RATE OF ACQUISITION OF THREE STUDY METHODS

by

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We accept this thesis as conforming to the
required standard

THE UNIVERSITY OF BRITISH COLUMBIA

November, 1971
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Date **NOVEMBER 12, 1971**
ABSTRACT

The relative rates of acquisition of three study methods taught college-level students were investigated. The term "rate of acquisition" was defined as the ease with which facility was achieved by students in the use of study methods. The study methods were: Survey, Question, Read, Recite, Review (SQ3R), Non-Linear Outlining (NLO) and Three-Level Outlining (3LO). The primary research questions raised were whether the relative rates of acquisition among the study methods would be the same at two different times during the study, and after the period of instruction. In addition, the question was asked if the relative rates of acquisition among the study methods would depend upon the readability levels of the instructional material which was drawn from a commercial reading and study manual (Miller, 1964).

The research design involved manipulating three independent variables: (1) the Treatments of SQ3R, NLO, and 3LO; (2) the Difficulty levels of instructional material as determined by the Flesch (1951) readability formula and designated EASY, MEDIUM, DIFFICULT; (3) the Time of assessment over the period of instruction which had two levels, Time 1 and Time 2.

The criterion measure for each reading exercise was a rate-of-gain score termed an Effective Reading Rate (ERR) which was the product of the student's comprehension score and his study reading time for any given article.
The results of the study indicated that no one study method appeared to be advantageous in terms of its rate of acquisition over the period of the study.

The NLO method did show a significantly higher ERR by the seventh week of instruction. An analysis of the data revealed that the variability of this finding was due to performance by students taught NLO on material of an EASY classification (low readability level). The implication is that NLO may be advantageous in terms of its rate of acquisition when paired with material of a low readability level.
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Chapter I

NATURE AND PURPOSE OF THE STUDY

Background of the Study and Related Literature

In the last twenty years study skills instruction has become a part of most college reading programs. Blake (1953) reported that over 90 per cent of the colleges in the United States offered reading improvement courses which included instruction in study skills. More recently, Geerlofs and Kling (1968) substantiated this finding and indicated that techniques which facilitate reading for study purposes are considered an essential component of nearly all college study skills programs.

However, a recent review of study skills research by Crewe and Hultgren (1968) notes that the question of which study technique is most suitable for college level study reading remains unsettled. Crewe and Hultgren were unable to identify any particular technique as being the most effective because so little research had been conducted on the relative effectiveness of study methods. They concluded their report by pointing out the need for a publication which summarized all research on study skills to serve as a reference tool for professionals engaged in this field.

One such evaluation of the research results on study skills courses was done by Entwisle (1960) who reviewed twenty-two reports. She included research studies which defined study skills in a broader sense than did Crewe and Hultgren who focused only on study reading.
techniques. For example, in Entwisle's review, evaluations were made of programs which included instruction in topics such as essay writing, study-time budgeting, and exam writing. Some courses included individual counselling for students with motivational problems. However, an examination of the reported studies revealed that all used evaluative criteria based on the amount and permanence of gains made by students on standardized reading tests or in grade point averages. Instruction in efficient reading techniques may be assumed to have been important in these programs. Entwisle noted that study skills do contribute to academic achievement but did not indicate the superiority of any one technique or program for either criterion mentioned. Furthermore, those criteria illustrated the overriding concern of previous research with pretest-posttest gain scores. No distinction was made between the period of time during which the student was learning new study techniques and the period after which he had gained facility in their use.

The importance of the instructional situation in determining the most suitable study-reading techniques for college students seems an important but neglected aspect of the research on study skill efficacy. Wright (1962) pointed out that student resistance to preview methods of study-reading such as Robinson's Survey, Question, Read, Recite, Review (SQ3R) and its many variants was often encountered. Wooster (1953) concluded that many students were unenthusiastic about such methods. In the studies reviewed by Entwisle, student motivation was viewed as scholarly drive or level of morale.
As such, motivation was considered a personality characteristic of the student and presented a possible confounding variable in experimental design to the controlled by establishing motivationally equivalent comparison groups.

An alternate view of student motivation is offered by Wood (1961) who examined the relationship between motivation and progress of students enrolled in a general reading improvement course designed to increase reading rate and comprehension. Using student drop-out rate as a criterion of program success, Wood concluded that attrition was not related to any measure of student personality characteristics but rather to objective evidence of their progress in the course. In Wood's study, student progress was evaluated by a reading-efficiency score defined as the product of the reading rate and the comprehension scores. Daily increases in the reading-efficiency score constituted the rate-of-gain for each student.

Although not directly concerned with study methods, Wood's research suggested another dimension that should be considered in any evaluation of the efficacy of any study method. This was the interaction between the productivity of a study method and student motivation or perseverance during the instructional period. This research further suggested the criteria used in any evaluation of study method efficacy should not be concerned with increases in grade point averages alone as they occur sometime after the course; nor should they be only comprehension and/or reading rate gain scores. Instead the criteria should include a rate-of-gain score obtained
during the instructional period. The question of which study method to teach may then be more fully answered.

The study technique Survey, Question, Read, Recite, Review (SQ3R) developed by Robinson (1941) is the one most frequently taught in college reading courses (Harris, 1968). Several other study methods are reported elsewhere in the literature; but as Cranny (1955) pointed out, these involve slight modifications of SQ3R and their theoretical basis depends upon the same or similar research. In view of this, the research which related to SQ3R applies to its many variants.

An extensive review of the research pertaining to the empirical basis of the rationale for the SQ3R method is not planned here as complete reviews are already available. McCormick (1943) has provided a detailed review of forty-six relevant articles.

The research on the SQ3R steps has also been fully reviewed. Wark (1964:168) indicated what he considered some of the fundamental problems with the method:

The Survey step is based on an overly generous extra-polation from a short passage to a whole text. The Question step is advocated in the face of data which show that pre-questioning may be a detriment to comprehension. The working note form of Recitation is probably effective, but no evidence is given that it is any better than simple re-reading.

Willmore (1963) concluded:

The Survey step has not really been tested, and studies which are relevant are unimpressive in supporting the value of Survey. Questions can be helpful, but weaknesses were found in many of the studies; and in general, it would be difficult to generalize to other settings since so much depends on type of material and where the questions are placed. The value of Recitation and Review are well established, but there is no evidence that they are more effective if applied in the SQ3R manner.
A recent review of the literature on study skills by Crewe and Hultgren (1968) demonstrated the paucity of research examining SQ3R as a total system or as compared to other dissimilar methods such as underlining.

One analysis of the complete SQ3R method was done by Wark (1964:168) who reported that the results of his "large scale study skills project" showed SQ3R to be ineffective. Wark's concluding statement that SQ3R is supported more by tradition than any rigorous consideration of the data on productivity is interesting, for it characterizes the focus of nearly all the research done on the method, that is, on the end product. The concern is with the system as an organizational aid in promoting increased comprehension and retention for content-master questions of student texts.

To some degree two studies depart from this focus on comprehension gain scores. Wooster (1953) included in his findings a mention of reading rate increase and student acceptance of SQ3R; both of which were negative.

In a comparative study of SQ3R, Underlining, Outlining, and Reading, Willmore (1966:110) used the following criteria to determine the superiority of the Underlining technique:

1) significantly higher scores than all other techniques,
2) less implementation time than SQ3R or outlining, and
3) shown greater preference by most students.

While not emphasizing it, both studies indicated a different interpretation of the productivity of a study skill; that is, the efficiency of the method in terms of economy of study time.
In the SQ3R method the recitation step requires the sequential construction of an outline type of organizational pattern. Robinson (1961:29) suggested the following procedure for recitation:

Having read the first section, look away from the book and try briefly to recite the answer to your question. Use your words and name an example. If you can do this you know what is in the book; if you can't, glance over the section again. An excellent way to do this reciting from memory is to jot down cue phrases in outline form on a sheet of paper. Make these notes very brief.

The emphasis of this step in the SQ3R procedure is on the specific form of the note-taking - 'cue' phrases written down in sequential outline form from memory. Robinson (1961:26) drew upon Arnold's (1942) study to justify this format stating that:

Recitation techniques of complete outlining, underlining, writing summaries, jotting down summary phrases, and discussions have tried, and the system of reading a headed section and then jotting from memory a key phrase or so in the reader's own words have been found the most effective.

However Arnold's research showed no significant differences for comprehension when outlining, underlining with marginal notes, precis writing and re-reading were compared with each other. It is difficult to see how Robinson could relate his recitation proposals to Arnold's results.

Willmore (1966) compared merely outlining with outlining in the SQ3R procedure with college students and found the latter to be significantly superior in terms of increased comprehension of textbook material. These results must be qualified, however, because the techniques were presented to all experimental groups, and as SQ3R employs an outline format for its organizational pattern, a carryover effect may have resulted.
Willmore's results must be further qualified in view of Wooster's (1953) study on SQ3R.

Wooster's subjects were given a ten-week training period which was presumably long enough for them to become well trained in the SQ3R method. No gains in either comprehension or reading rate were evidenced. He concluded that students spent most of their time acquiring additional skill in outlining and were not able to learn the total, integrated method.

There is some evidence that the outlining format, which Robinson uses in the SQ3R system, can become effective if extensive training is given in the technique. Barton (1930) found that outlining resulted in greater comprehension gains than merely reading only if students were first given training in outlining.

A study which was concerned with the instructional aspects of outlining was done by Stone (1962). His criteria for evaluating student progress was their improved facility in outlining. Increased facility in outlining was measured by a decrease in the amount of time needed to read and outline an article. No comprehension measure was obtained; instead students exchanged outlines and evaluated them for appropriateness of content on a consensus basis. While Stone did not obtain any objective measure of comprehension, he did report significant gains in reading outlining times for textbook material.

Both SQ3R and one of its modifications, Three Level Outlining (3LO) developed by Johnson (1964) were used in a Reading and Study Skills course at Simon Fraser University during the summer semester.
The students reported dissatisfaction with the amount of practice time needed to acquire facility with these methods and few used them in their studying.

Examination of research revealed a lack of comparative studies of the relative instructional efficacy of study techniques. The requirements which a method must meet in order to be readily acquired were examined.

A necessary requirement of any technique if it is to be readily acquired is that it provide a framework which allows rapid yet accurate perception of basic relationships (chronology, cause and effect, main and subordinate ideas) within and across a variety of instructional materials. As well, the organizational pattern, the written outline, must be flexible enough to allow the addition of as much or as little supportive detail as needed. Finally, the organizational pattern must function as a recall pattern.

The provision of a rapid and accurate initial orientation in the material devolves upon the Survey step in any study method. However, it is the resulting graphic representation of the organizational pattern which both facilitates perception of the author's organization, and provides the framework within which additional detail is placed. Both SQ3R and 3L0 attempt to do this in a logical and sequential manner. However, an examination of a statement by Johnson (1964:269) in support of his method over that of Robinson's served to illustrate the shortcomings of both in this respect. Johnson stated that the lack of organization commonly found in an introduction to texts,
which he labels a 'misplaced glossary', is perceived by the student employing SQ3R as a legitimate discussion of a topic unless the survey step is performed exceptionally well. Such a mis-reading will not occur, he claimed, if 3LO is used because the manipulation of the material does not take place until a complete outline is made. Illustrated here was the inadequacy of SQ3R in providing the student with an accurate initial orientation into the material as well as the inability of 3LO to do so with any rapidity. Both the rigid procedures and time required to perform these techniques suggested reasons for their failure to provide an adequate comprehension level within an acceptable study-time limit.

Because of the foregoing criticism of SQ3R and 3LO attention was directed toward the development of an alternative study procedure and organizational pattern. A technique was needed which would allow the student to perceive and evaluate an author's presentation rapidly, yet accurately.

As an alternative to the sequential and time consuming operations required for the construction of the SQ3R and 3LO organizational patterns, the matrix structure of Jenkinson (1966) was adapted to form the NLO for use in a study procedure termed POPRADR.

The study procedure entitled POPRADR stood for: P—the student pre-read the article; OP—he then constructed the organizational pattern (OP) which was a written outline; R—next he read the article; AD—then he added supportive detail to his OP; R—finally he reviewed by answering comprehension questions. Unlike the
sequential treatments of either SQ3R or 3L0, the NLO organizational pattern is unordered and thus allows main ideas to be more readily symbolized in written form according to the student's initial perception and categorization of the written information. By restructuring or manipulating the information at the beginning rather than at the end of the method's procedure, the time required to read should be reduced. Any adjustments to the relative importance of subtopics as determined during reading may still be accommodated within the organizational pattern at the AD step.

A preliminary study (Franklin and Sweet, 1970) was undertaken to compare the three methods of SQ3R, 3L0, and NLO using the criterion of rate of acquisition for instructional materials drawn from a reading study manual. Rate of acquisition was defined as the ease with which students achieved facility in the use of the study methods. The results of the study showed that, as compared to SQ3R and 3L0, the NLO was more easily acquired as measured by a reading rate-of-gain score. However, the study was limited to students enrolled in the arts and science faculties of a four year university and only one readability level of material was used. Before any decision could be made concerning which of the three techniques was most easily acquired, further study was needed. Toward this end the present study was undertaken.

The Problem

The present study sought to establish the relative rates of acquisition of students taught SQ3R, NLO, and 3L0, respectively.
The investigation was designed to answer three questions:

1. Will the relative rates of acquisition among the study methods be different at various times during the period of instruction?

2. Will the relative rates of acquisition among the study methods depend upon the readability level of the instructional material?

3. Will the relative rates of acquisition among the study methods be different after the period of instruction?

For the purpose of formulating experimental hypotheses to answer the first two research questions, three manipulated independent variables were selected: (1) Treatment groups, the levels of which were SQ3R, NLO, and 3LO; (2) Difficulty levels of instructional material, defined by the Flesch readability formula as the three levels of EASY, MEDIUM, and DIFFICULT; (3) Time of assessment, which had two levels, determined by two points of time during the instructional period, ie. at the fourth and seventh week of the study.

For the purpose of formulating experimental hypotheses to answer the third research question, two manipulated, independent variables were selected: (1) Treatment groups, the levels of which were the study methods SQ3R, NLO, and 3LO (as above); (2) Time of assessment which had two levels, the pretest and posttest.

The dependent variable used in the study was a rate-of-gain score termed Effective Reading Rate (ERR). This index was the product of the students comprehension score, expressed as a proportion, and the study-reading time, expressed in words-per-minute, for a given article. The ERR was assessed at four different times during the study: (1) the first week (pretest); (2) the fourth week; (3) the seventh week; (4) the eighth week (posttest).
The following experimental hypotheses were formulated for the first research question.

Hypothesis 1. There will be a significant overall difference in ERR among the Treatment groups favouring the NLO when Time of assessment and Difficulty of reading material are pooled.

Hypothesis 1 is the expectation that a significant difference will exist among the study methods for the period of instruction. Support for this hypothesis comes from the study of Franklin and Sweet (1970) who found that NLO resulted in a higher rate-of-gain score as compared to SQ3R and 3L0 for a six week period of instruction.

Hypothesis 2. There will be a significant difference in ERR between the assessment Times in the direction of the second assessment time when both Treatment and Difficulty are pooled.

Hypothesis 2 is the expectation that instruction and practice will result in increased facility in the use of study methods by students. This will be reflected in an increased rate-of-gain score for the Treatment groups over the period of instruction.

The following experimental hypothesis was formulated for the second research question:

Hypothesis 3. There will be a significant difference in ERR among the Difficulty levels (readability levels) of the reading material when the levels of Treatment and Time are pooled.

Hypothesis 3 is the expectation that the differentiation of the reading material by the readability formula is a meaningful one for the sub-population.

The following experimental hypothesis were formulated for the third research question:
Hypothesis 4. There will be a significant difference in ERR among the Treatment groups in favour of the NLO after the period of instruction.

Support for Hypothesis 4 comes from the findings of Franklin and Sweet (1970), that NLO had a significantly higher rate-of-gain score as compared to SQ3R and 3LO after a six week period of instruction.

Hypothesis 5. There will be a significant difference in ERR between the pretest and posttest for all Treatment groups in the direction of the posttest.

Hypothesis 5 parallels hypothesis 2 as it is expected that instruction and practice will result in increased facility in the use of study methods by students. This will be reflected in increased rate-of-gain scores for the Treatment groups over the period of the study.

While insufficient evidence exists with which to specify experimental hypotheses for the following interactions, they will be investigated as they are relevant to the first two research questions: (1) a Treatment x Time interaction effect; (2) a Treatment x Difficulty interaction effect; (3) a Treatment x Time x Difficulty interaction effect.

Theoretical Rationale

Most evaluative research on study method efficacy at the college level has used the criterion of pretest and posttest gain scores for comprehension. This is a measure of a students acquired facility in the use of a study method.

Previous research has not focused on the period of learning between the pretest and posttest. Measures of student performance
such as comprehension or reading rate made during this period reflect increasing degrees of facility in the use of study methods.

The studies by Wright (1962), Wooster (1953), and Franklin and Sweet (1970) suggested that, during the learning period, perseverance was needed to acquire facility in the use of a study technique. These studies further suggested that perseverance was lacking in many students enrolled in college reading and study courses.

The notion of rate of acquisition formulated for the present study assumed an interaction between students' perseverance and their awareness of increasing facility in the use of a study method. By using a rate-of-gain index termed an Effective Reading Rate (ERR) as the dependent variable the concept of rate of acquisition was quantified. It was assumed that rate of acquisition would be indicated by an improved ERR over the period of study. The ERR was the evaluative criterion used for determining the relative rates of acquisition, or instructional efficacy, of the study methods.

Summary

Research on the efficacy of study skills, and in particular on SQ3R, typically emphasized the data on productivity, such as reading rate or comprehension gain scores on standardized reading tests. Increases in academic performance were also widely used as evaluative criteria. Although student motivation is a problem in the learning and acquisition of study techniques, it was viewed as a personality characteristic of the student and was not generally considered to be intimately related to the instructional situation.
Wood's study showed that student attrition rate was correlated with objective measures of progress in a reading and study course. This suggested that the acquisition of a study technique would be facilitated by providing the student with a rate-of-gain score as evidence of his progress. It was proposed that rate-of-gain scores should also function as one of the evaluative criteria for determining the most suitable study technique for college level students.
Chapter II

METHOD

Experimental Design

In order to answer the research questions formulated in the study (see e.g. P. 10) it was necessary to manipulate three independent variables: (1) the Treatment groups designated SQ3R, NLO, and 3LO; (2) the levels of Difficulty of the informal (non-standardized) assessments made up of instructional materials drawn from a reading and study manual (Miller, 1964), differentiated by the Flesch readability formula and designated EASY, MEDIUM, and DIFFICULT; (3) the points of Time during the study at which the informal and formal (standardized) rate of acquisition assessments were made. The Nelson-Denny Reading Test for High Schools and Colleges, (1960) was used for the formal assessments. The informal assessment materials are contained in Appendix B.

Treatment. The first research question was formulated to ascertain the relative rates of acquisition of study methods. It was assumed that the dependent variable, the ERR, would be higher for a study methods which provided a rapid yet accurate initial perception of the main idea relationships in the material. This assumption makes the organizational pattern the focal point of any study methods. The NLO provides a non-linear organizational pattern while the SQ3R outline is linear in format. Figure 1 illustrates this difference.
<table>
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<td>a. Detail</td>
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![Figure 1. Comparison of Linear and Non-Linear Outlining Formats](image)

The procedures of SQ3R and NLO may be contrasted in terms of order as well. For example, SQ3R requires the student to pre-read the material, then list the main ideas as they appeared in the article. NLO allows the student to combine main ideas according to his perception of their relative importance during pre-reading. Following the construction of the initial organizational pattern, SQ3R requires the student to deal with each main idea in a sequential fashion while NLO makes no such restriction.

Three-Level Outlining (3LO) was included in the study because, although its organizational pattern format is similar to SQ3R, 3LO differs somewhat in procedure. For example, an arbitrary number of sub-divisions in the outline (a minimum of two and a maximum of five main ideas) requires the student to regroup and consolidate what he has read. This operation was claimed by its author to require the student to identify the main ideas and perceive the major relationships as quickly as possible (Johnson, 1964:273).
Detailed descriptions of the SQ3R, NLO and 3L0 study procedures are contained in Appendix A.

For comparison and instruction purposes all three techniques could be accommodated within the POPRADR framework, even though each differs in procedural purpose. Thus, time could be controlled for the P step, the OP step, and the total procedure. This provided a means of measuring the efficacy of each technique by unit of study time. By controlling the P and OP steps a closer analysis of their relative effect upon the R and AD steps could be obtained. The variation in study time between techniques was obtained in the R and AD steps as the student noted the time he had completed these steps. A maximum time of three and one half minutes was placed on the R and AD steps for each reading exercise. This raised the possibility of imposing a floor effect upon the ERR but previous experience in Simon Fraser University Reading and Study laboratory suggested it would not. Total time spent in study in the POPRADR framework then, was measured from the beginning of the Pre-reading to the point where the student was ready to answer the comprehension questions. Comprehension questions on the articles read were substituted for the Review (R) step and reflected the amount of recall obtained from the whole procedure as aided by the OP which also functioned as a recall pattern. It may be charted as follows:
Thus a comparison of two linear and one-linear outline formats and procedures was obtained.

**Level of Readability of the Instructional Material.** The second research question was formulated to ascertain the relative effect of the readability levels of the instructional material upon the ERRs of the study methods. The informal assessments were made using this material which was drawn from a reading and study manual (Miller, 1964).

The choice of a reading and study manual for the instructional material, and the use of a readability formula to differentiate that material are described below.

Geerlofs and Kling (1968) pointed out that most reading and study programs employ instructional material drawn from manuals rather than texts. However, previous studies relating to SQ3R have usually employed student text-book material either to assess the acquisition
of content while using a technique or to increase the transfer effect of the instructional materials. Dubois (1969) used comprehension as a criterion to evaluate the effect of text book versus general reading instructional materials on later transfer of skill to text-book material. He found no statistically significant differences. While relevance of instructional material to the student's study situation was desired it is questionable if the use of text-book material would have accomplished this as students are required to read widely of material varying in content, style, and conceptual depth.

An examination of reading and study manuals revealed they do vary in style, content, and readability level. Author's style and content may be judged and controlled only subjectively and therefore readability was chosen as the differentiating criterion. Most reading and study manuals designed for use with college students vary in readability from the high school level to the senior year of college. Articles were selected which spanned this range. Three levels were selected: high school, second year college and fourth year college. These were measured by the Flesch (1951) readability formula and designated EASY, MEDIUM, and DIFFICULT, respectively.

Time of Assessment. The first research question was formulated to ascertain the relative rates of acquisition among the study methods at different points of time during the period of instruction. The third research question was formulated to ascertain the relative rate of acquisition among the study methods after the period of instruction. Repeated measures of the relative ERR for the study methods provided
an indication of the relative rate of acquisition for each technique over the period of the study.

The treatment groups were assessed at four intervals over the eight week period of the study, in which subjects met once per week. Pretests and posttests utilizing the Nelson-Denny Reading Test for High Schools and Colleges, Forms A and B (1960) were given in the first and eighth week of the eight week study. During the period of instruction which ran from the second to the seventh week of the study, subjects were assessed on an informal instrument at the third and seventh week intervals.

It would have been desirable to use test instruments which allowed the full use of the POPRADR procedure at each of the four assessment intervals. However the decision was made to select a standardized test for the pretest and posttest measures to minimize the practice effect inherent in repeated measures on the same subjects with similar stimulus materials.

The pretest was used to determine the equivalence of the groups prior to instruction. The posttest was used to provide a measure of the rate of acquisition among the study methods after the period of instruction.

Dependent Variable. The speed of acquisition measure used for the informal measures, the ERR, was obtained for the formal pretest and posttest by taking the per cent of correct answers and multiplying it by the Study Reading Rate in the comprehension subtest. This study reading rate was calculated by dividing the total
number of words in the comprehension subtest by the reading time, which was twenty minutes.

This method was chosen in lieu of the one-minute reading rate subtest of the Nelson-Denny Reading Test for High Schools and Colleges (1960) because conditions more closely resembling the informal assessments were desired. The formal and informal tests were related in that they both measured students comprehension for a specified reading time but the formal test procedures did not allow the full employment of the POPRADR procedure.

Figure 3 summarizes the data collection plan required to answer the research questions formulated in the study. The plan involved three different treatment conditions: SQ3R, denoted $P_1$; NLO, denoted $P_2$; and 3LO, denoted $P_3$. The first and second informal assessment times are denoted $T_1$ and $T_2$, respectively. Three articles for each of three readability levels denoted EASY, MEDIUM, and DIFFICULT were assessed at both informal assessment times.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pretest</th>
<th>Wk 2</th>
<th>Wk 3</th>
<th>Wk 4</th>
<th>Wk 5</th>
<th>Wk 6</th>
<th>Wk 7</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQ3R ($P_1$)</td>
<td>$O_1$</td>
<td>$X_1$</td>
<td>$X_1$</td>
<td>$T_1$</td>
<td>$X_1$</td>
<td>$X_1$</td>
<td>$T_2$</td>
<td>$O_2$</td>
</tr>
<tr>
<td>NLO ($P_2$)</td>
<td>$O_1$</td>
<td>$X_2$</td>
<td>$X_2$</td>
<td>$T_1$</td>
<td>$X_2$</td>
<td>$X_2$</td>
<td>$T_2$</td>
<td>$O_2$</td>
</tr>
<tr>
<td>3LO ($P_3$)</td>
<td>$O_1$</td>
<td>$X_3$</td>
<td>$X_3$</td>
<td>$T_1$</td>
<td>$X_3$</td>
<td>$X_3$</td>
<td>$T_2$</td>
<td>$O_2$</td>
</tr>
</tbody>
</table>

Figure 3. Experimental Design Involving Three Independent Variables.

NOTE: Instruction (X) occurred during both week four and week seven in the form of a ten minute review of the instruction up to that point.
The Sample

The subjects for the experiment were 113 volunteers from a group of 500 students who scored in the lowest one-third category on an informal measure of reading rate and comprehension administered to the 1500 first year students at the British Columbia Institute of Technology. The informal measure used to determine students who were in the lowest one-third category was constructed from the Science Research Associates (1959) material from Kit IVa. Students were asked to read and answer one rate-builder card over a range of three colours (grade levels ten, twelve, and fourteen). A reading time of three minutes was allowed for each card. Comprehension was determined by the number of correct answers given for the ten questions which accompanied each card.

The composition of the twenty classroom groups made available by the Reading and Study Program was determined by students' time-tables. Nine of these classroom groups were randomly selected and blocked into three levels designated HIGH, MEDIUM, and LOW on the basis of group mean ERR scores obtained from the Nelson-Denny Reading Test for High Schools and Colleges, (1960), Form A, administered in the reading laboratory to each classroom group during the first week of the study. A group from each level was the assigned at random to one of the three treatment groups. Blocking was done to minimize the possibility of initial differences between the Treatments.

Reading Material

The reading material for the informal assessments was drawn from a reading and study manual (Miller, 1964). Six articles of
equal length (1350 words) were selected, three of which could be read and the appropriate study method applied within the hour period available at each assessment time. The subject matter of the reading material was varied and selected for potential interest to technological students. The content is illustrated by the titles of the articles, given in Table 1. Table 1 also contains the readability levels as determined by the Flesch readability formula. The six articles used in the informal assessments are reproduced in Appendix B.

**Table 1**

Readability Categories of Material Used On First and Second Informal Assessments

<table>
<thead>
<tr>
<th>Level</th>
<th>Title</th>
<th>Flesch Score</th>
<th>Assessment Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult</td>
<td>Lightning In A Nutshell</td>
<td>35</td>
<td>$T_1$</td>
</tr>
<tr>
<td>Difficult</td>
<td>Electronics - Your Chance To Shape The Future</td>
<td>35</td>
<td>$T_2$</td>
</tr>
<tr>
<td>Medium</td>
<td>The Story Of Western Union</td>
<td>41</td>
<td>$T_1$</td>
</tr>
<tr>
<td>Medium</td>
<td>Mass Investment</td>
<td>45</td>
<td>$T_2$</td>
</tr>
<tr>
<td>Easy</td>
<td>Insurance For Life</td>
<td>52</td>
<td>$T_1$</td>
</tr>
<tr>
<td>Easy</td>
<td>Western National Parks</td>
<td>52</td>
<td>$T_2$</td>
</tr>
</tbody>
</table>

**Measuring Instruments**

The measuring instrument for the six reading passages were sets of questions drawn from Miller's (1964) reading and study manual. Each set of ten questions contained two multiple choice items, two completion and six true-false items summed for a score out of ten. The questions required the recall of factual detail (Miller, 1964:2).
The student could not refer back to the article when he answered the questions. However, he could refer to his organizational pattern.

The Comprehension subtest of the *Nelson-Denny Reading Test for High Schools and Colleges*, Forms A and B (1960) was used for the pretest and posttest respectively. Each form of the test consists of eight paragraphs with an average length of 242 words for Form A and an average length of 261 words for Form B. The reader is instructed to read each paragraph and then answer multiple choice questions which require the recall of factual detail. The reader may refer back to the paragraph when answering the questions. There are four questions per paragraph with the exception of the first paragraph which has eight questions. Thus the format and procedures of this test did not match those of the informal assessment material. Nevertheless the *Nelson-Denny Reading Test for High Schools and Colleges*, (1960) was considered the best instrument to use in view of its proven reliability and short administration time of twenty minutes. The authors of this test report a reliability coefficient of .81 for the comprehension subtest.

**Procedure**

The experimenter and another experienced instructor collected all the data in the study and conducted all training sessions. Instructors were randomly assigned to the treatment groups involved in the study. Similar lesson plans were used by both instructors. A meeting was held before the experiment to further coordinate lesson presentation. The instructional procedures are elaborated in Appendix C.
Treatment groups met one hour per week in a normal classroom setting for the eight week period of the study. A pretest utilizing the Nelson-Denny Reading Test for High Schools and Colleges, Form A, (1960) was administered in the first week. For the second and third weeks, instruction and practice was provided with the appropriate study method before the first informal assessment of rate of acquisition in the fourth week. Two further weeks of instruction and practice followed with the second informal assessment of rate of acquisition in the seventh week. For both the first and second informal assessments the three difficulty levels of reading materials were presented in a non-systematic order to avoid confounding order effects with the Difficulty of timed reading practice drills to avoid any Hawthorne effect. The Form B of the Nelson-Denny Reading Test for High Schools and Colleges (1960), was administered in the eighth and final week.

Analysis of the Data

For the purpose of evaluating the treatment effects, four response measures of the dependent variable, ERR, were obtained in the period of the study.

Prior to the instructional period, the Nelson-Denny Reading Test for High Schools and Colleges Form A, was given as a pretest to determine the equivalence of the treatment groups. To ascertain this equivalency a one-factor analysis of variance was performed on the dependent variable, ERR, for Treatment group ERR mean scores.
The data analysis design for the informal assessment corresponds to a three-factor fixed effects analysis of variance model with all factors crossed (Glass and Stanley, 1970). The study methods SQ3R, NLO and 3LO comprised the levels of the Treatment factor. The two informal assessment intervals of the instructional period comprised the levels of the Time factor. The three readability levels (EASY, MEDIUM, and DIFFICULT) of the informal assessment reading materials comprised the levels of the difficulty factor. The three classroom groups which composed each treatment group i.e., the levels of HIGH, MEDIUM, and LOW obtained on the basis of the classroom group means in the Nelson-Denny Reading Test for High Schools and Colleges, Form A, (1960) were included as a level of the treatment factor.

The experimental model is diagrammed in Figure 4. The treatment factor groups SQ3R, NLO, and 3LO are denoted $P_1$, $P_2$, $P_3$ respectively. The levels of $P$, LOW, MEDIUM, and HIGH, are denoted $G_1$, $G_2$, $G_3$, respectively. The first and second time intervals are denoted $T_1$ and $T_2$, respectively. The reading material, differentiated by a readability formula composed the difficulty factor levels, EASY, MEDIUM, and DIFFICULT are denoted $D_1$, $D_2$, $D_3$, respectively.
The two informal assessments of the instructional period were designed to measure the rate of acquisition of the three study methods on reading material of three readability levels. To test hypotheses 1, 2, and 3, a three-factor analysis of variance was performed on the data using the factors of Treatment, Difficulty, and Time.

The Nelson-Denny Reading Test for High Schools and Colleges, Form B, was given as a posttest to measure the relative rate of acquisition among the study methods after the period of instruction. To test hypothesis 4 a one-factor analysis of variance was performed on the data using the factor of Treatment.

\[
\begin{array}{|c|c|c|}
\hline
\text{TREATMENT FACTOR} & \text{DIFFICULTY FACTOR} & \text{TREATMENT FACTOR} \\
\hline
& \text{P}_1 & \text{P}_2 & \text{P}_3 \\
\hline
& G_1 G_2 G_3 & G_1 G_2 G_3 & G_1 G_2 G_3 \\
\hline
\text{T}_1 & D_1 & X_{ptd} & \\
\text{D}_2 & & & \\
\text{D}_3 & & & \\
\hline
\text{T}_2 & D_1 & & \\
\text{D}_2 & & & \\
\text{D}_3 & & & \\
\hline
\end{array}
\]

Figure 4. Three Factor Design for Analysis of Informal Measures
To test hypothesis 5, a two-factor analysis of variance was performed on the pretest and posttest data using the factors of Treatment (Programs) and Time (Pretest and Posttest).

Because both standardized and non-standardized measuring instruments were used in the study, correlations between the following variables and variable pairs were determined: (1) Pretest ($O_1$); (2) posttest ($O_2$); (3) $T_1D_1$; (4) $T_2D_2$; (5) $T_1D_3$; (6) $T_2D_1$; (7) $T_2D_3$. 
Chapter III

RESULTS OF THE STUDY

The treatment group ERR means and standard deviations obtained in the Nelson-Denny Reading Test for High Schools and Colleges, Form A (1960) which was administered prior to the instructional period, are summarized in Table 2. A one-factor analysis of variance was performed on these data. The results of this analysis are summarized in Table 3. They indicated no initial ERR differences between the groups.

The treatment group ERR means and standard deviations obtained on the two informal assessments of the instructional period are summarized in Table 4. A three-factor analysis of variance, summarized in Table 5 was performed on these data. The main effect means for three factors of Treatment, Time, and Difficulty are given in Table 6.

A significant main effect difference was found for the factor of Treatment ($F = 17.55$, $df = 2/6$, $p < .05$). The Tukey method for two-factor analysis of variance post hoc comparisons (see eg. Glass and Stanley, 1970:444)\textsuperscript{1} was employed to construct simultaneous confidence intervals around the treatment group ERR mean differences.

\[
(X_1 - X_2) \pm \frac{q_{IJ}}{\sqrt{\frac{MSW}{N}}} \sqrt{N/J}
\]

where, $X_1$ = Treatment group mean  
$I$ = Levels of Difficulty factor within Time factor  
$J$ = Levels of Treatment factor  
$N$ = Number of observations  
$MSW$ = Mean square from analysis of variance

\textsuperscript{1}This test is defined in Glass and Stanley (1970) as:
TABLE 2

SUMMARY OF TREATMENT GROUP ERR MEANS AND
STANDARD DEVIATIONS FOR THE NELSON DENNY READING
TEST FOR HIGH SCHOOLS AND COLLEGES, FORM A, PRE-TEST

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_1$ (SQ3R)</td>
<td>52.57</td>
<td>14.37</td>
</tr>
<tr>
<td>$P_2$ (NLO)</td>
<td>53.85</td>
<td>16.28</td>
</tr>
<tr>
<td>$P_3$ (3LO)</td>
<td>49.05</td>
<td>14.32</td>
</tr>
</tbody>
</table>

TABLE 3

SUMMARY TABLE OF ANALYSIS OF VARIANCE FOR
TREATMENT GROUP ERR MEANS FOR THE NELSON DENNY
READING TEST FOR HIGH SCHOOLS AND COLLEGES, FORM A, PRE-TEST

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>108.40</td>
<td>2.40</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>ERROR (Groups W. Treatment)</td>
<td>6</td>
<td>45.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
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TABLE 4

SUMMARY OF TREATMENT GROUP MEANS
AND STANDARD DEVIATIONS FOR THE FIRST
(T₁) AND SECOND (T₂) INFORMAL ASSESSMENT

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>READABILITY LEVEL</th>
<th>T₁</th>
<th>T₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₁ (SQ3R)</td>
<td>D₁ (EASY)</td>
<td>86.62</td>
<td>29.12</td>
</tr>
<tr>
<td></td>
<td>D₂ (MEDIUM)</td>
<td>86.27</td>
<td>25.64</td>
</tr>
<tr>
<td></td>
<td>D₃ (DIFFICULT)</td>
<td>106.92</td>
<td>33.40</td>
</tr>
<tr>
<td>P₂ (NLO)</td>
<td>D₁</td>
<td>104.04</td>
<td>38.89</td>
</tr>
<tr>
<td></td>
<td>D₂</td>
<td>83.83</td>
<td>28.48</td>
</tr>
<tr>
<td></td>
<td>D₃</td>
<td>100.25</td>
<td>30.93</td>
</tr>
<tr>
<td>P₃ (3LO)</td>
<td>D₁</td>
<td>69.94</td>
<td>32.80</td>
</tr>
<tr>
<td></td>
<td>D₂</td>
<td>73.36</td>
<td>26.74</td>
</tr>
<tr>
<td></td>
<td>D₃</td>
<td>40.42</td>
<td>30.88</td>
</tr>
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</table>
### TABLE 5

**SUMMARY TABLE OF ANALYSIS OF VARIANCE FOR FIRST \(T_1\) AND SECOND \(T_2\) INFORMAL ASSESSMENTS**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>ERROR TERM</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT (P)</td>
<td>G(P)</td>
<td>2</td>
<td>7215.62</td>
<td>17.55</td>
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</tr>
<tr>
<td>TIME (T)</td>
<td>GT(P)</td>
<td>1</td>
<td>2083.58</td>
<td>32.47</td>
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</tr>
<tr>
<td>DIFFICULTY (D)</td>
<td>GD(P)</td>
<td>2</td>
<td>82.77</td>
<td>0.17</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>GROUPS W. TREATMENT (G(P))</td>
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<td></td>
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</tr>
<tr>
<td>PT</td>
<td>GT(P)</td>
<td>2</td>
<td>595.00</td>
<td>9.27</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>PD</td>
<td>GD(P)</td>
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<td>637.48</td>
<td>5.50</td>
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</tr>
<tr>
<td>TD</td>
<td>GTD(P)</td>
<td>2</td>
<td>30.25</td>
<td>0.16</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>GT(P)</td>
<td></td>
<td></td>
<td>64.17</td>
<td></td>
<td></td>
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<tr>
<td>GD(P)</td>
<td></td>
<td>12</td>
<td>115.83</td>
<td></td>
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</tr>
<tr>
<td>PTD</td>
<td>GTD(P)</td>
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<td>124.31</td>
<td>0.68</td>
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</tr>
<tr>
<td>GTD(P)</td>
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<td>183.37</td>
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<td>FACTOR</td>
<td>TREATMENT (P)</td>
<td>TIME (T)</td>
<td>DIFFICULTY (D)</td>
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<td></td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>----------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁ (SQ3R)</td>
<td>96.59</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₂ (NLO)</td>
<td>109.12</td>
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</tr>
<tr>
<td>P₃ (3LO)</td>
<td>69.91</td>
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<td></td>
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<tr>
<td>T₁ (Time)</td>
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<td>85.66</td>
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<tr>
<td>T₂ (Time)</td>
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<td></td>
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<tr>
<td>D₁ (EASY)</td>
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<td></td>
<td>91.78</td>
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<tr>
<td>D₂ (MEDIUM)</td>
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<tr>
<td>D₃ (DIFFICULT)</td>
<td></td>
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<td>94.05</td>
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</tr>
</tbody>
</table>
TABLE 7

POST HOC ERR MEAN COMPARISONS OF TREATMENT GROUPS (SQ3R, NLO, 3LO) FOR THE POOLED INFORMAL ASSESSMENT TIMES (T₁ AND T₂)

<table>
<thead>
<tr>
<th></th>
<th>OBSERVED MEANS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td></td>
<td>96.59</td>
<td>109.12</td>
<td>69.91</td>
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<table>
<thead>
<tr>
<th></th>
<th>OBSERVED MEAN DIFFERENCES</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>-12.53</td>
<td>26.67</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>39.20</td>
<td>---</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>(-29.38, +4.32)</td>
<td>(+9.82, +43.52)</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>(+22.35, +56.05)</td>
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</table>
pooled over the factors of Time and Difficulty. The results of this analysis are given in Table 7. The results showed that no significant difference existed between SQ3R and NLO. However both SQ3R and NLO had significantly higher ERR means than 3LO. This did not support the expected direction of difference as stated in Hypothesis 1, that NLO would have a significantly higher ERR than SQ3R and 3LO.

A significant main effect difference was found for the factor of Time ($F = 32.47, df = 1/6, p < .05$) in favour of the second assessment time. This supported Hypothesis 2, that a significant difference would exist between the first and second assessment times of the period of instruction in favour of the second assessment time.

No significant main effect difference was found for the factor of Difficulty. Thus, no support was provided for Hypothesis 3, that a significant difference would exist between the levels of readability of the reading material.

A significant Treatment X Time interaction effect, illustrated in Figure 5, was found ($F = 9.27, df = 2/6, p < .05$). The means for this interaction are given in Table 8.

A simple effects analysis (see eg. Winer, 1962) was employed to study further the Treatment X Time interaction. Table 9 summarized the results of this analysis which showed treatments differed significantly at both the first ($T_1$) assessment Time ($F = 17.77, df = 2/12, p < .05$) and the second ($T_2$) assessment Time ($F = 48.25, df = 2/12, p < .05$).
TABLE 8

TREATMENT X TIME INTERACTION: MEAN ERR SCORES
FOR THREE TREATMENT GROUPS, SQ3R, NLO, 3LO, FOR THE
FIRST (T₁) AND SECOND (T₂) INFORMAL ASSESSMENT TIMES

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>TIME</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>T₁</td>
<td>T₂</td>
<td></td>
</tr>
<tr>
<td>(SQ3R) P₁</td>
<td>92.24</td>
<td>100.94</td>
<td></td>
</tr>
<tr>
<td>(NLO) P₂</td>
<td>96.46</td>
<td>121.78</td>
<td></td>
</tr>
<tr>
<td>(3LO) P₃</td>
<td>68.30</td>
<td>71.54</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5. Treatment X Time Interaction: Mean ERR Scores for Three Treatment Groups, SQ3R (P1), NLO (P2), and 3LO (P3) for the First (T1) and Second (T2) Informal Assessment Times.
TABLE 9

SUMMARY TABLES OF ANALYSES OF VARIANCE
FOR SIMPLE EFFECTS OF TREATMENT AT TWO
LEVELS OF TIME (TIME 1 AND TIME 2)

**TIME 1**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>4224.78</td>
<td>17.77</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>ERROR</td>
<td>12</td>
<td>237.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>14</td>
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**TIME 2**

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</thead>
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<td>48.250</td>
<td>&lt;.05</td>
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<tr>
<td>ERROR</td>
<td>12</td>
<td>237.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Error Term: \(
\frac{SS_G(P) + SS_{GT(P)}}{df_G(P) + df_{GT(P)}}
\)
Using the Tukey method for one-factor analysis of variance post hoc comparisons, (see eg. Glass and Stanley, 1970:385)\(^2\), simultaneous confidence intervals were constructed around the treatment group ERR mean differences at both levels of the Time factor, \(T_1\) and \(T_2\). The results of this analysis are given in Table 10. For \(T_1\), no significant difference was found between SQ3R and NLO. However both SQ3R and NLO had significantly higher ERR means than 3LO. For \(T_2\), a significant difference was found between SQ3R and NLO in favour of NLO. Both SQ3R and NLO had significantly higher ERR means than did 3LO.

A significant Treatment X Difficulty interaction effect, illustrated in Figure 6, was found (\(F = 5.50, \text{df} = 2/12, p < .05\)). The means for this interaction are given in Table 11.

A simple effects analysis (see eg. Winer, 1962) was employed to study further the Treatment X Difficulty interaction. Table 12 summarizes the results of this analysis: treatments were significantly different at the EASY level of Difficulty (\(D_1\)), (\(F = 21.82, \text{df} = 2/18, p < .05\)); they differed significantly at the MEDIUM (\(D_2\)) level of Difficulty (\(F = 4.20, \text{df} = 2/18, p < .05\)); and they differed significantly at the DIFFICULT level (\(D_3\)), (\(F = 13.61, \text{df} = 2/18, p < .05\)).

\[^2\text{This test is defined in Glass and Stanley (1970) as:}\]
\[
(X_1 - X_2) + 1 - qJ, J(n-1) \sqrt{MSw} / n
\]

where, \(\bar{X}\) = Treatment group mean  
\(J\) = Levels of Treatment factor  
\(J(n-1)\) = Degrees of freedom from MSw  
\(n\) = Observations per (Treatment) group  
\(MSw\) = Mean square from analysis of variance
TABLE 10

POST HOC ERR MEAN COMPARISONS OF TREATMENT GROUPS
FOR BOTH INFORMAL ASSESSMENT TIMES (TIME 1 AND TIME 2)

TIME 1

<table>
<thead>
<tr>
<th></th>
<th>OBSERVED MEANS</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td></td>
<td>92.24</td>
<td>96.46</td>
<td>68.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>OBSERVED MEAN DIFFERENCES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>-4.22</td>
<td>23.94</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>28.16</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>CONFIDENCE INTERVALS AROUND OBSERVED MEAN DIFFERENCES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>(-15.41, +33.85)</td>
<td>(+4.31, +43.57)</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>(+8.55, +47.79)</td>
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</tr>
</tbody>
</table>
TABLE 10 (continued)

TIME 2

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBSERVED MEANS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.94</td>
<td>121.78</td>
<td>71.54</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBSERVED MEAN DIFFERENCES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>-20.84</td>
<td>29.40</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>50.24</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONFIDENCE INTERVALS AROUND OBSERVED MEAN DIFFERENCES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>(-40.47, -1.21)</td>
<td>(+9.77, +49.03)</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>(+30.61, +69.87)</td>
<td>---</td>
</tr>
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</table>
Figure 6. Treatment X Difficulty Interactions: Mean ERR Scores For Three Treatment Groups, SQ3R ($P_1$), NLO ($P_2$), and 3LO ($P_3$) For Three Levels of Readability, EASY ($D_1$), MEDIUM ($D_2$), and DIFFICULT ($D_3$).
TABLE 11

TREATMENT X DIFFICULTY INTERACTION: MEAN ERR SCORES FOR THREE TREATMENT GROUPS, SQ3R (P₁), NLO (P₂), 3LO (P₃) FOR THREE LEVELS OF DIFFICULTY, EASY (D₁), MEDIUM (D₂), AND DIFFICULT (D₃)

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>DIFFICULTY</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EASY (D₁)</td>
<td>MEDIUM (D₂)</td>
<td>DIFFICULTY(D₃)</td>
</tr>
<tr>
<td>SQ3R (P₁)</td>
<td>89.93</td>
<td>92.82</td>
<td>107.00</td>
</tr>
<tr>
<td>NLO (P₂)</td>
<td>120.58</td>
<td>100.20</td>
<td>106.57</td>
</tr>
<tr>
<td>3LO (P₃)</td>
<td>64.85</td>
<td>76.29</td>
<td>68.60</td>
</tr>
</tbody>
</table>
TABLE 12

SUMMARY TABLE OF ANALYSIS OF VARIANCE
FOR SIMPLE EFFECTS OF TREATMENT OF
THREE LEVELS OF DIFFICULTY (D₁, D₂, D₃)

EASY (D₁)

<table>
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<tr>
<th>SOURCE</th>
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<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>4675.83</td>
<td>21.82</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>ERROR</td>
<td>18</td>
<td>214.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

MEDIUM (D₂)

<table>
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<th>p</th>
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</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>899.11</td>
<td>4.20</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>ERROR</td>
<td>18</td>
<td>214.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

DIFFICULT (D₃)

<table>
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<tr>
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<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>2916.25</td>
<td>13.61</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>ERROR</td>
<td>18</td>
<td>214.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Error Term: \( \frac{SS_{G(P)} + SS_{GD(P)}}{df_{G(P)} + df_{GD(P)}} \)
Using the Tukey method for one-factor analysis of variance post hoc comparisons (see eg. Glass and Stanley, 1970:385) simultaneous confidence intervals were constructed around the treatment group ERR mean differences for each level of the Difficulty factor. The results of this analysis are given in Table 13. For EASY material, a significant difference was found between SQ3R and NLO, favouring NLO. Both SQ3R and NLO had significantly higher ERR means than 3L0. For MEDIUM materials, no significant difference was found between SQ3R and NLO, nor between SQ3R and 3L0. A significant difference was found between NLO and 3L0 in favour of NLO. For DIFFICULT material, no significant difference was found between SQ3R and NLO. Both SQ3R and NLO had significantly higher ERR means than 3L0.

There was no significant Treatment X Difficulty X Time interaction effect.

The treatment group ERR means and standard deviations for the Nelson-Denny Reading Test for High Schools and Colleges (1960), Form B, which was administered after the instructional period as a post-test are summarized in Table 14. A one-factor analysis of variance was performed in these data. The results of this analysis, given in Table 15, showed a significant difference for Treatment \( (F = 6.71, \text{ df} = 2/6, p < .05) \).

Using the Tukey method for one-factor analysis of variance post hoc comparisons (see eg. Glass and Stanley, 1970:385), simultaneous confidence intervals were constructed around the treatment group ERR mean differences. The results of this analysis are given in
TABLE 13

POST HOC MEAN COMPARISONS OF TREATMENT GROUPS
FOR THREE LEVELS OF READABILITY (D₁, D₂, D₃)

EASY (D₁)

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<tr>
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<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td></td>
<td>89.93</td>
<td>120.58</td>
<td>64.85</td>
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</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>-30.65</td>
<td>25.08</td>
</tr>
<tr>
<td>P₃</td>
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<td>55.74</td>
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<td>SQ3R (P₁)</td>
<td>NLO (P₂)</td>
<td>3LO (P₃)</td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>(-52.34, -11.04)</td>
<td>(+3.39, +46.77)</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>(+34.05, +77.43)</td>
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TABLE 13 (continued)

MEDIUM (D$_2$)

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<td>SQ3R (P$_1$)</td>
<td>NLO (P$_2$)</td>
<td>3LO (P$_3$)</td>
</tr>
<tr>
<td></td>
<td>92.82</td>
<td>100.20</td>
<td>76.29</td>
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<td></td>
<td>SQ3R (P$_1$)</td>
<td>NLO (P$_2$)</td>
<td>3LO (P$_3$)</td>
</tr>
<tr>
<td>P$_1$</td>
<td>---</td>
<td>- 7.38</td>
<td>16.53</td>
</tr>
<tr>
<td>P$_3$</td>
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<td>23.91</td>
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<td>NLO (P$_2$)</td>
<td>3LO (P$_3$)</td>
</tr>
<tr>
<td>P$_1$</td>
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<td>(-29.07, +14.31)</td>
<td>(-5.10, +38.28)</td>
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<tr>
<td>P$_2$</td>
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<td>(+ 2.22, +45.60)</td>
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TABLE 13 (continued)

DIFFICULT (D3)

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<td>SQ3R (P1)</td>
<td>NLO (P2)</td>
<td>3LO (P3)</td>
</tr>
<tr>
<td>z^2</td>
<td>107.01</td>
<td>106.57</td>
<td>68.60</td>
</tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>SQ3R (P1)</td>
<td>NLO (P2)</td>
<td>3LO (P3)</td>
</tr>
<tr>
<td>P1</td>
<td>---</td>
<td>0.44</td>
<td>38.40</td>
</tr>
<tr>
<td>P3</td>
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<td>37.96</td>
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<table>
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<th></th>
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</thead>
<tbody>
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<td>NLO (P2)</td>
<td>3LO (P3)</td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>---</td>
<td>(-21.25, +22.13)</td>
<td>(+16.71, +60.08)</td>
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</tr>
<tr>
<td>P2</td>
<td>---</td>
<td>(+16.27, +58.65)</td>
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### TABLE 14

**SUMMARY OF TREATMENT GROUP ERR MEANS AND STANDARD DEVIATIONS FOR THE NELSON DENNY READING TEST FOR HIGH SCHOOLS AND COLLEGES, FORM B, POSTTEST**

<table>
<thead>
<tr>
<th>TREATMENT GROUP</th>
<th>MEAN</th>
<th>SD</th>
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<tbody>
<tr>
<td>SQ3R (P₁)</td>
<td>62.28</td>
<td>15.54</td>
</tr>
<tr>
<td>NLO (P₂)</td>
<td>63.50</td>
<td>17.08</td>
</tr>
<tr>
<td>3LO (P₃)</td>
<td>46.31</td>
<td>16.67</td>
</tr>
</tbody>
</table>

### TABLE 15

**SUMMARY TABLE OF ANALYSIS OF VARIANCE FOR TREATMENT GROUP ERR MEANS ON THE NELSON DENNY READING TEST FOR HIGH SCHOOLS AND COLLEGES, FORM B, POSTTEST**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>2</td>
<td>340.11</td>
<td>6.71</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>ERROR (Groups W. Treatment)</td>
<td>6</td>
<td>50.69</td>
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<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
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<td></td>
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</tr>
</tbody>
</table>
### TABLE 16

**POST HOC ERR MEAN COMPARISONS FOR TREATMENT GROUPS**

(SQ3R, NLO, AND 3LO) FOR THE NELSON-DENNY READING TEST

FOR HIGH SCHOOLS AND COLLEGES, FORM B, POSTTEST

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBSERVED MEANS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60.17</td>
<td>66.12</td>
<td>45.44</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBSERVED MEAN DIFFERENCES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>-5.95</td>
<td>14.73</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>20.68</td>
<td>---</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>SQ3R (P₁)</th>
<th>NLO (P₂)</th>
<th>3LO (P₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONFIDENCE INTERVALS AROUND OBSERVED MEAN DIFFERENCES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁</td>
<td>---</td>
<td>(-23.78, +11.88)</td>
<td>(-3.1, +32.56)</td>
</tr>
<tr>
<td>P₃</td>
<td>---</td>
<td>(+2.85, +38.51)</td>
<td>---</td>
</tr>
</tbody>
</table>
Table 16. No significant difference was found between SQ3R and NLO, nor between SQ3R and 3LO. A significant difference was found between NLO and 3LO in favour of NLO. This did not support the expected direction of the differences as stated in Hypothesis 7, that NLO would have a significantly higher ERR mean than SQ3R and 3LO.

A two-factor analysis of variance was performed on the pretest and posttest treatment group ERR means. The results of these data, summarized in Table 17, showed no significant difference for the factor of Time (between pretest and posttest). This did not support Hypothesis 8, that a significant difference would exist between the pretest and posttest (in the direction of the posttest) for the treatment groups.

A summary table of the correlations between the following variables and variable pairs is given in Table 18: (1) pretest \( O_1 \); (2) posttest \( O_2 \); (3) \( T_1D_1 \); (4) \( T_1D_2 \); (5) \( T_1D_3 \); (6) \( T_2D_1 \); (7) \( T_2D_2 \); (8) \( T_2D_3 \).
**TABLE 17**

**SUMMARY TABLE OF ANALYSIS OF VARIANCE FOR TREATMENT GROUP ERR MEANS FOR THE NELSON-DENNY READING TEST FOR HIGH SCHOOLS AND COLLEGES, FORM A, PRETEST, AND FORM B, POSTTEST**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>ERROR</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<tr>
<td>TREATMENT (P)</td>
<td>G (P)</td>
<td>2</td>
<td>243.18</td>
<td>3.53</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>TIME (T)</td>
<td>GT(P)</td>
<td>1</td>
<td>137.56</td>
<td>4.69</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>GROUPS W. TREATMENT G(P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT</td>
<td>GT(P)</td>
<td>2</td>
<td>110.02</td>
<td>3.75</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>GT(P)</td>
<td></td>
<td>6</td>
<td>29.34</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 18

INTERCORRELATIONS OF TREATMENT GROUP ERR MEANS FOR
THE NELSON- DENNY READING TEST FOR HIGH SCHOOLS AND COLLEGES, FORMS A (NDA),
FORM B (NDB) AND THE FIRST (T1) AND SECOND (T2) INFORMAL ASSESSMENT
TIMES FOR THREE READABILITY LEVELS, EASY (D1), MEDIUM (D2), DIFFICULT (D3)

<table>
<thead>
<tr>
<th>MEASURES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NDA</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 NDB</td>
<td>.73</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 T1D1</td>
<td>.19</td>
<td>.29</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 T1D2</td>
<td>.33</td>
<td>.32</td>
<td>.51</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 T1D3</td>
<td>.20</td>
<td>.38</td>
<td>.49</td>
<td>.42</td>
<td>1.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6 T2D1</td>
<td>.36</td>
<td>.43</td>
<td>.64</td>
<td>.24</td>
<td>.46</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 T2D2</td>
<td>.30</td>
<td>.25</td>
<td>.56</td>
<td>.34</td>
<td>.46</td>
<td>.75</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8 T2D3</td>
<td>.14</td>
<td>.20</td>
<td>.37</td>
<td>.14</td>
<td>.44</td>
<td>.63</td>
<td>.60</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Chapter IV

SUMMARY, DISCUSSION AND CONCLUSIONS

The Problem

Most research on study method efficacy at the college level has used an evaluative criterion of comprehension gain scores for standardized reading tests or content-mastery of actual study material. In spite of evidence which suggests acquisition of preview-type study techniques as a problem due to poor student motivation, the evaluative research has ignored the instructional aspects of study method efficacy in attempting to determine which study method is most suitable for college study-reading.

The present study sought to determine the relative rates of acquisition for three study methods, SQ3R (Survey, Question, Read, Recite, Review), NLO (Non-Linear Outlining), and 3LO (Three-Level Outlining) as determined by a rate-of-gain score, ERR (comprehension x study reading time), assessed at different intervals during and immediately after the period of instruction.

Since there was concern for determining the effect of the instructional materials upon the relative rates of acquisition for the techniques, material of three readability levels was presented to the subjects at two different times during the period of instruction.

Procedure

Three hundred, volunteer, first year students in a Reading and Study program at the British Columbia Institute of Technology...
who had scored in the lowest one-third category of an informal measure of reading rate and comprehension administered to the freshman class, constituted the group from which the subjects for the study were drawn. The Reading and Study program had twenty classroom groups, nine of which were randomly selected, and assigned to three treatment groups, SQ3R, NLO, and 3LO.

An experimental design was formulated which involved the manipulation of three independent variables: the Treatment groups of study methods taught students comprised of SQ3R, NLO, and 3LO; the Difficulty level of the instructional material as determined by a readability formula and designated EASY, MEDIUM, and DIFFICULT; the Time of assessment of the relative rates of acquisition among the study methods over the period of the study. These assessment times were: (1) pretest ($O_1$); (2) the first informal assessment ($T_1$); (3) the second informal assessment time ($T_2$); (4) and the posttest ($O_2$).

The dependent variable for each assessment time was a rate-of-gain score termed an Effective Reading Rate (ERR) which was the product of the student's comprehension score and study-reading time for a given article. The ERR was assessed at four times over the period of the study:

1. A pretest using the Nelson-Denny Reading Test for High Schools and Colleges, Form A (1960), was administered in the first week to determine the equivalence of the treatment group.
2. An informal assessment of rate of acquisition using material of three readability levels from a reading and study manual (Miller, 1964) was administered in the fourth week of the instructional period.
3. A second informal assessment of rate of acquisition using comparable material from the same source (Miller) was administered in the seventh week of the instructional period.
4. A posttest using the Nelson-Denny Reading Test for High Schools and Colleges, Form B (1960) was administered in the eighth and final week to provide a measure of the rate of acquisition after the period of instruction.

Findings

The experimental hypotheses tested in the study dealt with the proposition that study methods would vary with respect to their relative rate of acquisition as measured by an ERR score assessed on material of three readability levels, and at two different times during the period of instruction. An additional assumption was that relative rates of acquisition among the study methods at the two informal assessment intervals would be similar on the formal posttest.

Tests of the experimental hypotheses based upon the pretest, posttest, and the two informal assessments produced the following findings:

1. The first research question raised in the study pertained to the relative differences in ERR scores among treatment groups. In order to answer this question two experimental hypotheses were tested using the treatment group ERR mean scores obtained from the two informal assessments.
The first hypothesis, that treatment group ERR means would differ significantly for the period of instruction (Time 1 and Time 2 pooled), was supported by a significant main effect for treatment \((F = 17.55, \text{df} = 2/6, p <= .05)\). Significantly different pair-wise comparisons were noted between SQ3R and 3LO, favouring SQ3R and between NLO and 3LO favouring NLO, but not between SQ3R and NLO.

A significant Treatment X Time interaction effect \((F = 9.27, \text{df} = 2/6, p <= .05)\) was found. An analysis of the simple treatment effects at the two levels of Time was significant for Time 1, \((F = 17.77, \text{df} = 2/12, p <= .05)\) and for Time 2 \((F = 48.25, \text{df} = 2/12, p <= .05)\). Pair-wise comparisons of treatment group ERR means at Time 1 showed no significant difference between SQ3R and NLO but a significant difference was noted between SQ3R and 3LO in favour of SQ3R, and between NLO and 3LO in favour of NLO. Comparisons at Time 2 showed a significant difference between SQ3R and NLO in favour of NLO, between SQ3R and 3LO, and between NLO and 3LO in favour of SQ3R and NLO respectively.

It was further hypothesized that there would be a significant difference between the two informal assessment times when the factors of Treatment and Difficulty were pooled. This hypothesis was supported by a significant main effect for Time \((F = 32.47, \text{df} = 1/6, p <= .05)\) in the direction of the second assessment time (Time 2).

2. The second research question pertained to the dependence of the relative ERR among the study methods on the readability level of the assessment material used during the period of instruction. In order
to answer this question one experimental hypotheses was tested using the treatment group ERR mean scores obtained in the two informal assessments.

It was hypothesized that the relative ERR mean scores for the treatment groups would depend upon the readability level of the material denoted EASY, MEDIUM, and DIFFICULT, presented at the two informal assessment times. No significant main effect difference was found for the faster of Difficulty. A significant Treatment X Difficulty interaction effect (F = 5.50, df = 4/12, p < .05) was found. An analysis of the simple treatment effects at the three levels of Difficulty was significant for EASY (F = 21.82, df = 2/18, p < .05), for MEDIUM (F = 4.20, df = 2/18, p < .05), and for DIFFICULT (F = 13.61, df = 2/18, p < .05). Pair-wise comparisons of the treatment group ERR means at each level of Difficulty produced the following results: for EASY material, significant differences were found between SQ3R and NLO; for MEDIUM material, there was no significant difference found between SQ3R and NLO nor between SQ3R and 3LO, but a significant difference between NLO and 3LO was found in favour of NLO; for DIFFICULT material, there was no significant difference between SQ3R and NLO, but a significant difference was found between SQ3R and 3LO and between NLO and 3LO in favour of SQ3R and NLO respectively.

No significant Treatment X Difficulty X Time interaction effect was found.

It was hypothesized that there would be a significant difference among the readability levels of the informal assessment
material pooled over the factors of Time and Treatment. This hypothesis was not supported.

3. The third research question pertained to the relative differences in ERR scores among treatment groups after the period of instruction. In order to answer this question two experimental hypotheses were tested using the treatment group ERR mean scores obtained on the pretest and posttest.

It was hypothesized that there would be a significant difference among the treatment group ERR means on the posttest favouring the NLO. A significant main effect difference for the Treatment factor was found ($F = 6.71$, df = 2/6, $p < .05$). However the expected direction of the difference was not supported. Pair-wise comparisons of the treatment group ERR means showed no significant difference between SQ3R and NLO, nor between SQ3R and 3LO. A significant difference between NLO and 3LO in favour of NLO was found.

It was hypothesized that a significant difference would exist between the pretest and posttest for the treatment groups. This hypothesis was not supported.

Discussion

Based upon the analysis of the data collected in the study no one study method appeared to be advantageous in terms of its rate of acquisition on material of three readability levels over the period of the study.

Hypothesis 1, that a significant difference among Treatments would exist when the factors of Time and Difficulty were pooled was
supported. However neither SQ3R nor NLO were significantly different from each other. Both SQ3R and NLO showed significantly higher ERR than 3LO.

The ERR means for 3LO at the first and second Informal Assessment interval, 68.29 and 71.54 respectively, suggested a lack of acquisition for this technique. This may reflect an instructional period which was too short or not intensive enough for the adequate learning of this particular method. However it is more likely that the 3LO ERR means reflected a floor effect imposed by the controlled time period of the POPRADR procedure.

Hypothesis 2, that significant differences would exist between the two informal assessment times when the treatment group ERR means were pooled was supported. This showed the rates of acquisition were increasing for one or more of the study methods over the period of instruction. A significant Treatment X Time interaction effect was found. This indicated that the rate of acquisition for the study methods was related to the duration of instruction and practice for the period of the study.

Hypothesis 3, that a significant main effect for Difficulty would exist was not supported. This could mean that the readability formula did not differentiate the material in a meaningful way for the population sampled. A significant Treatment X Difficulty interaction was found. This indicated a relationship between the study method procedure and the readability level of the material.
The analysis of the simple Treatment effects at the three levels of Difficulty showed that NLO had a significantly higher ERR for the EASY level of readability as compared to either SQ3R or 3LO. The simple Treatment effects at the two levels of Time showed that NLO had a significantly higher ERR for the Second informal assessment time. Thus NLO showed a significantly higher rate of acquisition for EASY material by the seventh week of the study. This finding is in agreement with that of Franklin and Sweet (1970) who found that NLO had a significantly higher rate of acquisition by the sixth week of instruction on material with a readability level which corresponded to the EASY level of Difficulty in the present study.

While there were no significant differences between Treatments at the first informal assessment time as determined by the simple Treatment effects analysis at the two levels of Time, an inspection of the ERR means for NLO (104.04), SQ3R (86.62) and 3LO (69.94) at the EASY level of readability for the first informal assessment time, showed that students taught NLO had a higher rate of acquisition by the fourth week of instruction for material of an EASY readability level.

The finding that SQ3R did not have a significantly higher ERR than did 3LO at the MEDIUM level of readability but did so at both the EASY and DIFFICULT levels is an unexplained phenomenon.

The non-significant Treatment X Difficulty X Time interaction effect found showed that the form of the Treatment X Time interaction was the same at all levels of Difficulty, and that the form of the
Treatment X Difficulty interaction was the same at both levels of Time.

Hypothesis 7, that Treatment groups would differ significantly on the posttest was supported. SQ3R showed a significantly higher ERR than NLO or 3LO, and NLO showed a significantly higher ERR than 3LO. This did not reflect the rank order of treatment group ERR means in the second informal assessment.

However any interpretations of the posttest results were questionable in view of the low correlations between the formal and informal measures.

Further reservations concerning the posttest results were necessary as a result of the test of Hypothesis 8 which expected a significant difference between the pretest and posttest ERR means for the treatment groups. This expectation was not supported.

Possible explanations for both the low formal-informal test correlations, and the seeming lack of an increasing rate of acquisition (for the study methods) between pretest and posttest are: (1) that the procedures of the formal tests did not allow the full implementation of the POPRADR procedure, i.e. no organizational pattern would be outlined; (2) the formats of the formal and informal tests differed, i.e. the pretest and posttest each had eight paragraphs on different topics, the informal tests each had three complete articles on one topic. It may be that the skills of SQ3R, NLO and 3LO could only be applied effectively to the longer articles and/or that the operative component of each method is the written outline.
Conclusions

Given the data analyzed in the present study it may be concluded that among the three study methods compared, SQ3R, NLO, or 3LO, none showed a significantly higher rate of acquisition over the period of the study.

However, the fact that NLO did show a significantly higher rate of acquisition score by the seventh week of instruction suggests that, of the three techniques under study, NLO was the most advantageous in terms of its rate of acquisition on material on an EASY readability level.

The positive relationship between the NLO and the EASY level of readability may have been due to the NLO procedure which required the student to manipulate the main idea relationships during the PREREAD and ORGANIZATIONAL PATTERN steps. This appears to have been the most successful procedure for EASY material during the instructional period whereas the more structured and sequential procedures of SQ3R were as readily implemented as the NLO for the MEDIUM and DIFFICULT material.

The 3LO did not appear to be an adequate technique when evaluated by a rate-of-acquisition score. The results suggest that students taught 3LO may have been preoccupied with the procedure and lost sight of the equally important goal of attaining comprehension. It may be that acquisition of 3LO, and for that matter, SQ3R and NLO would be facilitated by an alternate instructional emphasis, ie. either rate or comprehension. A further possibility is that the
techniques were higher level skills for which more ability was needed than was present in the sample. The fact that no one study method showed a clear-cut superiority in terms of ERR for all levels of material and that the NLO did so only for EASY material by the seventh week suggests that either the ability of the students or the intensity of instruction was the overriding factor in the findings.

Under the conditions of the study the relative rates of acquisition, as determined by the posttest, did not reflect the findings of the second informal assessment time.

Furthermore, as determined by the pretest, posttest comparison of pooled Treatments, the rate of acquisition measure, ERR, did not demonstrate the assumed interaction between student perseverance and increased facility for study method use. It would appear that differences in format and testing procedures between the formal and informal tests preclude any interpretation of rate of acquisition for the period of the study. Thus any interpretation of the relative rates of acquisition of the study methods must be specific to the population sampled, to the manual from which the informal tests were drawn and to the teaching conditions of the period of instruction.

Implications for Future Research. The study should be replicated with an alternate method of data collection. For example, two dependent variables could be used: (1) a measure of facility as determined by pretest and posttest comprehension gain scores; (2) a rate of acquisition score (ERR) measured during the instructional period. The inclusion of a control group would be necessary to determine relative facility.
Alternate analysis of the data could also illuminate the ERR index. For example, comprehension and study-reading time could be separately tabulated. This would allow an analysis which would show the relative contribution of each to the total ERR index.

If a replication is done with a repeated measures on the same sample, a different pretest and posttest instrument should be substituted for the Nelson-Denny Reading Test for High Schools and Colleges, (1960). An instrument which allows the full implementation of the POPRADR procedure and which has a high correlation with the informal assessment instruments should be used.

The study should be replicated with a more intensive instructional period, eg. a course in which students met twice per week for two hours each session. If the study methods are higher-level skills, more closely spaced instruction may be necessary for adequate acquisition.

The study should be replicated with student ability controlled to determine if this had a bearing on acquisition of the techniques. Also a seemingly less complex study method such as underlining might be compared with the preview-type methods of the present study.

**Instructional Implications.** The most clear-cut conclusion to be drawn with regard to study method instruction is a matching of readability level and technique. Student success appeared more likely when EASY material was paired with the NLO method. This suggests that instructional sequencing of the techniques may facilitate student perseverance and acquisition. For example, the NLO may be
introduced with low readability material followed by SQ3R and higher readability material.

The results of this study are specific to the sample assessed and to the manual from which the informal assessment material was drawn. Certainly further studies with samples differing in ability and reading achievement are necessary before any firm conclusions may be drawn concerning the relative instructional efficacy of SQ3R, NLO, and 3LO.
REFERENCES


Franklin, P. and Sweet, R. 1970. POPRAD III: An Alternative Study Technique. (unpublished study, Simon Fraser University)


Jenkinson, M. 1966. Increasing Reading Power in the Social Studies. *Perspectives in Reading* No. 6 International Reading Association, Newark, Delaware


APPENDIX A

STUDY METHODS PROCEDURES
"POPRADR" is a higher level study designed to give the student an organized approach to his reading by having him produce a non-linear outline of the material. As well as this, the OP functions as a set of notes in that it provides an excellent visual recall pattern showing the important relationships and associations of the relevant data in the material read.

**P -- PRE-READING.** This involves two procedures: (a) overview of the material, looking at the title, author, table of contents, 'blurbs', preface, etc. This amounts to be a general 'psyching out' of the book, article or chapter; (b) pre-view skim the material read the first and last paragraph and the first (topic) sentence of each intervening paragraph. Note bold face headings, italicized type, etc. The reader is looking for the main ideas and any major statements about them. Now produce the organizational pattern.

**OP -- ORGANIZATIONAL PATTERN.** The OP takes the following form at this stage.

![Organizational Pattern Diagram]

This visual pattern, based on the information extracted during pre-reading, reflects the author's purpose and organization. (The 'why' and 'how' of the article). With this meaningful framework outlined the reader can now proceed to the next step.
R -- READ. Because he has a clear image of the author's organization (and purpose, or thesis) the reader can now read more purposefully; he can read to elaborate upon the basic main ideas and secondary ideas.

AD -- ADD. Having read the material the reader now can add the detail to the OP.

Depending upon the purpose of the reader, i.e. whether or not he wishes to master the material or just obtain a superficial view of it, three modifications may be made to have procedures.

For Complete Mastery: (1) After the 'pre-read', construct the initial OP without looking at the material; (2) For 'read', the material maybe overview-skimmed to further ascertain what sections are most relevant. These may then be read thoroughly; (3) For 'add', the reader may read the material and then add or add as he reads. However, for a highly detailed treatment one section (or main idea) at a time may be read and then added to the OP without reference to the material.
The title for this new higher-level study skill is abbreviated in the current fashion to make it easier to remember and to make reference to it more simple. The symbols SQ3R stand for the steps which the student follows in using the method; a description of each of these steps is given below:

**SURVEY** 1. Glance over the headings in the chapter to see the main points which will be developed. Also read the final summary paragraph if the chapter has one. This survey should not take more than a minute and will show the three to six core ideas around which the discussion will cluster. This orientation will help you organize the ideas as you read them later.

**QUESTION** 2. Now begin to work. Turn the first heading into a question. This will arouse your curiosity and so increase comprehension. It will bring to mind information already known, thus helping you to understand that section more quickly. And the question will make important points stand out while explanatory detail is recognized as such. Turning a heading into a question can be done instantly upon reading the heading, but it demands a conscious effort on the part of the reader to make this a query for which he must read to find the answer.

**READ** 3. Read to answer that question, i.e., to the end of the first headed section. This is not a passive plodding along each line, but an active search for the answer.

**RECITE** 4. Having read the first section, look away from the book and try briefly to recite the answer to your question. Use your own words, and include an example. If you can do this you know what is in the book; if you can't, glance over the section again. An excellent way to do this reciting from memory is to jot down cue phrases in outline form on a sheet of paper. Make these notes very brief!

Now repeat steps 2, 3, and 4 on each subsequent headed section. That is, turn the next heading into a question, read to answer that question, and recite the answer by jotting down cue phrases in your outline. Read in this way until the entire lesson is completed.
When the lesson has thus been completely read, look over your notes to get a bird's-eye view of the points and their relationship and check your memory as to the content by reciting on the major sub-points under each heading. This checking of memory can be done by covering up the notes and trying to recall the main points. Then expose each major point and try to recall the subpoints listed under it.

These five steps of the Survey Q3R Method -- Survey, Question, Read, Recite, and Review -- when polished into a smooth and efficient method should result in the student reading faster, picking out the important points, and fixing them in memory. The student will find one other worthwhile outcome: Quiz questions will seem happily familiar because the headings turned into questions are usually the points emphasized in quizzes. In predicting actual quiz questions and looking up the answers beforehand, the student feels that he is effectively studying the material considered important in a course.
THREE-LEVEL OUTLINING METHOD

The term "three levels" in this method refers to:

(a) The first level, and the highest level - the chapter title.
(b) The second level - the section headings.
(c) The third level - the subheadings.

Three-level outlining consists of constructing an outline of a chapter according to five simple rules.

Rule I Always go to the Three Levels
Rule II Have from two to five Section Headings
Rule III Have from two to five Sub-Headings per Section
Rule IV Copy every word of the Headings
Rule V Stay on the left side of your paper for the rough draft. Complete the final draft on the right side of your paper

Steps in Three-Level Outlining

Step 1. Count the Headings and Copy them down -- note if there are more than five top-level section headings.

(a) First look at the title of the chapter and ask yourself -- "If I were writing a chapter on this subject what would I include?" After thinking about it a student is much more sensitive to the content of the chapter. As you read the headings you think - "Yes, I would include that" or "I never thought of that".

(b) You react more to the headings and are more interested, therefore, you pay more attention and understand and remember the material more easily.

Step 2. Group the Headings as Necessary --

(a) This rule is required in chapters with more than five top-level section headings or more than five sub-headings in any section. The students groups his headings and sub-headings so as to have not more than five major section headings and not more than five sub-headings under each.

Step 3. Sub-divide the headings as necessary -- this refers to two separate procedures:
(a) When a chapter has no sub-headings, the students must make them up. A minimum of two is required.

(b) If, upon careful reading of the chapter, the student finds the author has really dealt with two topics under one sub-headings, he should divide the subjects into two appropriate sub-headings.

Step 4. **Add up the New Headings and Copy Them Down**

(a) This means looking at each group of sub-headings and deciding whether it is well represented by its section heading.

Step 5. **Reproduce the Outline from Memory**

(a) Turn the paper over and write it out. You can try it mentally first.

(b) The student should take the time to learn as much as possible from this study since it can be his most profitable point in his study as the basic organization of the chapter is clearly learned. From then on he is working from a familiar outline and relating pertinent facts to it from notes and reference materials.

(c) Whatever study method is used the student should review his notes from time to time.

(d) For some, a single review before an examination will be enough, for others, periodic reviews make for better and more permanent remembering.

**Conclusion**

With the Three-Level Outlining this means reproducing the outline from memory. If you can't do it, the chapter is fading and you must re-study the rough and final drafts.
APPENDIX B

INFORMAL ASSESSMENT MATERIALS
LIGHTNING IN A NUTSHELL

The Magic Of Electronics

Electrons are everywhere! They form the pictures on your television screen; they carry the music through your hi-fi set; every time you get your feet wet in a thunderstorm, they're splashing all around you; they're behind the cause of the rich brown suntan that you get on the beach each summer; they even flow abundantly in and out of stars googollians of miles away from you in space. It took a long time for men to understand these things, but when they did, a new branch of engineering was born — electronics.

The future of electronics abounds with magic — like the lamp the genie gave to Aladdin; if you handle it the right way, there is no wish too fantastic to be granted.

So what is this magical electronics? Electronics is a branch of science and engineering which explains and exploits the magic of electrons for the use of mankind, but what are electrons? As Joseph J. Thomson discovered, they are lightweight charges of negative electricity that neutralize the heavier positive electrical charges in every atom.

James Chadwick, an English physicist, discovered that this atomic core or nucleus also contains even heavier particles called neutrons because they are neutral and have no electrical charge. For his world shattering discovery of the neutron, Chadwick received the Nobel Prize in 1935. The possible existence of the neutron had been postulated by Lord Ernest Rutherford in 1920, but Chadwick's brilliant experimental work was responsible for its discovery. The electron's charge was first measured by Robert Millikan, and it was proposed as a kind of shell to the atom by Niels Bohr. Albert Einstein inferred (and it was later proved) that electrons, as well as protons and neutrons, become heavier the faster they are made to travel, but of the three basic subatomic particles, the electron could be impelled to the highest speeds by far. Since the electron is only one-2000th as heavy as the proton and the neutron, it can be accelerated very nearly to the speed of light by energy sources that engineers have been able to build.

The Application of Electrons

How do you accelerate an invisible, infinitesimal speck of matter? Because it has an electrical charge, it can be accelerated by a magnetic field or another
electrical charge. Electromagnets in combination with charged plates are used in television picture tubes to guide beams of electrons to the screen. As the electrons strike the screen in a particular pattern, the screen glows intermittently to produce a picture.

Accelerated electrons produce the light in fluorescent lamps and neon signs, and the opposite approach works too, for the energy in a beam of light falling on certain materials can cause electrons to flow in the materials, this latter effect being the one that makes solar cells generate electricity.

There are many kinds of electromagnetic radiation, some visible (light) and some invisible (radio, infrared, ultraviolet, and x-ray) to the human eye. Each kind can be used to generate or transfer some type of energy — electromagnetic, electrical, thermal or mechanical — by focusing or directing it into a gas, a liquid or a solid. By exploitation of such phenomena engineers have made certain crystals into transistors that detect and amplify radio impulses, opening a whole new field — solid-state electronics. The same phenomena have made microminiaturization possible, when different solid materials are "fused" together, each responding differently. By joining together the right combination, you can build a radio receiver (or transmitter, or computer unit, etc.) the size of a matchstick or smaller, like lightning contained in a nutshell!

The total range of electromagnetic waves covers the higher energy gamma, X- and ultra-violet radiations all the colors of the rainbow from deep violet to deep red in visible light, through the lower energy infrared, microwave and longer radio radiations. All of these have applications in electronics, and most of the possibilities are still undreamed.

The brain and nervous system are themselves electronic-like, a fact that forms the basis of a new field of interest to research engineers called cybernetics, which concentrates on a study of the relationship between this human "electronic" network and man-made machines. A new school of psychologists has been inspired by electronics to investigate the possibilities of what they call "SBS," which stands for "Synthetic Behavior Systems" and has as its goal the development of electronic machines based on human behavior patterns — machines that think for themselves and learn from their own mistakes. Engineers working in this same area call their objective "Artificial Intelligence." Machines using these concepts could be sent off to the moon or planets to determine whether or how a human being could survive there.
The Realm of Electronics

What is the domain of electronics? It extends through all the sciences, from biology to astronomy; it has created entirely new and exciting engineering fields; it is vital to the exploration of outer space; to industry, to medicine, to communications; and most significantly, it can be the basis of your own future.

How far can you go in an electronics career? Only the laws of nature can stop you — and new laws are always being discovered. Someday you may discover one yourself, or you may apply new laws to the invention of new devices. Or perhaps you'll uncover a new slant on the old laws and establish a breakthrough like television, or radar, or the electron and ion microscopes. Whatever career you choose in the wide realm of electronics, whether as scientist, engineer, teacher, technician, or even salesman — you'll have endless opportunities to contribute to mankind's progress and your own satisfaction.

Since World War II, electronics has expanded with the lightning speed of the particles after which it is named. According to Secretary of Commerce Luther Hodges, "During the past ten years, the manufacture of electronics products expanded twice as fast as the (total) national output . . . research and development in electronics accounted for expenditures of an estimated $2 billion . . . New scientific knowledge led to the establishment of entirely new enterprises which did not exist before the war, or existed only as laboratory curiosities . . . ."

One breakthrough leads to another; each fans outward like a searchlight beam to illuminate new ideas, new applications, new products. In electronics you will be working at new frontiers, with the most powerful and stimulating forces of nature — electricity, magnetism, and the mysterious "glue" that holds together the parts of an atomic nucleus.

Is there a future in electronics? The Universe itself is your only limit!

From: Increasing Reading Efficiency
Revised Edition
Lyle L. Miller  pp 281-82
ANSWER THESE QUESTIONS

1. Total time used reading and developing your study technique ______.

2. Number of Correct Answers ______.

3. Questions -

   True  False

1. Electronics is an area of science and engineering which explains and exploits the magic of electrons to benefit mankind. _____  _____

2. Joseph J. Thomson discovered that electrons are lightweight charges of positive electricity that neutralize the heavier negative charges in the atom. _____  _____

3. The electron can be accelerated to greater speeds than either the neutron or proton because:
   
   ______(1) it has a neutral charge and is highly flexible.
   
   ______(2) more information is available in relation to the electron.
   
   ______(3) the electron is much lighter than the proton or the neutron.
   
   ______(4) the electron becomes lighter as its speed is accelerated.

4. An example of electromagnetic radiation visible to the human eye is ________________.

5. The phenomena which allow engineers to develop transistors have opened a new field — solid state electronics. _____  _____

6. The field of cybernetics involves investigation of the microminiaturization phenomenon. _____  _____

7. The goal of the researcher participation in the "SBS" investigation is:
   
   ______(1) to discover a higher energy gamma radiation
   
   ______(2) to develop a method of fusing together different solid materials.
   
   ______(3) to increase knowledge of solid-state electronics.
   
   ______(4) to develop electronic machines based on human behavior patterns.

8. The domain of electronics extends throughout all the ________________ , from biology to astronomy.

9. In the past ten years the manufacture of electronic products expanded half as rapidly as the total national output. _____  _____

10. Electronics is a desirable area of occupation because it is as unlimited as the universe. _____  _____
USE THESE PAGES TO DEVELOP YOUR STUDY TECHNIQUE.
Electronics—Your Chance to Shape the Future

Career horizons unlimited!

In science and engineering nowadays there is an often used word. That word is "exotic." Exotic implies something strange and wonderful. Career opportunities in electronics promise to be exotic. In fact, new opportunities continually arise -- not only for the creative scientist and engineer, but for every eager searcher whatever his special interests may be. The situation is almost parallel to that time-worn dream of romantic inventors -- perpetual motion. It works this way. Laboratory experiments require new kinds of electronic instruments that develop into new fields of gadgetry which branch out into new discoveries about the laws of nature that lead to new kinds of industry which again branch out into new household conveniences, more effective methods of communication, better ways to control illnesses, safer and faster travel, more efficient techniques in education, more luxuries to enjoy cheaper products through automatic mass-production, speedier ways to solve complex problems, highly accurate air defense and alarm systems to assure your security, as well as an over-all increase of precision throughout almost every endeavor stimulated by modern society. A few examples are automatic pilots for aircraft and sea-going craft, electronic controls in factories, hearing aids, tape recorders, and manned spaceflight.

The rapid and continuous application of electronics provides jobs for everyone: scientists and engineers evolve new principles, engineers design devices based on those principles, technicians and craftsmen use their skills to construct the devices, salesmen see that the devices are distributed, field technicians install and maintain the devices, and teachers train students in all of these techniques.

As an electronics specialist, you can be involved in the excitement of building and operating analog or digital computers, giant radar installations, microwave relay systems that span the continent, missile tracking and detection systems as well as automatic countdown systems for checking out and launching the big "birds," radio telescopes at the great observatories, television transmitters and cameras (both black and white and full color) and perhaps one day stereophonic installations at FM radio stations, and remote-control handling systems in the nuclear or industrial manufacturing fields. These are only random choices of challenging activities that are available for
you today. Tomorrow's will be even more extensive.

Astrionics

Someday men are going to land on the moon and planets to colonize those alien bodies. They will be able to accomplish this mainly because of a new branch in electronics. Astrionics is the field of application of the electronics technology involved with spaceflight, just as avionics is the field of application of electronics to flight within the Earth's atmosphere. In each case electronics provides navigational and control equipment that performs tasks with precision and speed beyond the capability of human beings. Electronic devices also assure communications that give the pilot and crew vital information, including the isolation and warning of a malfunction to the craft. Astrionics further includes an entirely new area that is just now getting under way: satellite communications system. There will be electronic repeater-stations in space that can relay voice, television, facsimile and teletype signals from any one point in the world to distant points. They will be unaffected by weather conditions on Earth or magnetic storms on the Sun, because they will use microwave radio. Another young and rapidly growing technology, this uses electromagnetic waves of such short wavelength that they can pass through the spaces between raindrops or electrified particles in the gases of the upper atmosphere. Already experimental models of these repeater-stations have been successfully orbited in space.

Intellectronics

As this coined word implies, it describes another new field of electronics -- the processing and storing of information. Ultimately, all information presently stored in books may be much more efficiently stored by electronic means. This would have a powerful effect on the processes of education -- since at the push of a button, so to speak, any kind of special information on whatever subject could be retrieved and displayed in a matter of seconds. Certainly this would be a great help to you in researching a theme paper. It would also help your teacher devise ways to build up your background of knowledge faster. The scientist, engineer, and technician too, would be saved a vast amount of valuable time that they now use up in searching through technical literature for solutions to problems. Intellectronics is a wide-open field to those of you with a mathematical bent. It depends upon the development of new approaches to information theory, computer-logic, and on non-
linear differential equations. Yet those of you who
like to tinker experimentally, build gadgets, or are
curious about natural phenomena also have a place
in intellectronics.

Low temperature electronics -- Cryogenics

This is the realm of extremely low-temperature
phenomena (sometimes referred to as cryogenics).
It is becoming increasingly important in electronics,
since electrical conductivity increases as temperature
drops lower and lower. At the temperature of liquid
helium some metals become superconductors. The
general reason is that almost all the atoms which
form the material cease their thermal vibrations in
crystalline lattice structures and offer virtually no
resistance to the passage of electrons from one to
another. Cryogenic electronics could be your dish,
if you have an exploring kind of mind that likes to
delve into the physical properties of nature and
adapt them to useful work on new levels. Take your
choice; you can be either an electronics physicist or
electronics engineer and still find a place in cryogenics.

MHD and plasma electronics

"MHD" stands for magnetohydrodynamics. It
deals with the motion of an electrically conducting
fluid in the presence of a magnetic field. A plasma is
a gaseous mixture of charged particles -- negative
electrons and positively charged molecules of gas.
After acceleration by a magnetic field these particles
possess enormous energies, evidenced by kinetic
temperatures of thousands to millions of degrees.
The thermonuclear reaction possible with this phe­
nomenon could lead to the direct conversion of matter
into electricity. Designers are already at work on
MHD engines for space ships. Such engines could
accelerate a space craft to half the speed of light.
Other types of space engines being actively worked
upon by electronics engineers include electrostatic
as well as ion-driven ones. The problems involved
with MHD are formidable. Ultra high temperatures
can be maintained for but brief fractions of a second.
The problem of confining the high temperature
plasma by a magnetic field is waiting to be solved.

Electronics at home

After all this talk about extremely low and ex­
tremely high temperatures, it may appear rather
prosaic to discuss electronics in the home. Yet it's
not prosaic at all, for electronics is exciting in all of
its many forms. Increasingly, electronics engineers have been creating more and more automatic devices for the home. With the tremendous advances made in miniaturization through solid-state electronics much equipment can be packed into a small space. Normally, hi-fi amplifiers require areas covering one-half to one full square foot of space. Micro-miniaturization has made it possible to produce an amplifier in a space no larger than a dime. An entire computing system can be built into a cubic foot or less.

Career summary

Because electronics forms a vitally important sustaining part of so many other areas of endeavor, it is practically impossible here to make a job-by-job listing of all available positions. Most electronics work is usually accomplished by teams. A given project may offer work to persons ranging in education from high school graduate to Doctor of Science or Philosophy. In terms of varied skills, electronics runs the gamut from factory assembly-line to research engineers. In terms of opportunities, there are vast areas of specialization within industry and the military. In terms of salaries, those in the electronics industry are well above those of technical industry in general.

Electronics is moving forward at such a pace that alert, well-trained and interested people must be found to help both the military and industry keep up with technological progress. Training may be either academic or technical or both. Such training most assuredly requires a solid and well-planned high school education as a basis with additional reading and tinkering on your own.

Record Reading Time

From: Increasing Reading Efficiency
Revised Edition
Lyle Miller. pp231-233
ANSWER THESE QUESTIONS

1. The total time used reading and developing your study technique ________.

2. Number of Correct Answers ________.

3. Questions -

1. The way in which new opportunities continually arise in the field of electronics may be compared to the inventor's dream of:
   _____(1) laboratory experiments.
   _____(2) automatic mass production.
   _____(3) perpetual motion.
   _____(4) manned space flight.

2. An electronics specialist can be involved in the excitement of building and operating analog and digital computers. True______ False______

3. ______________ is the field of application of the electronics technology involved with space flight.

4. Intellectronics involves the new area of satellite communications. True______ False______

5. Intellectronics is a wide-open field to those with a mathematical bent. True______ False______

6. Cryogenics is a field dealing with extremely high-temperature phenomena. True______ False______

7. The thermonuclear reaction possible with the "MHD" phenomenon could lead to:
   _____(1) the direct conversion of matter into electricity.
   _____(2) the formation of a gaseous mixture of charged particles.
   _____(3) the development of a magnetic field.
   _____(4) the production of negative electrons.

8. Electronics engineers are creating fewer and fewer devices for the home. True______ False______

9. Miniaturization is the process which has made it possible to produce many household devices which fit in very small places. True______ False______

10. In terms of educational training, most jobs in electronics require at least a ________________ education.
USE THESE PAGES TO DEVELOP YOUR STUDY TECHNIQUE
The Story of Western Union

From smoke signals to talking wires

The streamlined telegraph era of today is a far cry indeed from the primitive fire, smoke and flag signals of early times. A thousand years before this era of highspeed selective switching systems, radio beam telegraphy and multi-channel, printing telegraphy, man wished for rapid communications. In medieval times, knights flashed their burnished shields to communicate with each other. Argonauts used colored sails on their ships to convey a meaning. The Greeks, Romans and Aztecs used relay runners. In the days of Julius Caesar, sentinels were stationed in towers at regular intervals to shout messages from one to the other, covering as much as 150 miles in a few hours.

The jungles of Africa and islands of the South Pacific still echo with the throbbing of native tom-toms, or drums, to communicate with distant villages. Our American Indians signaled by day with puffs of smoke, and at night by waving torches and shooting flaming arrows into the sky. The huge fortune of the Rothschilds was made in part through information they obtained by use of carrier pigeons. Semaphore towers were used by George Washington during the Revolutionary War, and more than a century ago systems of Semaphore Towers, with arms that were moved to various positions to convey messages, were built for hundreds of miles in France, England and the United States. Early forms of rapid communication, however, were all slow. Men constantly rebelled against the limitations of time and space.

The first man to direct thought to the use of electricity for communications was Roger Bacon, in 1267, and he was put in jail for twenty years for dealing in black magic. The burgomaster of Magdeburg, Germany, Otto Von Guericke, made the first electricity-producing machine in 1650. It was a sulphur ball that he charged by rubbing his hands on it, just as we can charge our bodies by rubbing our feet on a thick rug. Wood, of England, found in 1726 that electricity could be conveyed by a metal conductor, and a few years later Gray and Wheeler sent electricity through 800 feet of wire. Thus the basic principle of telegraphy was known more than 200 years ago.

After that time, literally hundreds of men carried the knowledge of electricity forward, each adding something that helped in the invention of the tele-
graph. Oersted showed that current exerts a force which will deflect a magnet; LaPlace advanced the idea that a magnetic needle might be deflected to receive messages at a great distance; and Ampere put magnetic needles at the ends of 26 wires, so that deflections would signal the letters of the alphabet. In 1820 Baron Schilling, a gay captain of Hussars in the Russian Army, produced a telegraph which he operated by the use of five magnetic needles.

Harrison Grey Dyar operated a telegraph line on Long Island, N.Y., in 1826. Joseph Henry, a school teacher at Albany (NY) Academy, operated an electromagnetic telegraph in his room in 1830 and '31. He also built a line which he operated between two buildings at Princeton University in 1836. Gauss and Weber devised a simple magnetic telegraph in 1833 at the University of Goettingen, and Steinheil improved on their system in 1836. In the following year, Sir Charles Wheatstone and Sir William Cooke obtained a patent in England for their telegraph, the first in England.

Samuel Finley Breese Morse

The first really practical telegraph system was invented by Samuel F. B. Morse, a distinguished American painter who founded the National Academy of Design.

Returning from a trip to Europe on board the Packet Ship "Sully" in 1832, Morse received his great inspiration. He realized that, if he could transmit intelligence and record it at a distance, he could revolutionize communications. He thought of signs which could be transmitted over a wire, and realized that the dot, dash and space were three signals which could be easily communicated. Morse was appointed professor of the Literature of the Arts of Design at New York University in 1835. This gave him a small salary, and provided the rooms in Washington Square where he built his first telegraph instrument, a crude affair constructed on a picture frame, with an ordinary lead pencil suspended by a pendulum to make the dots and dashes.

Morse demonstrated his first apparatus before a group of friends in his rooms at New York University on September 2, 1837. One of those present was Alfred Vail, son of Judge Stephen Vail, of the Speedwell Iron Works at Morristown, N.J. Young Vail became Morse's partner, providing money and building new and better instruments. These instruments were shown before an audience in the Geological Cabinet of the New York University, January 24, 1838. General Thomas S. Cummings was present,
and when Morse asked for a message to be sent, a friend of Cummings wrote a facetious military command: "Attentions, the Universe! By Kingdoms, Right Wheel!"

Morse exhibited the telegraph before President Van Buren and his Cabinet at Washington, D.C. Members of Congress called it a crazy scheme. Morse tried for years to get Congress to appropriate money for an experimental line, and finally his bill was passed on March 3, 1843. News of the Bill's passage was brought to him by Annie Ellsworth, daughter of the Commissioner of patents, and he gave Annie the honor of preparing the first telegram. The first telegraph line, built between Washington, D.C. and Baltimore, was opened before a distinguished group in the Supreme Court Chambers, on May 24 1844. The first telegram, handed to Morse by Annie Ellsworth, was "WHAT HATH GOD WROUGHT!"

The experimental line was exhibited for a year, but government officials decided the telegraph was an interesting toy that never would earn enough money to support itself. Morse then persuaded a skeptical public to buy stock and finance the telegraph as a private enterprise. The telegraph industry has been a private enterprise ever since, far outgrowing the subsidized, government-operated telegraph systems of foreign countries. More than a third of the world's telegraph mileage is in the United States.

Morse and his associates extended the Washington-Baltimore telegraph line to New York City in 1846. Others obtained licenses from Morse and built lines between New York and Buffalo, New York and Boston, and other eastern cities. Western Union now has over 2,500,000 miles of carrier system circuits, many of which carry as many as 288 messages simultaneously.

Western Union -- How it started

Over fifty telegraph companies were in operation in 1851 when a group of Rochester (NY) men led by Hiram Sibley, Ezra Cornell, Samuel L. and Henry R. Selden organized to found the New York and Mississippi Valley Printing Telegraph Company. Lines to operate the House Printing Telegraph System, which printed the received message in plain Roman letters instead of dots and dashes, had been built prior to 1850 between New York and Boston, and between New York and Philadelphia. The group of Rochester men acquired rights to extend the House System throughout the United States.

Thirteen other companies were operating short lines in the five states north of the Ohio River. It
was not easy to send a telegram a great distance; it had to be transferred from one line to another and the charges of each line had to be paid. Service was slow and unreliable. Two of these lines were sold for debt, and the others were in such an impoverished condition that the New York and Mississippi Valley Company bought them out. The Company was named Western Union Telegraph Company, indicating the union of the western lines in one system, on April 4, 1856. This name was insisted upon by Ezra Cornell, pioneer line builder, who used a part of the telegraph fortune he made to found Cornell University. Western Union continued its policy of merging with other companies and building new lines, rapidly extending telegraph service over the nation.

This continued growth and expansion was accompanied by study and research into the improvement of machines and services. Consequently Western Union was able to provide better service to its customers with each passing year.

Record Reading Time  

From: Increasing Reading Efficiency Revised Edition  
Lyle Miller. pp 219-221.
THE STORY OF WESTERN UNION

ANSWER THESE QUESTIONS

1. The total time used reading and developing your study technique ______.

2. Number of Correct Answers ________.

3. Questions -

   1. Which of the following methods of communications was not used in the early days?
      _____(1) Flashing of sunlight from shields.
      _____(2) Coded colored sails.
      _____(3) Sending messages by wire.
      _____(4) Shouting messages through signals.

   2. The one thing which all early forms of communication had in common was that they were all _________.

   3. Early ideas of using electricity for communication brought accusations of black magic.

   4. The basic principles of telegraphy were unknown before the 20th Century.

   5. Samuel Morse invented the first really practical telegraph system.

   6. The major contribution which Alfred Vail made to Morse's invention by his partnership was his financial assistance.

   7. Members of Congress were enthusiastic after Morse's demonstration in Washington, D.C.

   8. The money for the building of the first experimental telegraph line was provided by _________.

   9. In 1851 there was only one major telegraphic company operating in the United States.

10. The company which was the forerunner of Western Union was the:
      _____(1) New York and Mississippi Valley Company.
      _____(2) House Printing Telegraph Company.
      _____(3) Ohio River Telegraph Company.
      _____(4) Sibley — Cornell — Selden Telegraph Company.
USE THESE PAGES TO DEVELOP YOUR STUDY TECHNIQUES
MASS INVESTMENT

Industry and business are working with the New York Stock Exchange and with other segments of the securities business to create a nation of share owners and a stronger America. Our ultimate goal is a direct ownership interest in the tools of production for every family in this country — or, to put it another way, we would like to see to it that every American who is able to, owns a share of American business.

It is our deep conviction that capitalism in the United States cannot even survive without direct public participation and support. We cherish our political democracy — now, to safeguard that political freedom, we must seek true economic democracy.

The most prosperous year in our history has just ended. At the start of 1954 the immediate future is clouded by such factors as declining new and unfilled orders in the hands of manufacturers, a rise in business inventories, a slight increase in unemployment, retail sales a little smaller than they might have been. It is quite possible that the current year may see a outlook — and with it go all the qualms which accompany any attempt to gauge exactly the immediate future.

Long View

But if we step back a bit and try for a longer perspective, we get a different view and the ruts that look so ominous when they are under our noses seem to level off. In my opinion the future of America's industrial development is still in the toddling stage. A growing population is demanding a bewildering variety of goods and services which didn't exist even a couple of decades ago. Lest this may sound like overly optimistic theorizing, I should like to mention a comment made a few days ago by Crawford H. Greenewalt, President of Du Pont.

"It is also interesting to note," he said,"that when anyone in the past has attempted to predict the long-term future, his forecast has turned out to be hopelessly shortsighted and pessimistic."

We are just starting to learn the potentialities of such industries as electronics, petro-chemicals, antibiotics — while stretching ahead, still to be explored, is the incalculable range of atomic energy. The pressure for more and better products must grow indefinitely; and the pressure must come from a fully employed and increasing labor force which has income to satisfy its wants and needs.
Industry itself knows that its own vitality hinges upon figuring out new and better ways to satisfy the American public — and is spending more than one billion dollars a year on research with that ultimate aim in mind. This often spectacular technological progress, of course, is translated every year into the construction of new plants and equipment.

Funds Needed

Industry cannot afford to rely on a limited number of people for capital to finance future expansion. The money that is needed must come from millions of people who are not now investors — the investors of the future who will share in the ownership of American industry.

Now, how does all this affect the New York Stock Exchange? How can the Stock Exchange make the maximum effective contribution to the national welfare? The answer, it seems to me, lies in the honest and efficient discharge of the Exchange's responsibilities to the public and to industry.

Mass production and mass distribution are two modern phenomena on which American prosperity is founded. But to exploit those two concepts for the maximum benefit of the maximum number of people, a third concept must be added — mass investment. It's no secret that a great many people, including myself, were disturbed by the disclosure in the Brookings Institution census of share owners that only 6,500,000 people had an ownership stake in our corporate wealth at the close of 1951. That figure must be multiplied again and again — if we want capitalism to work at maximum efficiency.

Primary Job

I regard it as a primary job of the Stock Exchange to make true economic democracy part of our way of life and not merely a catchy phrase.

In recent years the Exchange has conducted an intensive educational campaign to tell people about the importance of the investment process to our economy. We intend to intensify and broaden that effort. In January of this year, as part of our campaign to encourage share ownership, one of the most significant developments in financial history was made available to the public by the Exchange's member firms: The opportunity to purchase the securities of our great corporations on a pay-as-you-go basis. The Monthly Investment Plan, as it is popularly known, clears the road — for the first time — to mass investment.
New Departure

The Monthly Investment Plan represents a radical step for the Stock Exchange community — just as radical in its way as General Electric's use of Bing Crosby and Ken Carpenter to discuss the importance of investment before a nationwide radio audience — just as radical as Pennsylvania Railroad, Chrysler, Socony-Vacuum, Monsanto Chemical and Allied Chemical utilizing the street floor windows of Exchange member firms to graphically tell to the public their own story and the contribution of investment to their growth.

Simply as a matter of self-preservation, industry must go to the public for a larger share of the funds needed for new plants and equipment. For the investor must be protected, too, whether he is already a share owner or is becoming one for the first time. The Stock Exchange, of course, has its own regulations for the protection of the investor — such safeguards as insistence on sound corporate accounting practices by its listed companies, frequent and full reports to their share owners, and that supervision which has given member firms a record of integrity and fair dealing.

Taxation

The Exchange has a responsibility in other areas in which the interests of the investor are at stake — the responsibility to fight against confiscatory, unfair and crippling Federal Tax legislation. Freedom of capital has been the cornerstone of our business system since this nation was founded. Yet the Capital Gains Tax and double taxation of dividends have seemed to be almost deliberately contrived to impede the freedom of capital and to discourage investment. These are unjust laws. It is our obligation to oppose them — and I am pleased to report that the new administration appears to be as aware as we are of their inherent defects.

In his State of the Union Message, President Eisenhower said: "We should now revise the more glaring tax inequities, particularly on small tax payers; reduce restraint on the growth of small business, and make other changes that will encourage initiative, enterprise and production."

A Free Market

We have still another responsibility: To maintain a marketplace where the securities of the nation's
leading corporations can be bought and sold quickly. The need for such a marketplace led to the foundation of the New York Stock Exchange 162 years ago. The need today is greater than it was then and the need tomorrow will be greater still. We provided such a marketplace in George Washington's day — we shall provide it for the America of tomorrow, the prosperous nation built by mass investment.

From: Increasing Reading Efficiency
Revised Edition
Lyle L. Miller pp 273-74
ANSWER THESE QUESTIONS

1. Total time used reading and developing your study technique _____.

2. Number of Correct Answers ________.

3. Questions -
   1. Industry and business are working with the exchange to increase the number of share owners. True False
   2. The Exchange would like to see everyone everywhere own shares of American industry. True False
   3. According to this author, economic democracy is necessary to safeguard political freedom. True False
   4. America's industrial development is in its infancy. True False
   5. The author believes he is justified in being True False

6. Capital to finance future expansion must come from
   ____ (1) Increased profits.
   ____ (2) Future investors.
   ____ (3) Borrowed money.
   ____ (4) Retained earnings.

7. At the close of 1951 how many people shares as owners of our corporate wealth?
   ____ (1) 5,000,000
   ____ (2) 3,500,000
   ____ (3) 3,000,000
   ____ (4) 6,500,000

8. The primary job of the Exchange is to protect investors. True False

9. The Monthly Investment Plan clears the road to True False

10. Tax legislation can't harm the interests of investors. True False
INSURANCE FOR LIFE

Four Types of Life Insurance

Most family life insurance falls into 4 main categories — term insurance, ordinary life, limited-payment life, and endowment. Your agent will get out his little black book and give you details about each variety, but here are some general facts you should know.

Term Insurance

Term insurance provides temporary coverage only. It runs for a limited number of years, usually 5 or 10, and then expires unless renewed, always at a higher premium rate necessitated by the increased age of the policyholder. For a young person it is much the cheapest kind of insurance, and can provide valuable protection for temporary periods.

But term insurance has serious disadvantages. Its cost becomes prohibitive as one grows older and it usually has no cash or loan value. If your health fails, you may not be able to renew your coverage without a medical examination. The insurance pays off only if the policyholder dies. Insurance experts say no family should depend upon term insurance alone for any length of time.

Ordinary Life

Ordinary life, which is often called straight life or whole life, is the most popular form of life insurance. As its name implies, its purpose is to provide lifetime protection, and it does this at a premium rate which can never increase. Premiums are determined by your age at the time you take out the policy (the younger you are, the lower they are), and are payable as long as you live.

The face value of an ordinary life policy is payable only at death but such policies have, in addition, attractive investment features. As time passes, they acquire an increasing cash value and can be converted into dollars and cents if you need money for an emergency or no longer have dependents to protect.

Moreover, you have the privilege of borrowing money on an ordinary life policy or can put it up as collateral for a loan. For all these reasons most experts think the average family should build its insurance program around at least one ordinary life policy.
Limited Payment Life

Limited-payment life insurance is exactly like ordinary life, except that premiums are paid for a limited number of years instead of for life. Usually, after a period of either 20 or 30 years, the policy becomes paid up, and the policyholder remains insured from then on without having to spend another cent on premiums.

Many young people prefer these limited-payment policies because they don't like to look forward to paying premiums as long as they live, but they have one drawback: the premiums are a good deal higher than those of ordinary life, and the young breadwinner, whose income and babies are both apt to be small, can't get as much protection for his money as he could if he bought ordinary life.

A better type than 20-or 30-year payment life for most young people, the top authorities say, is life paid up at age 65. This gives relatively low-cost protection for one's family, yet doesn't require continuing premiums after the normal retirement age.

Endowment

Endowment policies carry a far greater investment element than either ordinary life or limited-payment life policies. This kind of insurance is very expensive for the amount of protection afforded, but if you buy it you are assured of collecting the full face value of your policy at the end of a specified number of years. Or your beneficiaries collect if you die before the policy matures.

When I was 21, I took out a modest 20-year endowment policy. Not long ago, when I reached 41, I collected the full value of the policy and applied it against a mortgage on my home. That worked out very well, but, looking back, I feel I was rather foolish. Had I turned up my toes at any time during the 20 years, my dependents would not have received nearly as much cash as they would have if I had put the same amount of premiums into another type of policy.

When the endowment matured I was in good health, fortunately, and able to replace it with ordinary life coverage, but had that not been the case my family would now be unprotected except for a group policy which I have.

Which Types For You?

In considering the 4 principal types of policies I have described, remember you don't have to select
just one kind. Your needs may call for several types of policies.

If you are a breadwinner of 30, for example, have two children, are just making ends meet, but expect to have a larger income in a few years, you may find it wise to buy a comparatively small ordinary life policy and even smaller endowment coverage for your kids' college costs, but a big slice of term insurance to protect your family until you can afford more permanent insurance. In this case, it is important to be sure your term insurance can be converted into permanent insurance.

Family Income Policies

Before doing this, though, you should ask your agent about family-income and family-maintenance policies. These are combinations of ordinary life and term insurance which have been specially designed to help young families over their lean years.

On the other hand, if you are now earning a lot of money but expect a reduced income later, you may wish to invest in a life-annuity contract. There are many different kinds of annuities, but they all have one thing in common: they provide the insured person with a regular income from a specified date until death.

Four Suggestions

There are 4 final tips, however, which the risk experts have for every insurance purchaser.
1. Read the fine print on any policy you buy and be sure you understand it.
2. Pay your premiums annually or semiannually instead of on a monthly or quarterly basis. You'll save a good deal of money that way over the years.
3. Keep your policies in a safe place, preferably in your home, and let the person who will settle your affairs in the event of your death know where they are. A safe-deposit box is safe, but it generally has the disadvantage that after the death of the insured it may not be opened except by court order.
4. Review both your property and life insurance programs at regular intervals. Changing family needs frequently require changes in insurance. Students of the subject told me every family should re-examine its program at least once every 3 years.
While all insurance is a form of gambling, it is gambling which permits you to play safe. "The essence of the business," Winston Churchill once said, "is bringing the magic of averages to the rescue of the millions."

This magic, if intelligently applies, can provide an inestimable amount of security for you and your family.

From: Increasing Reading Efficiency
Revised Edition
Lyle L. Miller  pp 259-60
ANSWER THESE QUESTIONS

1. Total time used reading and developing your study techniques _______.

2. Number of Correct Answers _______.

3. Questions -

   1. Although low in cost, term insurance has the disadvantage of providing only ______ coverage.

   2. Premiums on ordinary life insurance are determined by your ______ when you take out the policy.

   3. On limited-payment life insurance one pays a fixed premium for as long as he lives.

   4. Endowment policies are much more expensive than the other three types for the same amount of coverage.

   5. Mr. Woodbury says you need to select the one type of insurance which will give you the most protection for your money.

   6. A combination of ordinary life and term insurance commonly used by young families is called a:

      _____(1) Family-income policy.
      _____(2) Child support policy.
      _____(3) Life annuity contract.
      _____(4) Ordinary term life insurance policy.

   7. Premiums are the same each year whether paid quarterly or annually.

   8. Reading the fine print in a policy may protect you from buying worthless insurance policies.

   9. You will save money by arranging to pay your insurance premiums:

      _____(1) Monthly.
      _____(2) Weekly.
      _____(3) Annually.
      _____(4) Whenever you can.

10. Mr. Woodbury recommends that families re-examine their insurance policies at least once every three years. _____
WESTERN NATIONAL PARKS

From those who are searching for a space that is wide and open after spending a winter being confined, the Western parks offer nature in broad tracts virtually untamed and unspoiled. The southern circuit, in the first place, has Grand Canyon, a tremendous split in the earth's physiognomy that is 217 miles long, anywhere from 4 to 18 miles wide, and a mile deep. All this can be found in the northeast corner of Arizona.

Grand Canyon

Only 105 miles of the chasm are within the limits of the National Park, but still, that should give you plenty to look at. At Yavapai Point on the south rim, it is ten miles across the ditch, and geologists from the National Park Service give daily lectures here about the wonders of nature. Among the wonders is the Colorado River which buzzes along through the canyon floor at anywhere from 2 1/2 to 20 miles an hour chewing away a million tons of sand every day. This has been going on longer than I can quite comprehend, and it just shows you what persistence can accomplish.

For those who stand on the rim and look down, the Canyon is always changing. As the sun shifts the 'vermilion shades become russet, the cerise becomes bronze, maroon blends into copper, the orange becomes tarnished, the white turns ashen gray. Those who view these proceedings from the south rim can make their headquarters at El Tovar Hotel. Paved footpaths run out from here and the morning drives of the motor coaches stop at Powell, Hopi, Mohave, Pima, and come to a halt at Hermit's Rest. An afternoon drive travels east through the Kaibab National Forest, skimming the Canyon's rim with stops at Yavapai, Yaki, Moran, and Lipan, terminating at the Indian Watchtower, which offers one of the finest views of the Canyon, the Kaibab Forest, and the Navajo Indian country as well.

El Tovar Hotel, the Bright Angel Lodge and Grand Canyon Cabin Camp offer fine food and reasonable accommodations. The buses are operated by Fred Harvey, who also maintains a string of mules. The mules are for those who are less engaged by a long distance view than a close-up inspection. The penalty for this curiosity comes in the form of mule-back journeys into the Canyon itself. Guides lead
the curious from the south rim down Bright Angel Trail stopping at Indian Gardens and ending on the rocky banks of the Colorado exactly one mile below the rim. After lunch by the river, and afternoon's climb lands you back on the rim before dinner. Twenty thousand people make the trip every year. For those who would commune even closer to rock bottom, there is a two-day Phantom Ranch trip. The ranch, on the floor of the Canyon, has rustic cabins and even a swimming pool.

The numerous package tours of the Santa Fe Railroad ranging from two weeks to a month and priced from $200 up, cover not only the usual tourist attractions of the western U.S., but also extend into Canada and Mexico. All 31 of the tours include stops at Grand Canyon.

Zion and Bryce

Travelers doing Grand Canyon can easily tie in visits to the Utah parks — Bryce Canyon and Zion. At Zion, the Virgin River is busy washing away a canyon from the Navajo sandstone beds. The Mount Carmel Tunnel at Zion has six windows cut out of the rock, giving magnificent views of the Canyon 1,000 feet below. Once out of the tunnel, the highway takes a sightseers on a twisting trail to the Canyon floor, a feat which took the river a million years to accomplish. There are trips to the floor by horseback too.

Bryce Canyon is something else again, possibly because it is not really a canyon at all but a sort of natural amphitheater formed out of the pink and white limestone. It is two miles wide, three miles long and 1,000 feet deep.

A variety of all-expense escorted tours are conducted through the southern Utah-Arizona parks by the Union Pacific Railroad. Figuring from Cedar City, Utah, and including all meals and lodging, there is a five-day Zion, Bryce and Grand Canyon trip for $78 and another over the same route with a shorter schedule for $71.75. Three days at Zion comes to $46 and two days of Zion and Grand Canyon is $40.75. There are convenient trains to Cedar City from Chicago and St. Louis and also from Los Angeles.

The Chicago Northwestern and Union Pacific tie up with a package tour of the Utah-Arizona National Parks covering all three from Chicago in twelve days for $238.50 in coaches, or about $50 more in sleeping cars. Another tour takes in the above areas and also Yellowstone, leaving Chicago every Sunday.
Yellowstone

Yellowstone was the great unbelievable phenomenon when it was first explored. New Englanders, who seem to have been more skeptical than most, simply refused to believe the existence of geysers bursting into the sky every few hours. Today, a million visitors come to see the wonders of Yellowstone. It is the largest and oldest of the national parks, comprising 3,500 square miles on which the black bear, the grizzly, the deer, the moose, the beaver, the antelope and the buffalo roam. The Giant geyser sends a jet of steam 240 feet in the air, which is 100 feet higher than Old Faithful.

The hotels at Yellowstone include Mammoth Springs, a full-fledged resort enterprise including cottages; Old Faithful Inn, a luxurious log cabin lodge with the geysers performing all but in the front yard; the Canyon Hotel near the rim of the canyon, and celebrated for its tremendous "lounge," one of the largest hotel rooms in captivity. There is a standard two-and-a-half-day hotel tour to Yellowstone pegged at $46.75, which includes all meals and persons in a double room without bath.

The Northern Pacific Railway runs several "Yellowstone Vacation" tours, among them a four-day trip based on a cost of $69.50, which begins at Gardiner, northern entrance to the Park area.

Glacier

Yellowstone occupies the northwest corner of the state of Wyoming but for those who are looking for lands even more northern, there are the Northern Rockies which form the Glacier National Park in the top of Montana. These mountains rise in an abrupt wall straight out of the Montana plain and appear higher than their average of about 10,000 feet. The range is covered by dense forests, glacial valleys and mountains meadows tossing with wildflowers all summer long. There are some sixty silver glacier caps, 200 lakes, and cascades and waterfalls on which there is no census. If it's warm around your block, come to Iceberg Lake where small but cold bergs float on the surface in the middle of the summer.

There is no problem about where to rest one's head between sightseeing excursions. The Glacier Park Hotel commands the east entrance, Many Glacier sits on the edge of Swiftcurrent Lake, and the Lake McDonald Hotel rests by the shores of the largest lake on the west side of the park. Hotels are
on the American plan, starting at $9.25 per day. There also is lodging to be had at Alpine chalets at Granite Park and Sperry Glacier and at a number of camps with grocery stores nearby.

Glacier is the only national park on the main line of a transcontinental railway and is in easy reach from Chicago, St. Paul, or California and the west via Portland or Seattle. The Western Star, a Great Northern streamliner, stops at both the east and west entrances of the park everyday during the summer season which on the railroad calendar runs from June 15 to September 10.

A good part of the Glacier Park area was bought from the Blackfeet Indians whose reservation adjoins the premises. The tribe sends a delegation to pitch a summer encampment near the Glacier Park Hotel and presents pow-wows each night. They wear beaded white buckskin, war bonnets of tossing eagle feathers and other raiment representative of the well-dressed Indian.
ANSWER THESE QUESTIONS

1. The total time used reading and developing your study technique __________.

2. Number of Correct Answers __________.

3. Questions -

   1. It is possible to motor down to the banks of the Colorado River in Grand Canyon Park. ____  __

   2. It is possible to motor down to the banks of the Virgin River in Zion Park. ____  __

   3. Bryce Canyon is sort of a natural ____________________________

   4. The largest and oldest of the national parks is:

      ____ (1) Yellowstone.

      ____ (2) Grand Canyon.

      ____ (3) Bryce Canyon.

      ____ (4) Zion.

   5. Old Faithful is the highest geyser in Yellowstone Park. ____  __

   6. One of the largest hotel rooms may be found in the Canyon Hotel in Zion. ____  __

   7. Hotels in Glacier Park operate on the American Plan rather than on a fixed fee for the whole trip. ____  __

   8. Glacier is the only national park on the main line of a transcontinental railway. ____  __

   9. A good part of the ____________________________ Park area was bought from the Blackfeet Indians.

   10. Which of the following was not mentioned as an attraction in Yellowstone Park:

        ____ (1) Spacious hotels and lodges.

        ____ (2) Beaver and other wild life.

        ____ (3) Indian pow-wows each night.

        ____ (4) Geysers of great beauty.
APPENDIX C

INSTRUCTIONAL PROCEDURES
APPENDIX C

INSTRUCTIONAL PROCEDURES

The instructional procedures for each technique were determined by the POPRADR framework and took the following form: beginning with the first week of the eight week study.

**Week One.** The *Nelson-Denny Reading Test for High Schools and Colleges*, Form A, (1960) was administered to the students followed by a description of the purpose and duration of the course. Students were told that the course would focus on the learning of a study method rather than the attainment of a high reading rate.

**Week Two.** The PREREAD (P) and ORGANIZATIONAL PATTERN (OP) were introduced in this session. The PREREAD step was patterned after the Preview skimming technique formulated by Berg, Taylor and Franchenpohl (1962). The construction of the OP outlines for each method was demonstrated and practice provided with material drawn from the *Controlled Reading Study Guide*, Set LK (Taylor, et.al., 1964).

**Week Three.** The full POPRADR procedure was demonstrated and practice provided in this session using material drawn from Taylor, et.al. (1964).

**Week Four.** Ten minutes of review of the POPRADR procedure was provided followed by the first informal assessment. The assessment was administered to students as a series of timed reading practice drills.

**Week Five.** The techniques of overview skimming (Berg, Taylor and Franhenpohl, 1962) were demonstrated and practice time provided
in this session. It was pointed out to students that overview skimming was to be used as an adjunct to, and/or in conjunction with thorough reading in the READ step.

**Week Six.** Practice was provided in the use of the complete POPRADR procedure using material drawn from *Successful Reading,* (Norman, 1968). The first five selections were used; the students were given eight minutes to finish each selection.

**Week Seven.** Ten minutes of review of the full POPRADR procedure was provided followed by the second informal assessment. The assessment was administered to student as a series of timed reading practice drills.

**Week Eight.** The Form B of the *Nelson-Denny Reading Test for High Schools and Colleges,* (1960) was administered to students. The administration adhered to the procedure described in the manual for the comprehension subtest.