin Bobbitt (1924) and Tyler (1934) wrote of the importance of highly refined instructional objectives others like Bloom, et al., (1956), Mager (1962) and Krathwohl, et al., (1964) have published materials on the usefulness of such directions. The issue of the projected feasibility, desirability and/or effectiveness (Walbesser, 1971) of behavioral objectives have been discussed (Gagné, 1965, 1971, 1972; Eisner, 1967; Evans, 1968; Atkins, 1968; Clark, 1971; Popham, 1968, 1972;

Stake, 1970) but as yet without any certain outcome. The discussion on the subject has been mostly theoretical speculations.

The major rationale for providing students with objectives prior to or in conjunction with (inserted and presented after) instructional materials is to avoid irrelevant activities and direct the learner's effort towards mastering the expectations as stated in the objectives.

#### Objectives vs. no objectives

The most important effects of providing students with Behavioral Objectives were proposed to be: (1) improved instructional effectiveness; (2) improved instructional affect; (3) improved instructional efficiency; and (4) improved individualization of instruction (Popham, 1969a, 1969b; Walbesser, 1971).

Most research suggest that groups using instructional or behavioral objectives were superior to groups not using objectives. Lawson (1974) stated that knowledge of behavioral objectives was most helpful in promoting attending behavior and in most cases where the objectives were highly relevant to the instructional task, learning was enhanced.

The most commonly cited study in support of the use of behavioral objectives is that by Mager and McCann (1961) in which the authors used three groups of graduate engineers. The first and second groups were taught in

conventional expository methods, while in the third group the Ss were given detailed statements of the training objectives as well as sample criterion items and allowed to pursue their own course of study. The Ss in the third group significantly out-performed the other groups by reaching the objective criterion in 65% less time.

The significance of the finding, however, is seriously questioned since it was possible that one of the other uncontrolled variables could have affected the outcome e.g., the sample criterion items; the conventional expository method; and the self-instructional method. Beside those possibilities, the Ss were graduate engineers dealing with a pseudo-engineering problem. The possible interaction between the mentioned uncontrolled variables and the behavioral objectives could have effected the significant findings (follows from Carroll, 1963).

This does not mean that behavioral objectives groups cannot yield significant results over non-behavioral groups. Orpha Duell (1974) found that a group using behavioral objectives performed significantly better ( $p < .01$ ) than a non-behavioral group on a recall test and concluded that only if objectives direct the students to learn information which would not otherwise be classified as important or likely to be tested, will such directions be very meaningful. The two groups had comparable results on application tests ( $p > .05$ ). This may suggest that the objectives were concerned mainly with the learning of



facts, as indeed they were, or probably, that the tests were not very revealing.

Under a conference environment Blaney and McKie (1969) arranged groups of students into: (1) those using behavioral objectives; (2) those using a general orientation to the program; and, (3) those who simply attended the conference. On a criterion test after the conference, the Ss from the group using behavioral objectives performed significantly better than the others ( $p < .05$ ).

Merrill and Towle (1972) found that there was no significant difference between a behavioral objective group and a non-behavioral objective group as far as end performance was concerned. The facts, that this study was done with graduate students (supposedly with high intellectual ability, and high motivation). that the material used was C. A. I. (computer assisted instruction) which had an inherently well organized structure, could have affected the non-significant findings.

Behavioral objectives given to graduate students prior to a regular lecture had a significant effect ( $p < .05$ ) on student achievement. This was in comparison with another group not using objectives but attending the same lecture (Long & Huck, 1973). Still at the graduate level, T. Varagunan (1971) obtained significant results with medical students on both immediate and delayed post-tests ( $p < .01$ ).

Though behavioral objectives have been used in

many subject areas: in chemistry (Boardman, 1970); in agriculture (Bishop, 1969); in programmed mathematics (Engel, 1968); in medicine (Varagunan, 1971); and in economics (Tiemann, 1967) statistically significant results were not always obtained. In fact Duchastel and Merrill (1973) in summarising a review of studies using behavioral objectives stated that the availability of objectives only facilitated learning in certain circumstances.

One source of the inconsistent findings obtained may have been the degree of specificity of the given objectives. The degree of specificity refers to the amount of behavioral information contained in the statement of the objective regarding the performance that the learner will be expected to demonstrate following instruction (See Mitchell, 1974, for a good critique).

#### Specific Objectives vs. General Objectives

The problem of the specificity of instructional objectives has been studied in several instances but without a clear-cut case for its use or disuse. Most of the relevant studies in this area have been done with added variables which have their own peculiar effects on learning, e.g., (a) the variable teaching method (lecture, discussion, expository vs. discovery, E.T.V. and C.A.I.); and (b) the classroom environmental variables. These variables can amplify negatively or positively whatever effects the objectives may have.

Nevertheless, some valid observations have been extracted from the available research. On the one hand, studies by Tiemann (1967); Baker (1969); Merrill (1970); Oswald (1970); Oswald and Fletcher (1970); Jenkins and Deno (1970); Stedman (1970); and, Lovett (1971) have all failed to demonstrate any statistically significant advantages in favour of using specific objectives. In some cases specific objectives had a debilitating effect (Oswald and Fletcher, 1970).

The Tiemann (1967) study looked at the differential effects of using specific and general objectives in conjunction with a televised college economic course. The results did not demonstrate superiority of specific objectives on immediate post-test, but significant differences were obtained on a delayed performance test ( $p < .05$ ). In this particular case, the televised nature of the instruction could have affected the results on the immediate post-test, but the specific objectives may have caused the Ss to somehow store the information much better and so were able to retrieve much more under a delayed testing condition.

Using a more conventional setting, Eva Baker (1969) hoped that the use of specific instructional objectives would cause greater attention and motivation resulting in a higher overall learning gain. She used three treatment conditions: Group I had specific objectives; Group II used a sort of placebo in the form of random objectives.

taken from the Social studies categories; and, Group III, had the general objectives from which group one's specific objectives were generated. No significant differences ( $p > .05$ ) were found between treatment groups as reflected on a twenty-three item criterion-referenced test.

Working along the same lines were Jenkins and Deno (1970). Their study utilized a 2x3 factorial design. Type of objectives (general or specific) and knowledge of objectives (to teacher, to teacher and students and to students) were the variables involved. There was no significant difference ( $p > .05$ ) in learning gains among the groups receiving general objectives, specific objectives and no objectives, although the experiment postulated an increase in motivation and attention which would result in higher overall learning gains. Like Baker (1969), Jenkins and Deno (1970) concluded that the teachers did not utilize the behavioral objectives. There was no control for that threat to internal validity, so the results are inconclusive at best.

Oswald (1970) though not using teachers as Jenkins and Deno (1970) and Baker (1969) did, found that giving students specific instructional objectives did not facilitate better performance. Similar findings were obtained by Etter (1969), Cook (1969) and Patton (1972).

It does seem that a case for the utilization of specific objectives in instruction has not been substantially supported, but evidence for its defence can

be found in studies by Rothkopf and Kaplan (1972), Dalis (1970), Nelson (1970), Hastings (1972), and Long and Huck (1972) among the best known.

Dalis (1970) utilized three experimental groups: Group I was given precise instructional objectives; Group II was given vaguely stated objectives; and Group III was given short paragraphs on related materials. The vague objectives were similar to the specific objectives except that both the content and dimensions were general. The Ss completed a 68-item criterion test, the results of which reflected statistically significant differences ( $p < .05$ ) in favour of the precisely stated objective group. The criterion items tested the entire content of the learning materials but even if the objectives mentioned only part of the information the results from using specific objectives can be positively affected (Rothkopf and Kaplan, 1972).

This positive effect was also supported by Janeczko (1971) who found that learners with prior knowledge of specific instructional objectives can be expected to perform on a higher level ( $p < .05$ ) than learners exposed to general objectives.

With both lecture (Lovett, 1971) and individual instruction situations (Janeczko, 1971; Rothkopf and Kaplan, 1974; and, Hastings, 1972), specificity of objectives has proved to be helpful in promoting learning.

There is, nevertheless, a paucity of empirical research on the topic of specificity of instructional

objectives and therefore the argument proposed by Eisner (1967, 1969) and other like him, that specifically stated behavioral objectives have a limiting effect on learning, has not been really disproved.

Another area of concern to the researcher in the field of instructional objectives is the question of placement, that is the use of objectives at the beginning of instruction, during instruction or at the end of instruction -- pre-objectives, inserted objectives and post-objectives.

#### Placement of Objectives

The question of whether or not the presenting of objectives facilitate learning has only been answered in doubtful terms. There is, nevertheless, the question of placement and the resulting differential mathemagenic effects.

Yelon and Schmidt (1972), Zimmerman (1972), Stedman (1970) and Kaplan and Simmons (1974) have been actually involved with this question of placement. Yelon and Schmidt (1972) utilized three variables that were used individually and cross-manipulated. The variables were: (a) behavioral objectives at pre-locations; (b) behavioral objectives inserted within the instructional materials; and (c) a pre-criterion test given during instruction. The Ss were assigned to one of eight experimental groups and the results on a performance test confirmed the hypothesis that there

are some conditions which are better suited for presenting behavioral objectives. Learning was facilitated when: (1) all three variables were combined; (2) when only a pre-criterion test was given; and (3) when objectives were presented prior to instruction and then at the end of instruction. Thus Yelon and Schmidt's study supported the overall facilitative effects of instructional objectives. Since the learning tasks involved in the study consisted of learning the principles of a Think-a-Dot game, the generalizability of the findings are rather limited.

Zimmerman (1972), in the same area, using five programmed mathematics units, gave Ss either: (a) behavioral objectives before each of the units; (b) behavioral objectives after each unit; and (c) no behavioral objectives. There were no significant differences between treatments. Any possible significant differences due to placement of objectives may have been dissipated because of the probable facilitative affects inherent in programmed learning.

Kaplan and Simmons (1974) investigated the possible effects that instructional objectives located before a text or after it can have on Ss learning information from the text. The Ss were divided into four groups: objectives presented before text (I) with and (II) without relevant information; and, objectives presented after text (III) with and (IV) without relevant information. In this study Ss performed very high on objective relevant

information, regardless of position of objectives. There was no statistically significant effects for differential placement of objectives ( $p > .05$ ).

The research covering the differential placement of instructional objectives in learning conditions is sparse but there seems to be a trend towards the use of objectives with other learning aids, e.g., (1) objectives and text structure; (2) comparison of the effects of objectives and other orienting stimuli (Papay, 1971). Papay (1971) found that behavioral objectives as well as questions and advanced organizers were significantly effective stimuli when compared with controls without orienting stimuli. These orienting stimuli were used both at pre- and post-locations. It must be mentioned that advanced organizers at pre-locations produced significantly better performance over both objectives and questions. Pre-location objectives had the least effect on learning. Studies by Rothkopf and Bisbicos (1967), Bruning (1968) and Frase (1967, 1968) support Papay's assessment that objectives at pre-locations produced the least effect on facilitation of learning over the control groups.

Studies have generally, nevertheless, favoured the placement of learning objectives prior to instructional materials.

#### Intentional and Incidental learning with objectives

Providing explicitly stated objectives in



conjunction with prose materials has had some interesting results especially in the area of what is retained from such learning experiences. When directions are given to learners, to learn a particular set of information from a text and not others, the set specified can be called intentional learning. Any other information retained from the text may be termed incidental.

Postman (1964), Deese (1964) and McLaughlin (1965) have all tended to broaden the definition of intentional learning to include much more than what may be stated in learning objectives. According to their bias, intentional learning includes the overt and covert responses elicited by the specific instructional stimuli. This will probably include all that the readers consider important upon reading the materials. The studies discussed in the following passages all used intentional learning to mean the learning of all information specified or alluded to in the instructional objectives given to the learners.

When provided with a set of learning objectives for a given task such as the learning of textual information, Ss learn information related to the objectives better than the information not so related (Rothkopf and Kaplan, 1972) besides that, the Ss learn information better than Ss not provided with instructional objectives (Kaplan and Rothkopf, 1974; Kaplan and Simmons, 1974).

These outcomes were expected, but it was also found that instructional objectives dispose Ss to learn

more of the incidental information than did giving directions, merely to learn from the passage (Rothkopf and Kaplan, 1972; Kaplan, 1973; Kaplan and Rothkopf, 1974). This effect was similar to that obtained with inserted post-questions (Rothkopf, 1970; Frase, 1970). Contrary to that were the findings by Duchastel (1973), Duchastel and Brown (1974), Duchastel and Gonzalez (1974) and Kaplan and Simmons (1974) which suggested that incidental learning was depressed while the intentional learning was accentuated.

If what is considered incidental in a text is of little or no importance to education, then that kind of specific selection of information can be very profitable, but if that is not the case, then such depression can be harmful if not properly controlled.

The Rothkopf and Kaplan (1972) study investigated intentional and incidental learning as a function of (1) density of the text sentences relevant to the objectives, and (2) the specificity with which objectives were described. The criterion tests included some items not directly relevant to the objectives. The results of the study, on 'verbatim recall' showed the following: (a) intentional learning was significantly greater than incidental learning ( $p < .05$ ); (b) with specific objectives, there was more intentional learning, greater than that from general directions to learn from the text. Incidental learning was not affected; (c) as instructional objectives increased in

density, the probability of learning any particular set of objective-relevant information was decreased. However the overall observations reflected significantly greater performance on both intentional and incidental learning as a function of using specific objectives.

Commenting on the Rothkopf and Kaplan (1972) study, Lawson (1974, p.16) suggested that since the "concomitant effects for both intentional and incidental learning were treated as being similar measurement indices, and subsequently analysed by means of analyses of variance rather than through a multivariate analysis technique" the findings cannot be more than tentative. But even that, may not fully account for discrepancies that manifest themselves.

In a replication of the study by Kaplan and Rothkopf (1974) varied length of passages as well as differing densities of the objective-relevant text components were used. Specifically stated objectives produced higher intentional learning than did generally stated objectives ( $p < .01$ ). The likelihood of mastering any single intentional item generally decreased as passage length increased ( $p < .01$ ). The recollection of intentional items decreased with increases in the density of objective-relevant sentences in the passages ( $p < .05$ ). Unlike the Rothkopf and Kaplan (1972) study, specificity of objectives and density of objective-relevant sentences in the passage had little or no effect on incidental learning, but the

likelihood of learning any incidental item decreased as passage length increased. The general decreases in intentional and incidental learning could not be definitely attributed to length of passages or density of objective-information, so another experiment was done which revealed the following: (a) the subjects, due to increasing the number of relevant sentences in the passage, significantly demonstrated a decreasing likelihood of intentional items being recalled ( $p < .05$ ); (b) performance on intentional items was significantly affected by the correlation between density of objective-information and passage length, so that when various lengths were matched with density, the number of relevant sentences recalled was greater for the longer passages. Beside the above, there was no statistically significant difference between intentional and incidental learning. The passages used were up to 1500 words involving up to 100 sentences each.

The uncertain findings for differences between incidental and relevant learning were also reflected in studies done by Duchastel (1973) and Duchastel and Brown (1974). They found that the use of specific objectives tended to encourage poor performance on the learning of incidental information. A further investigation by Duchastel and Gonzalez (1974), who used passage organization and objectives, revealed that: (a) relevant learning was favourably affected by the presence of objectives ( $p < .05$ ) under a free-recall testing condition; under recognition

testing no significant differences were obtained. The passages (36 sentences) were randomly put together or organized according to the name of the concepts used; (b) there were no significant effects for passage organization under either testing condition, but there was a drastic reduction in the amount of incidental learning by Ss in the objective groups under both free-recall and recognition tests ( $p < .01$ ).

The information from the studies discussed leaves much to be desired by way of formulating a specific statement concerning the effects of objectives on the learning of intentional and incidental learning from prose material.

Learning from prose materials is also aided by skilful use of questions which can promote attending behavior which in turn promotes internal information processing when reading.

#### The Use of Questions

Questions have always been used by teachers (regardless of type, appropriateness, etc.) generally to determine what students have learned, and not as aids to what students should be learning. Books, like that by Sanders (1966), attempt to orient the classroom teacher to the uses of different types of questioning strategies in the management of classroom teaching, but the idea of using questions inserted in text materials is given little coverage in such books.

The idea of using questions in text is not new and there is available recent research on the subject. Research has generally demonstrated that questions used in conjunction with text materials have a facilitative effect on learning (Hershberger, 1963; Rothkopf, 1966; Frase, 1967, 1968; Bruning, 1968; Grotelueschen, 1972; Sanders, 1973; Shavelson, 1974; Boker, 1974; and Richards and DiVesta, 1974).

#### Placement of Questions (Pre-, Post- and Inserted)

Adjunct questions administered shortly after text segments to which they were relevant have facilitated learning to a greater extent than questions placed prior to text, but both post- and pre-questions are generally superior to no questions at promoting learning (Owen, 1973; Wilson, Koran and Koran, 1974; Boker, 1974; Richards and DiVesta, 1974).

Undergraduate psychology students were put into one of six experimental groups with or without pre-questions. At the end of a two-week period of instruction the results on post-testing revealed that the group with questions did significantly better ( $p < .001$ ) than the non-question groups (Miles, Kibler and Pettigrew, 1967). The results provide some support for the idea that if students know what is expected of them as criterion for success (Bugelski, 1964) they could be expected to perform much better than if not so informed. This is also consistent

with one of the postulated positive effects of providing students with learning objectives prior to instruction.

Shavelson, et al., (1974) found no statistically significant effects for individual differences, but higher order pre-questions had a facilitative effect generally. The effects of pre-questions seem to neutralize individual differences.

Research by Feiman (1974) found that pre-questions led to significantly higher retention than post-questions, whereas, Owen (1973) found that although the use of adjunct questions promoted significantly higher performances than did the absence of questions while reading, alternative placement of questions, produced no significant differences on criterion performance among groups. There was a probability that motivational effects may have accounted for the non-significant differences and the inconsistent findings on the use of questions in general. Towards this end Frase, Patrick and Schumer (1970) investigated the effects of motivation in modifying the effects of adjunct questions. Using differing levels of monetary incentive (0¢, 3¢ and 10¢ for each correct answer) and frequency of questions (pre- and post-), the findings from a criterion test revealed the following: - There was a significant difference between pre- and post-question groups ( $p < .05$ ); the interaction between question placement and incentive levels was not statistically significant ( $p > .05$ ); performance of the pre-question group at the lowest level of

incentive was relatively depressed, while post-questions had the advantage; at the highest level of incentive there were similar performances for all groups. At the highest level of incentive, therefore, the performance of all other groups equalled the performance of the post-question group at the lowest level of incentive. This suggested that post-questions played an important role in maintaining learning at a high standard with or without incentive. Studies by Rothkopf (1965), Rothkopf and Bisbicos (1967), Frase (1968), Sanders (1973) and Wilson, Korán and Koran (1974) all supported a superior facilitative effect in favour of post-questions over pre-questions and no questions at all.

The Rothkopf and Bisbicos (1967) study used the reasoning that inserted questions can cause Ss to utilize an inspection behavior and focus attention on relevant aspects of the text. Using a 36-page section of The Sea Around Us the experimenters constructed questions which were given to Ss after or before every 3-page segment. The Ss that had questions after the segments did better than the Ss that had questions prior to each segment.

Frase (1968) investigated the prediction that questions would improve retention especially when they are placed after passages. After reading a 2000-word text which was divided into twenty passages of ten lines each with relevant questions placed either before or after each passage the Ss completed a retention test. Statistical significance ( $p < .001$ ) was obtained by the post-question



group. Pre-questioning decreased overall retention. Frase concluded that frequent post-questioning had a mathemagenic effect. The finding is consistent with that by Boyd (1973) and Richards and DiVesta (1974), that pre-questions affect mainly attention, but post-questions affect retention on a rehearsal basis.

A definite conclusion on the most effective application of questions cannot be readily made. The selection depends on a number of variables, e.g., text organization, passage length and number of passages.

Post-questions seem to have both specific (intentional) and general (intentional and incidental) facilitative effects, whereas pre-questions have mostly facilitative effects on specific (intentional) information. The pre-questions cause Ss to search only for intentional information, but with post-questions, if used correctly, Ss not knowing what exactly may turn out to be relevant, inspect the whole text more or less carefully (Glaser and Resnick, 1972, p.259).

#### Intentional and Incidental Learning

Research is not plentiful concerning the effects of questions on incidental and intentional learning. Studies by Frase (1968) as well as Rothkopf and Kaplan (1972) suggest that intentional learning is greater than incidental learning and that incidental learning depends on the frequency and location of questions within the text.

Studies by Rothkopf and Bisbicos (1967), Peeck (1970), Boyd (1973) and Rothkopf and Billington (1974) suggest that post-questioning facilitates the learning of intentional as well as incidental information. Pre-questioning focuses mainly on intentional information.

Incidental learning and intentional learning were both improved by the use of post-questions (Frase, 1967). In a later study Frase (1968) found that the retention of intentional information was significantly higher than the retention of incidental information ( $p < .001$ ). As post-questions became more frequent the retention scores increased. The Ss used one question after/before every 10 sentences; two questions after/before every 20 sentences; four questions after/before every 40 sentences; and, five questions after/before every 50 sentences. Frequent pre-questioning, it was suggested, interfered with overall learning by destroying the continuity of the prose materials. Size of passages between questions also had a depressing effect on incidental learning so that whether pre- or post-questions; the information retained decreased (less and less incidental information was retained) as size of passages increased.

The Frase, Patrick and Schumer (1970) study cited earlier revealed that under increased incentive conditions and with frequent post-questioning, Ss tended to fall below the control group (who used text alone) on measures of incidental learning, nevertheless, under infrequent

questioning both pre- and post-question groups performed above the control group on both incidental and relevant learning. Questioning frequency was listed as contributing to the modifying influence of motivational reasons, in this case, momentary incentive. A probable element that could possibly have affected the findings was the fact that the questions were on a separate sheet of paper. The conclusions arrived at by the experimenters cannot be generalized to situations where the passages and the questions are part of the text.

Another possible unaccounted for effect could have been the influence of 'running time', time taken by Ss to complete the studying of the text. No specific time was given as a limit for the studying of the text. The treatment group that had the highest retention scores also had the highest reading-time scores. It becomes doubtful, therefore, whether the treatment or the 'running time' had the stronger effect on Ss performance. The efficiency of any particular treatment was therefore rendered indeterminate (Carver, 1970). This element of 'running time' seemed not to have been controlled in much of the available research with questions as well as with objectives. Some treatments have allowed Subjects to finish before others while others have caused Ss to take as much study time as desired, but significant findings were obtained in many cases. What was not made quite clear was whether certain conditions were more effective than others within a fixed time.

### Objectives vs. Questions

Objectives and questions to the researcher's knowledge, have never been utilized with the same text on a research basis. The most relevant study is that by Papay (1971) which investigated the differential effects of behavioral objectives, questions and advanced organizers at pre- and post-locations and with a mass and distributed presentation on learning and retention of meaningful prose materials.

After reading a 3500-word passage only once the Ss from eight experimental groups completed an immediate retention test and some days afterwards a delayed retention test. The findings revealed that objectives, questions and advanced organizers were all effective stimuli on the immediate retention test. At pre-locations, all orienting stimuli groups were superior to the controls, but the groups using advanced organizers were superior to the groups using objectives and questions. Under the delayed retention testing the group that used post-questions was most effective.

Papay's study suggested that although the advanced organizers produced the best overall results during acquisition, consideration concerned with instructional materials development strongly recommend the use of criterion questions at post-locations. Objectives seemed to be preferable at pre-locations.

### Summary of Research

If the amount of information to be learned is sufficient to make Ss feel that they can master such information, they would study with greater concentration. Beyond a certain amount of information the Ss perhaps will study with very little or none at all (Anderson and Faust, 1973). Anderson and Faust (p.258) suggest that this point of 'procrastination' depends on the subject matter, the student's personal incentive and recent experiences.

In spite of the many faults in procedure, methodology and controls, the research discussed shows that instructional objectives do have a facilitative effect on learning from prose materials especially if given prior to studying relevant materials. The materials should not be too long nor too complex. Similar facilitative conclusions can be made about the use of post-questions in learning from prose materials. Learning materials should not be too lengthy, too saturated with relevant information, and the questions should not be too many at one time.

It is conceivable that if Ss are provided with sufficient time, that is, the necessary time required by those Ss to learn all the information given, they can reach mastery of the learning task. Carroll (1963), postulates that the following variables affect this assumption: (1) Aptitude; (2) Ability to understand instruction; and (3) Quality of instruction. The aptitude deals with the amount of time needed by the individual to master a task; the

ability to understand instruction concerns verbal ability and comprehension capability; the quality of instruction concerns the matching of the organization, presentation and explanation of the learning task to the individual's aptitude and ability. These variables are tied up to the amount of time given to the student in any learning situation and the amount of time that a student is willing to devote to the learning task.

Most studies on learning from prose have allowed the Ss as much time as needed to feel secure that they have mastered the task and in so doing, especially when comparing different learning conditions, the results are confounded. Probably the way of controlling for time is by using a 'fixed time' condition (Carver, 1970) even though that will not entirely rectify the possible disparities with the Time variable. The premise is, that under several experimental conditions and within a given 'fixed time', Ss performances on a common post-test should reflect the best learning conditions.

Although individuals bring different intellectual skills or cognitive strategies to the learning situation there may be a way to offset the possible differential effects and still get a certain requisite amount of learning from a given situation. Even when individuals with similar intellectual skills come to a learning task there can be a significant difference in the amounts learned (Postman, 1964; Esterbrook, 1959; Kausler and Trapp, 1960; Kohn, 1954;

Silverman and Blitz, 1956). The point being made is that individuals learn different amounts of information from any situation. It will be interesting to find ways that will cause any individual, given a certain prerequisite knowledge, to learn information at least to a minimum criterion level.

The research has shown that there are methods of presenting learning materials which would enable learners to retain more than they would otherwise.

Since pre-objectives can be expected to promote a forward inspection strategy which predisposes the learners to look for specific clues elicited by the objective stimuli, and post-questions tend to cause the reader to review the materials that he has read, it can be reasonably expected that the combined effects of both pre-objectives and post-questions on probable learning will be additive.

The main concern of this study, therefore, was to observe the effects that pre-objectives and post-questions used in conjunction can have on learning information from textual materials.

## CHAPTER III

## METHOD

Purpose

The literature reviewed in the previous chapter suggested that the use of pre-objectives can promote a forward inspection behavior which predisposes the reader to look for specific clues elicited by the objectives; and that post-questions will cause the reader to review the material covered in a more general way than will pre-questions.

It can reasonably be expected, therefore, that the interaction effects on probable learning caused by the objectives and questions inserted at relevant places in the text will be very revealing.

Towards this end the following hypotheses were proposed:-

H<sub>1</sub> -- That Ss given instructional objectives inserted before relevant segments of the text will perform better than Ss not given any orienting stimuli.

H<sub>2</sub> -- That Ss given inserted relevant post-questions will perform better than Ss not given any orienting stimuli.

H<sub>3</sub> -- That Ss given both inserted instructional objectives and inserted post-questions will



perform better than all other Ss.

### Subjects

A total of 72 pre-university students enrolled in Black Literature courses at Marianopolis College in Montréal, willingly participated in this study. They were middle-class and between the ages of 16-19 years and had all had some elementary biology. They were, therefore familiar with biological terms though not competent in the topic covered in the text. They were from four sections of the same course, having the same instructor.

### Learning Materials

The experimental text consisted of passages on Pathogenic Microorganisms which were organized very much in the manner suggested by Ausubel (1963). The text was meaningfully arranged so that associations between concepts and ideas involved were always explicit. The information was presented in a sequence that first presented general inclusive concepts and then particular instances within those concepts. Pathogens were introduced as those microorganisms that caused diseases in humans; then examples of pathogenic classes were introduced (e.g., Bacteria) and then diseases caused by them (e.g., tuberculosis). The manner in which these diseases were spread (e.g., droplet infection) and means of destroying them (e.g., heating) were presented next. With such a procedure it was expected that

the information will be easily assimilated.

The text was divided into four passages or segments with one instructional objective coming before each of them. The objective stated what the student should be able to do as a result of studying the passage. One such objective read:-

After reading the following passage you should be able to list the general names for the microorganisms that cause many diseases in humans.

No performance condition nor criterion level was explicitly stated in the objectives, although from the general covering directions some idea about performance condition was mentioned (i.e., free-recall and multiple choice testing). The objectives, therefore, are to be considered as specific instructional objectives.

After each segment there were questions relevant to the content of the passage and the objectives. There were ten questions and four objectives.

The text without adjunct stimuli (objectives or questions) contained 696 words; with objectives, 796 words; with questions, 820 words; and, with both objectives and questions, 920 words (Appendix A).

#### Instruments

Three types of achievement tests were administered: (1) an immediate free-recall; (2) an immediate multiple-choice recognition test; and (3) a delayed free-

recall test. Under the free-recall conditions the subjects were simply instructed to write down what they remembered about the content of the text they studied. Two qualified readers\* studied the text and agreed that the test should be marked on a possible 40 bits of information. All scores on the free-recall tests were based on 40 bits. The scoring was such that if more than one bit of information was mentioned in a sentence, the score for that sentence was based on the number of bits mentioned or incooperated. The scoring was verified by the two qualified readers and the experimenter. On the recognition test there were 20 items. These items were in multiple-choice format with each item containing five alternatives from which to choose one correct answer. The correct choices were so placed that guessing the same number choice for each item, e.g., an (a) in each instance, Ss could not get more than a third of the possible correct answers (Appendix B). The reliability of the test was low. ( $K-R_{21} = 0.2$ ).

In addition there was a questionnaire attempting to verify whether or not the subjects used the objectives and questions and whether or not they found the text easy or difficult to understand. The questions had four alternatives from which the Ss were asked to circle the one closest to their feelings on each question (Appendix C).

An unannounced delayed free-recall test was

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\* graduate students in microbiology

given six days after, to ascertain whether or not the possible immediate treatment-effects were maintained; that is, to find out if with the passage of six days the effects of the adjunct stimuli on learning were dissipated.

### Experimental Design

There were four experimental groups. The seventy-two subjects were randomly assigned to the following groups:

- (I) Ss using text alone
- (II) Ss using text with objectives
- (III) Ss using text with questions
- (IV) Ss using text with objectives and questions

The confidence level for the experiment was set at  $\alpha = .05$ .

Figure 1

### Diagrammatic Representation of the Experimental Design

NO ORIENTING STIMULI	ORIENTING STIMULI		
GROUP I	GROUP II	GROUP III	GROUP IV
Ss using text alone	Ss using text with objectives	Ss using text with questions	Ss using text with objectives and questions
n = 18	n = 18	n = 18	n = 18

The independent variable levels were: (a) text alone (with the orienting stimuli); (b) objectives; (c) questions; and (d) objectives and questions. The dependent

variables were scores on (1) an immediate free-recall of information from the experimental text; (2) an immediate recognition multiple-choice test; and (3) a delayed (6-day) free-recall test. The questionnaire was also used as a dependent variable.

### Procedure

The seventy-two Ss were randomly assigned to the treatment conditions in the following manner; the different versions of the text were randomly distributed to the Ss. The Ss were told that they were to work individually and that they should use the directions given to determine the strategy they should use in studying the text.

After studying the texts for 20 minutes the Ss turned the texts face down on the desks. The texts were removed and replaced by blank sheets of paper on which students wrote coded identification numbers. All Ss started work at the same time and had 15 minutes to do the immediate free-recall exercise.

The multiple-choice tests were distributed and completed in about six minutes. The questionnaire was then completed and handed in, and the experimenter thanked the Ss and the teacher who assisted.

The complete experimental study, i.e., introduction, distribution of papers, study time and testing time, in addition to the time at the end taken to explain what the experimenter expected to find as a result of the

study, amounted to a little over an hour.

Six days later an unannounced free-recall test was given in class. Forty Ss participated in this aspect of the experiment.

The minimum criterion level on all tests was set at 70%. That level of acceptance was not communicated to the Ss in the directions nor the objectives.

### Predictions

Because of the results of previous research it was expected that the Ss using text with both inserted objectives and questions would secure the best overall results on all achievement testing.

The objective-group and the question-group were expected to perform at approximately the same level. All groups with orienting stimuli were expected to be superior to the group using text alone, unless the information to be learned was already known by the Ss, or the learning task was so simple that any S would learn most of the information. Such 'ceiling effects' were not expected, however.

CHAPTER IV

RESULTS

The scores on the dependent variables were collected and analysed by a one-way analysis of variance and Duncan's New Multiple Range Test (Edwards, 1960) between group-means were made at  $\alpha = .05$ . The means and standard deviations for each dependent variable are presented in table 1. The analysis of variances (Table 2) reflect significant findings under the delayed free-recall situation. There were, nevertheless, a trend towards superior performances by groups using orienting stimuli under all testing conditions.

Table 4 shows the distribution of the Ss in each group under the testing situations. The distribution of the scores do not reflect much deviation between groups on the recognition test, but under the free-recall testing the major significant differences existed between the group using both objectives and questions and the control group using the text alone. Under delayed free-recall testing, 50% of the Ss in Group IV were able to reach the acceptable criterion level of 70% of total score points possible.

Table 1

Means and Standard Deviations for  
Immediate and Delayed Test Data

Variables	No orienting stimuli		Orienting stimuli		
	Text Alone		Objectives	Questions	Obj. & Questions
• Immediate Free-Recall Test					
M	20.611		24.444	25.111	25.222
SD	6.232		6.528	6.462	5.966
• Immediate Recognition Test					
M	17.000		16.889	17.056	17.778
SD	1.138		2.423	1.589	1.263
•• Delayed Free-Recall Test					
M	15.100		20.200	19.400	24.100
SD	3.215		6.989	7.291	7.866

• n = 18 for each group under immediate testing

•• n = 10 for each group under delayed testing



Table 2

Summary of the Analysis of Variance Results for the Immediate and Delayed Test Data

Variables	Source	SS	df	MS	F
Immediate Free-Recall Test	Between	257.708	3	85.903	2.164
	Within	2699.811	68	39.700	
	Total	2957.319	71		
Immediate Recognition Test	Between	8.819	3	2.940	1.042
	Within	191.833	68	2.821	
	Total	200.653	71		
Delayed Free-Recall Test	Between	408.600	3	136.200	3.127*
	Within	1567.800	36	43.550	
	Total	1976.400	39		

\* Statistically significant ( $p < .05$ )

Table 3

Multiple Comparisons:  
Duncan's New Multiple Range Test Applied  
to the Immediate and Delayed Test Data

Variables	Means	(I)	(II)	(III)	(IV)	Shortest Significant Ranges
Immediate Free-Recall Test	(1) 20.6	20.6	23.8	24.4	25.1	R <sub>2</sub> = 5.522 R <sub>3</sub> = 5.809 R <sub>4</sub> = 5.998
	(2) 23.8		3.200	3.800	4.05	
	(3) 24.4		0.006	0.006	1.03	
Immediate Recognition Test	Means	(I) 16.889	(II) 17.00	(III) 17.056	(IV) 17.181	Shortest Significant Ranges
	(1) 16.889		0.111	0.167	0.292	R <sub>2</sub> = 1.119
	(2) 17.000		0.056	0.056	1.181	R <sub>3</sub> = 1.729
Delayed Free-Recall Test	(3) 17.056				0.125	R <sub>4</sub> = 1.216
	Means	(I) 15.1	(II) 19.4	(III) 20.2	(IV) 24.1	Shortest Significant Ranges
	(1) 15.1		4.3	5.1	9.0*	R <sub>2</sub> = 5.964
Delayed Free-Recall Test	(2) 19.4			1.8	4.7	R <sub>3</sub> = 6.273
	(3) 20.2				3.9	R <sub>4</sub> = 6.473

\* Statistically significant (p < .05); even significant at  $\alpha = .005$  (R<sub>2</sub> = 8.769)

Table 4  
 Summary of Score Distribution for  
 Immediate and Delayed Test Data

Variables	Groups	Percentages								Total Above 70%
		0-49	50-59	60-69	70-79	80-89	90-100			
Immediate Free-Recall Test n = 18	I	8	2	6	2	0	0	0	2	(11.1%)
	II	2	6	5	2	2	1	0	5	(27.8%)
	III	4	2	4	5	3	0	0	8	(44.4%)
	IV	3	7	2	3	2	1	0	6	(33.3%)
Immediate Recognition Test n = 18	I	0	0	0	2	11	5	0	18	(100%)
	II	0	1	0	4	4	9	0	17	(94.4%)
	III	0	0	0	4	6	8	0	18	(100%)
	IV	0	0	0	1	6	11	0	18	(100%)
Delayed Free-Recall Test n = 10	I	9	1	0	0	0	0	0	0	(00%)
	II	5	0	4	0	1	0	0	1	(10%)
	III	4	2	4	0	0	0	0	0	(00%)
	IV	3	1	1	4	1	0	0	5	(50%)

### Immediate Free-Recall

The Ss given orienting stimuli (objectives, questions and objectives and questions together) did better than Ss using text alone (Table 1).

Although the means for Groups II, III and IV reflect higher performance (Table 2), there were no significant differences between group-means ( $F=2.164$ ,  $df=3/68$ ,  $p>.05$ ). Multiple comparisons between means failed to reveal any statistically significant differences (Table 3). The comparison between the group using text alone (control group) and the group using both objectives and questions approached statistical significance ( $F=1.042$ ,  $p>.05$ ) and so does not support the hypothesised superior performance for the group using both objectives and questions.

### Recognition Test

On the recognition test there were no statistically significant differences between means. The readability of the text used was not determined by any of the available readability formulas. No such objective measures were used since the students all performed at high levels, and since they indicated on the questionnaire that they found the text to be readily understandable. The mean scores are shown in table 2. They were very close but all above the 70% set as the level of acceptable performance. This suggested that the structure and readability of the text were probably adequate, but the test itself had an

extremely low reliability and the results were not very revealing.

Delayed Free-Recall

Under the delayed free-recall testing situation the most interesting effects were revealed. The means for the groups were 15.1, 20.2, 19.4 and 24.1 respectively (Table 2). The analysis of variance (Table 3) reflected a significant difference between groups ( $F=3.127, df=3/36, p < .05$ ). The multiple comparison reflected statistically significant performances in favour of the group using both objectives and questions ( $F=9.0, df=3/36, p < .05$ ). There was also a significant difference between the Ss using text alone and the Ss using objectives but only at the  $.05 < p < .10$  level.

Table 5 reflected the stability of the initial treatment effects on the group using both objectives and questions. The hypothesis that Ss given relevant post-questions will perform statistically better than Ss not given orienting stimuli was not supported under immediate free-recall. Under delayed free-recall testing the group using objectives out-performed the group using questions, but there was not a significant difference. In all instances the group using text alone had the lowest performance scores (Table 3).

Questionnaire Data

The scores from the questionnaire sheets were counted and divided according to negative and positive

Table 5

Comparison between Means (Free-Recall)  
showing Stability of Treatment Effects

GROUPS	Immediate	Delayed	Difference
I	20.611	15.100	-5.511
II	24.444	20.290	-4.244
III	25.111	19.400	-5.711
IV	25.222	24.100	-1.122

Table 6

Questionnaire Data

Source	Group I		Group II		Group III		Group IV	
	Pos. <sup>o</sup>	Neg. <sup>o</sup>	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
INTEREST	17	1	18	0	16	2	14	4
CONCENTRATION	15	3	16	2	15	3	15	3
DIFFICULTY	8*	10	3	15	4	14	3	15
STUDY TIME	14	4	17	1	12	6	14	4
INFO. DENSITY	16**	2	16	2	14	4	16	2
USE OF OBJECTIVES			17	1			16	2
HELP TO ORGANIZE			17	1			15	4
LIMIT ON LEARNING			13***	5			15	5
READ BEFORE PASSAGES			16	2			18	0
USE OF QUESTIONS					15	3	18	0
HELP TO ORGANIZE					14	4	18	0
HELP TO LEARN					13	6	17	1
READ AFTER PASSAGES					18	0	18	0

<sup>o</sup> Positive and Negative

\* Yes, difficult

\*\* Not too much (sufficient)

\*\*\* Not limiting on learning

aspects of the questions asked. Only the raw scores were used (Table 6). There was conclusive support for stating that the strategies used by the Ss in all groups were those suggested in the directions given with the text.

The questionnaire also revealed that the Ss had sufficient time to study the text and to re-read it (Table 7) several times.

Table 7

Group Means for No. of times Ss read text

Source	Mean times read
Group I	3
Group II	2.83
Group III	2.38
Group IV	2.50

Summary of the Results

Under immediate testing, the main postulated effect, that Ss using both inserted objectives and questions would perform better than other Ss, was supported, but the difference was not statistically significant ( $p > .05$ ).

However, under delayed testing, there was a statistically significant effect ( $p < .05$ ). The group using both objectives and questions was superior to all other groups, but significantly superior to the group using text alone even at the  $\alpha = .005$  level.

An examination of the Questionnaire data revealed that the strategies used by the Ss in the experiment were those suggested in the directions given with each version of the text. On the basis that the Ss did, the observed effects from the analysis of the testing data was attributed to the treatments given and not to the probable effects of individual cognitive strategies.

The overall superior performance by the group using both objectives and questions reflected the major postulated effect, that the preview and revision made possible through the combined use of pre-objectives and post-questions within a text would cause Ss to perform much better than Ss using either objectives, questions or text alone.

The concluding chapter will discuss these findings with respect to the study itself and with respect to the importance of these findings to the area of learning from prose.



## CHAPTER V

## DISCUSSION

When directed through orienting stimuli to concentrate on certain information in prose materials, students would be expected to do better on the learning of such information than other students not provided with orienting stimuli. Under immediate testing only an indication of possible better performance was demonstrated, but under delayed free-recall testing the postulated superior performance was confirmed. Those Ss provided with orienting stimuli again had higher performance scores, and the group using both inserted pre-objectives and inserted post-questions was significantly superior to the control group at the .05 level of confidence. Further analysis revealed that the significance was maintained even at the .005 level of confidence.

Non-significant differences on immediate testing were not entirely unexpected. Differences in test sensitivity may be a clue to differences in the task processing activities themselves as suggested by Friedman and Greitzer (1972) and may account for the different performances by the Ss on the recall and the recognition tests. With the recognition items, the questions and probable answers act as 'retrieval cues' which can trigger

a search procedure (cognitive) in the memory. Recognition tests are generally much more specific, and because of the choices (with multiple-choice) offered, easier to accomplish, though less revealing than free-recall tests or essay-type answers on the higher levels of cognition (analysis, synthesis and evaluation).

The coefficient of reliability of the recognition test ( $K-R_{21} = 0.2$ ) was too low to really reflect possible differences between groups due to treatment conditions; but the effectiveness of the instructional situations would probably reflect low estimates under multiple-choice testing. A coefficient of reliability should have been obtained prior to the experimental procedure or at some other time beside the time for experimental testing (For information on  $K-R_{21}$  see Mehrens and Lehmann, 1969; and Dizney, 1971). A more discriminating test should be developed and used to determine the probable effects of treatments. Questions requiring short essay-type answers may be more revealing.

The cognitive structure of the text itself was important to the initial similar performances by all groups involved. Text structure can and does have a positive effect on learning (Ausubel, 1963; Gagné, 1965; Frase, 1969, 1971; Friedman & Greitzer, 1972). Since the effect of this variable was not being observed and was used as an integral component in the design of the text, the possibility of its effects need not be discussed further. The important thing is that, in spite of the hierarchical structure of the text

(cognitive structure), the main experimental hypothesis was substantiated only under delayed testing.

The two factors: (1) rehearsal, afforded by the number of times the Ss read the text; and (2) the similarity of the subject matter, aided in the lengthening of the short-term memory of the Ss involved. Studies by Atkinson and Shiffrin (1968) and Dong and Kintsch (1968) lend support to the facilitative effects of rehearsal and similarity of materials on retrieval.

It is known and accepted that the long-term memory is of greater concern to the development of instructional materials (Miller, 1956; Moore, 1973). Therefore instructional materials should be designed with the specific intention of fostering long-term retention and that implies developing a resistance to forgetting by way of a good retrieval system (strategy for finding information) in the memory. With this method of arranging text materials with inserted pre-objectives and inserted post-questions, the Ss practise the recall of the information and so increase the probability of recalling such information at some later instance.

The finding that Group IV, using both pre-objectives and post-questions, did significantly better than the control group using the text alone, under delayed testing suggests that the combined effect of pre-objectives and post-questions must have caused the Ss to utilize a cognitive strategy that fostered long-term storage as well as a good

retrieval system. This inference is reflected in the observation that under delayed testing 50% of the Ss using both objectives and questions achieved the acceptable criterion level of 70% of the total criterion score, while none of the Ss with the text alone, or with questions, and only 10% of the Ss with objectives managed to achieve that level of performance.

The findings from the questionnaire offer some credibility to the main finding of the experiment. The majority of the Ss found that the text was interesting and not difficult. More Ss using text alone found that the text was difficult while more of the Ss using both objectives and questions found the text less interesting. They liked the text less but performed best. The differences between those items were minimal and so the probability of adversely affecting the effects of the treatment were rather remote. With the Ss given orienting stimuli there was consensus on their usefulness, and they all used the orienting stimuli.

The results from the questionnaire, therefore, suggest that the findings from the experiment may be safely attributed to the treatments given, and especially so, because the Ss all worked within a fixed time schedule.

In conclusion, the present study demonstrated that the combined effects of using pre-objectives and post-questions within a text can be more effective than using either one alone. The superiority of using both objectives and questions to provide favourable learning conditions was

reflected in significantly superior performance over a control group on a delayed free-recall test. Although there was no statistically significant differences between orienting stimuli groups, the groups using both objectives and questions approximated its initial learning performance while the other groups reflected decreased performances.

### Implications and Limitations

In cases where the text used does not have a cognitive structure much like what Ausubel (1963) recommends, significant results may not be obtained. However it seems reasonable to suggest that if the text is properly structured from a general introduction of concepts towards specific instances; that if the text is not too long and not too difficult for the Ss entering competences, then the combined use of pre-objectives and post-questions most probably will cause Ss to reflect significantly improved retention.

Further research may substantiate the positive effects that the results of this study have made apparent. The lengths of passages can be varied and relatively new information used e.g., fictional material. Under these restraints the effectiveness of the combined stimuli may be stretched, but given that objectives or questions alone can and do have significant effects under such conditions, (Lawson, 1974; Rothkopf & Kaplan, 1972; Frase, 1967, 1968; and Glaser & Resnick, 1972), the combined effect of both kinds of stimuli should still be additive.

Similar experiments of the kind reported here

can be done at different age and school curriculum levels to determine the universality of the facilitative effects obtained from using pre-objectives and post-questions in the same text. To control for possible 'novelty effects' longitudinal studies should also be attempted. Subjects should use learning materials of the kind utilized in the reported study for long experimental periods, e.g., a school term or a school year. With large enough numbers of subjects and reasonable controls, the long-term retention capabilities of the combined effects of inserted pre-objectives and inserted post-questions can be properly observed. If the inserted stimuli cause the students to interact with what they have come to expect through prior experiences with such stimuli especially if the effects were positive, then it is possible that the cognitive stimulation thus provided from the use of such stimuli may foster the adoption and maintenance of an intentional task-progression strategy. This strategy may cause the learners to always perform at high levels.

If from such long-term experimental observations statistically significant results are obtained then it may become advisable for instructional designers to utilize what this and other such studies may demonstrate, that using objectives and questions in conjunction can and does improve retention when learning from prose.

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APPENDIX A

Version of Experimental text given to the  
Ss using both objectives and questions

EXPERIMENTAL TEXT ON PATHOGENIC MICROORGANISMS

OBJECTIVE: AFTER READING THE FOLLOWING PASSAGE YOU SHOULD BE ABLE TO LIST THE GENERAL NAMES FOR THE MICROORGANISMS THAT CAUSE MANY DISEASES IN HUMANS.

The most dangerous organisms to humans are not necessarily the large ones, but microscopic ones that are called pathogens and may be taken into the body in food, water and air that look clean and pure. These organisms are further classified as Bacteria, Viruses, Protozoa and Fungi. A single microorganism can do very little damage by itself to the host, but under the favourable conditions of the human body, in warm moist tissues, the microorganisms multiply at an alarming rate to astronomical numbers in a few days.

Some diseases that afflict the human body, that are caused by pathogens are:- those caused by bacteria -- tuberculosis, leprosy, bubonic plague, pneumonic plague, pneumonia, diphtheria, typhoid fever, cholera, tetanus, syphilis and gonorrhoea; those caused by protozoa -- sleeping sickness, dysentery, malaria; those caused by viruses -- common cold, polio, influenza, small pox, yellow fever and measles; those caused by fungi -- ringworm and athlete's foot.

QUESTIONS: DO MICROORGANISMS REPRODUCE AT A RAPID OR SLOW RATE AND WHAT ARE THE NECESSARY CONDITIONS FOR REPRODUCTION?

NAME EXAMPLES OF DISEASES CAUSED BY BACTERIA, VIRUSES, PROTOZOA AND FUNGI.

OBJECTIVE: YOU SHOULD BE ABLE TO DESCRIBE THE MANNER IN WHICH VARIOUS DISEASE INDUCING MICROORGANISMS ENTER THE HUMAN BODY.

Pathogens cannot cause diseases unless they first enter the human body and produce toxins. The points at which entry is made are called the portals of entry. Organisms that cause respiratory diseases are usually coughed, sneezed or exhaled into the air in minute droplets of moisture that remain suspended in the air for long periods of time and are likely to be inhaled by another person. Such infection that results is called droplet infection. Some diseases spread in this way are tuberculosis, diphtheria, pneumonia and the common cold.

Organisms of intestinal diseases are discharged from the body in fecal material which often reaches water supplies or adheres to unwashed hands. The water may be used to drink and the dirty hands to prepare food. Those organisms enter the body of the potential victims through the use of contaminated food and water. Diseases spread in this way are typhoid fever, paratyphoid, cholera and amoebic dysentery.

Malaria and some other diseases of the circulatory system are transmitted by insects' bites -- through the blood.

Venereal diseases such as syphilis and gonorrhea are ordinarily transmitted through sexual contact by way of the vagina, penis and the mouth.

Some diseases have only one effective portal of entry, some have more than one portal of entry. Tetanus microorganisms may enter the body in several ways, but only when introduced through an open wound will the host become sick. The bubonic plague microorganisms are transmitted by the bites of rats and fleas, and are confined usually to the circulatory system; but if the infection gets very severe the microorganisms may break out of the blood vessels and reach the lungs, causing what would then be known as pneumonic plague. This form of the plague can then be spread by droplet infection.

QUESTIONS: EXPLAIN DROPLET INFECTION AND NAME SOME DISEASES SPREAD IN THAT WAY.

NAME SOME DISEASES SPREAD BY INSECTS' BITES, BY SEXUAL CONTACT, AND THROUGH OPEN WOUNDS.

HOW DOES THE BODY GET INFECTED WITH BUBONIC PLAGUE AND WHAT OTHER AFFLICTION CAN RESULT?

OBJECTIVE: YOU SHOULD BE ABLE TO DISCUSS THE PROCESS BY WHICH PATHOGENS THAT HAVE BEEN INTRODUCED INTO THE BODY SET UP THE INFECTION THAT CAUSES THE HOST TO BECOME SICK.

The introduction of pathogens into the host's body does not ensure that sickness will result. The occurrence

of the disease depends on the virulence of the microorganisms -- that is, the ability of the organisms to spread through the host's body and to produce toxins or do other damage to the body. Toxins are poisonous substances.

The ability of the pathogens to spread through the host's body depends on the possession by the microorganisms of any of several substances to counteract the host's defences.

The host's body produces white blood cells that surround and destroy the microorganisms. Some bacteria produce capsules of gelatin that protect them against white blood cells. Others produce leucocidins that kill the white cells. Some others even dissolve red blood cells.

The cells of most tissues are held together by the intercellular substance, hyaluronic acid. Some microorganisms produce enzymes which cause the separation of the body cells by dissolving the hyaluronic acid that holds the cells together. The microorganisms then rapidly penetrate the host's body tissues.

Some bacteria produce toxins -- substances that are highly poisonous to the host and can cause death to the host.

QUESTIONS: WHAT IS MEANT BY VIRULENCE OF AN ORGANISM?

WHAT DEFENCE MECHANISM DOES THE HUMAN BODY USE TO CONTROL THE SPREAD OF PATHOGENS THROUGH THE BODY?

HOW DO PATHOGENS EVADE THE DEFENSIVE ACTION OF THE HOST'S BODY?

OBJECTIVE: AFTER READING THE PASSAGE YOU SHOULD BE ABLE TO SPECIFY THE DIFFERENCES BETWEEN EXOTOXINS AND ENDOTOXINS AND NAME SOME PLACES WHERE THESE MAY BE FOUND.

There are two general types of toxins produced by bacteria: exotoxins, which are secreted by living cells and; endotoxins, which are not released until the death of the cells that will produce them.

Exotoxins are proteins and are most poisonous. One well known exotoxin is Clostridium Botulinum which causes a deadly form of food poisoning known as botulism. This clostridium botulinum thrives and is produced in improperly canned fish, beans or meats. Only a small taste of the contaminated food may be lethal -- sufficient to cause death. Fortunately this toxin is destroyed by heat. Any suspect food can be boiled ten or fifteen minutes to make it safe for eating. Other diseases associated with exotoxins are tetanus, anthrax and diphtheria.

Endotoxins are complexes of proteins, lipids and carbohydrates. Endotoxins are not destroyed by heat, unfortunately. They are produced by a variety of pathogens, especially those that live in the intestinal tract of the host. Endotoxins cause nausea, diarrhoea and fever -- symptoms of many gastrointestinal diseases.

QUESTIONS: HOW IS BOTULISM CAUSED AND HOW CAN THE CLOSTRIDIUM BOTULINUM BE DESTROYED?

WHAT ARE SOME OF THE ENDOTOXIN RELATED DISEASES?

APPENDIX B

Multiple-choice test items

MULTIPLE-CHOICE TEST DIRECTIONS

Name: .....

.....Directions.....

On the following pages you will be required to answer some specific questions.

Answer each question by selecting one of the five possible choices.

Select your answers in the following manner.

(Example)

The word 'Ibo' denotes

- a) a card game
- b) an African people
- c) a part of the body
- d) an exotic fruit
- e) a Nordic race

The correct answer is 'an African people', so you should draw a circle around the letter **(b)**.

ANSWER ALL OF THE QUESTIONS

TURN THE PAGE AND BEGIN TO DO THE MULTIPLE-CHOICE TEST

(You have 10 minutes)



1. What are the necessary conditions for the reproduction of most pathogenic microorganisms?

- a) hot and dry bodies
- b) wet and cold places
- c) 100°c
- d) cool and dark places
- e) warm and moist tissues (98.6°F)

2. Leprosy, bubonic plague and diphtheria are caused by

- a) fungi
- b) protozoa
- c) bacteria
- d) viruses
- e) all of the above

3. Which of the listed diseases is caused by the protozoa microorganisms?

- a) ringworm
- b) dysentery
- c) common cold
- d) plague
- e) all of the above

4. The skin disease, athlete's foot, is caused by

- a) fungi
- b) protozoa
- c) bacteria
- d) viruses
- e) none of the above

5. Some diseases like tuberculosis, and the common cold are introduced to the body through

- a) open wounds
- b) insect bites
- c) droplet infection
- d) sexual contact
- e) all of the above

6. The bubonic plague microorganisms enter the victim by means of

- a) bites of fleas and rats
- b) sexual contact
- c) open wounds
- d) virulence
- e) none of the above

7. The process by which pathogens are coughed into the air and breathed in by someone else is called

- a) contamination by infected water
- b) droplet infection
- c) pathogenic infection
- d) venereal infection
- e) none of the above

8. Which of the following is spread by sexual contact?

- a) syphilis
- b) cancer
- c) yellow fever
- d) tetanus
- e) pneumonic plague

9. A victim can be infected with pneumonic plague when
- a) the infection gets very severe
  - b) the victim is bitten a second time by infected rats
  - c) the bubonic plague pathogens break out of the circulatory system and enter the lungs
  - d) if the plague victim has a cold
  - e) in all of the above
10. The process by which pathogens spread through the body of the host and produce toxins is called
- a) virulence
  - b) portals of entry
  - c) leucocidins
  - d) pathogen potency
  - e) none of the above
11. How do pathogens that have entered a host protect themselves from the defences of the host's body?
- a) they hide in dark corners
  - b) they surround themselves in capsules of gelatin or kill the white blood cells
  - c) by multiplying at astronomical rates
  - d) by producing hyaluronic acid
  - e) in all of the above ways
12. Droplet infection usually spreads
- a) intestinal diseases
  - b) respiratory diseases
  - c) circulatory diseases

- d) venereal diseases
  - e) all of the above
13. The particular toxin found in contaminated canned food is
- a) the endotoxins
  - b) the exotoxin clostridium botulinum
  - c) the exotoxins
  - d) hyaluronic acid
  - e) none of the above
14. Clostridium botulinum can be destroyed by
- a) boiling the contaminated food for 10 or 15 minutes
  - b) removing the intestines
  - c) throwing away the suspected food
  - d) curing the diseases associated with it
  - e) exposing to direct sunlight
15. The pathogens that produce endotoxins live mostly in the
- a) living cells
  - b) the intestinal tract
  - c) improperly canned food
  - d) fish
  - e) meat
16. Which of these diseases are caused by endotoxins?
- a) influenza
  - b) diphtheria
  - c) gastrointestinal diseases
  - d) plague
  - e) common cold

17. Which of the following is not a pathogenic classification?
- a) anthrax
  - b) protozoa
  - c) bacteria
  - d) viruses
  - e) fungi
18. Which of the following has more than one effective portal of entry into the host's body?
- a) tetanus
  - b) plague
  - c) dysentery
  - d) malaria
  - e) none of the above
19. The tetanus microorganisms effectively enter the human body by means of
- a) contaminated drinking water
  - b) ingestion of contaminated soil
  - c) open wounds
  - d) sexual contact
  - e) droplet infection
20. What defense mechanism does the host's body use to protect itself against the spread of microorganisms?
- a) the red blood cells destroy them
  - b) white blood cells ingest and kill them
  - c) the body produces toxins

- d) the microorganisms are coughed out
  - e) all of the above
- 

- REMEMBER:
1. Check to see that you have circled the one best answer to each question.
  2. Having finished, turn your question package face down on the desk and raise your hand. The experimenter will come and get it.
  3. Will you please be as quiet as possible so as not to disturb those still at work.

THANK YOU

APPENDIX C

Questionnaire items

Items 1 to 15 were given to the Ss using -  
both objectives and questions within the text.

Items 1 to 6 and 11 to 15 were given to the  
Ss using questions within the text.

Items 1 to 10 were given to the Ss using  
objectives within the text.

Items 1 to 6 were given to the Ss using the  
text alone.

QUESTIONNAIRE

DIRECTIONS: Circle the answer that is closest to your feelings on each question.

1. Did you find the text interesting?

4	3	2	1
Very interesting	Quite interesting	Not very interesting	Not at all interesting

2. What was your degree of concentration in studying the text?

4	3	2	1
Great concentration	Quite some concentration	Little concentration	Very little concentration

3. Was the information in the text difficult to learn?

4	3	2	1
Very difficult	Quite difficult	A little difficult	Not at all difficult

4. Was the amount of time given to study the text sufficient?

4	3	2	1
Very sufficient	Quite sufficient	Barely sufficient	Not really sufficient

5. How many times did you read the text?

4	3	2	1
Four times	Three times	Twice	Once

6. Was there too much information for you to learn in the text?

4	3	2	1
Much too much	Too much	Not too much	Not at all too much



7. Did you use the learning objectives in studying the text?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

8. Did the objectives help you to organize in your memory the information you had to learn?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

9. Did the objectives limit the types of information you learned from the text?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

10. Did you read the objectives before studying the text?

4	3	2	1
Very carefully	Carefully	Carelessly	No

11. Did you verbally attempt the answer to the questions at the end of each passage?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

12. Did the questions help you organize the information in your memory?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

13. Did the questions help you to better understand and learn the information contained in the passages?

4	3	2	1
A great deal	Quite a bit	Very little	Not at all

14. Did you read the questions before you read the passages?

1. Yes
2. No

15. Did you read the questions after you read the passages?

1. Yes
2. No

APPENDIX D

Covering directions given to  
the four experimental groups.

These directions prefaced the  
corresponding version of the text  
given to Ss.

NAME: \_\_\_\_\_

### DIRECTIONS

Your participation in this study will enable educational researchers to better understand one aspect of how people learn from textual materials. Follow the directions given and please do not make notes.

You are to consider the text seriously, the same as you will any other written text from which you are expected to learn information. Study the text.

This is an experiment in learning. It is not for a grade and has nothing to do with your regular course work. Information gathered from the experiment will be used strictly towards the purpose of the experimenter's investigation into prose learning.

You will be asked to do (1) a free-recall exercise at the end of studying the text. You will be required to write everything that you can recall from the text; (2) a 20-item multiple-choice test; and (3) a short questionnaire on how you studied the text.

You have 20 minutes to study the text; 15 minutes in which to do the free-recall exercise; 10 minutes to do the multiple-choice items; and, 5 minutes to do the questionnaire.

All material used in the study must be returned to the experimenter.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. THANK YOU.

NAME: \_\_\_\_\_ (OBJECTIVES & TEXT)

### DIRECTIONS

Your participation in this study will enable educational researchers to better understand one aspect of how people learn from textual materials. Follow the directions given and please do not make notes.

You are to consider the text seriously, the same as you will any other written text from which you are expected to learn information.

This is an experiment in learning. It is not for a grade and has nothing to do with your regular course work. Information gathered from the experiment will be used strictly towards the purpose of the experimenter's investigation into prose learning.

You will find an objective at the start of each passage. These objectives will serve to orient the reader to what he or she is to concentrate on. Use them as guides to study.

You will be asked to do (1) a free-recall exercise at the end of studying the text. You will be required to write everything you can recall from the text; (2) a 20-item multiple-choice test; and (3) a short questionnaire on how you studied the text.

You have 20 minutes to study the text; 15 minutes to do the free-recall exercise; 10 minutes to do

the multiple-choice items; and, 5 minutes to do the questionnaire.

All material used in the study must be returned to the experimenter.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. THANK YOU.

NAME: \_\_\_\_\_ (QUESTIONS & TEXT)

### DIRECTIONS

Your participation in this study will enable educational researchers to better understand one aspect of how people learn from textual materials. Follow the directions given and please do not make notes.

You are to consider the text seriously, the same as you will any other written text from which you are expected to learn information.

This is an experiment in learning. It is not for a grade and has nothing to do with your regular course work. Information gathered from the experiment will be used strictly towards the purpose of the experimenter's investigation into prose learning.

You will be given some questions at the end of each prose passage. These questions should act as a review on what you would have read and remembered. Attempt to answer all the questions mentally, after reading the relevant passages.

You will be asked to do (1) a free-recall exercise at the end of studying the text. You will be required to write everything you can recall from the text; (2) a 20-item multiple-choice test; and (3) a short questionnaire on how you studied the text.

You have 20 minutes to study the text; 15 minutes to do a free-recall exercise; 10 minutes to do the

multiple-choice items; and, 5 minutes to do the questionnaire.

All material used in the study must be returned to the experimenter.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. THANK YOU.



NAME: \_\_\_\_\_ (OBJECTIVES & QUESTIONS & TEXT)

#### DIRECTIONS

Your participation in this study will enable educational researchers to better understand one aspect of how people learn from textual materials. Follow the directions given and please do not make notes.

You are to consider the text seriously, the same as you will any other written text from which you are expected to learn information.

This is an experiment in learning. It is not for a grade and has nothing to do with your regular course work. Information gathered from the experiment will be used strictly towards the purpose of the experimenter's investigation into prose learning.

You will be given objectives before each passage and questions at the end of each passage. The objective will orient you as to what you should retain from the text. The questions will act as review and set the information in your memory. Answer all the questions mentally.

You will be asked to do (1) a free-recall exercise at the end of studying the text. You will be required to write everything you can recall from the text; (2) a 20-item multiple-choice test; and (3) a short questionnaire on how you studied the text.

You have 20 minutes to study the text; 15

minutes to do a free-recall exercise; 10 minutes to do the multiple-choice items; and 5 minutes to do the questionnaire.

All material used in the study must be returned to the experimenter.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO. THANK YOU.