INFORMATION TO USERS

The most advanced technology has been used to photograph and reproduce this manuscript from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.
Text annotation and underlining as metacognitive strategies to improve comprehension and retention of expository text

Harris, June, Ph.D.
The University of Arizona, 1990
TEXT ANNOTATION AND UNDERLINING AS METACOGNITIVE STRATEGIES TO IMPROVE COMPREHENSION AND RETENTION OF EXPOSITORY TEXT

by

June Harris

A Dissertation Submitted to the Faculty of the
DIVISION OF LANGUAGE, READING AND CULTURE
In Partial Fulfillment of the Requirements For the Degree of
DOCTOR OF PHILOSOPHY
WITH A MAJOR IN READING
In the Graduate College
THE UNIVERSITY OF ARIZONA

1990
As members of the Final Examination Committee, we certify that we have read
the dissertation prepared by June Harris
entitled Text Annotation and Underlining as Metacognitive Strategies
to Improve Comprehension and Retention of Expository Text

and recommend that it be accepted as fulfilling the dissertation requirement
for the Degree of Ph. D.

Judy Vladeck Mitchell 7/30/90
Date

Aida A. Allen 7/30/90
Date

James R. Rankin 7/30/90

Final approval and acceptance of this dissertation is contingent upon the
candidate's submission of the final copy of the dissertation to the Graduate
College.

I hereby certify that I have read this dissertation prepared under my
direction and recommend that it be accepted as fulfilling the dissertation
requirement.

Dissertation Director 7/30/90
STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, permission must be obtained from the author.

SIGNED: [Signature]

[Author's Name]
ACKNOWLEDGEMENTS

I wish to express my gratitude and appreciation to the following people who have helped make my doctoral work possible:

To my mother, Ann Tyus, for her moral and financial support, without which I could not have completed this degree;

To my committee chair, Dr. Adela Allen, who has encouraged and helped me throughout my program;

To Dr. Judy Mitchell, whose advice and help on this dissertation was invaluable;

To Dr. James Rankin, who has offered advice, help, and encouragement from the beginning of my doctoral studies;

To Dr. Margaret Fleming and Dr. Duane Roen, members of my minor committee, both fine teachers, good friends, and expert sources of advice and information;

To Dr. Darrell Sabers and his assistant, Anne Gurney, for their much-needed help on my data analysis;

To Dr. Juan Garcia and Dr. Phil Keller for their help in the selection of the reading passages used in this study;

To Mirtha Miller for her help in scoring the retellings;

And special thanks to my friends and fellow graduate students Ann Schlumberger and Debbie Tidwell, who not only helped score retellings, but who also offered friendship, moral support, cheerleading, and encouragement.

I am greatly indebted to all of you.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>8</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>9</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>11</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>13</td>
</tr>
<tr>
<td>Background of the Study</td>
<td>13</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>17</td>
</tr>
<tr>
<td>Research Questions</td>
<td>17</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>19</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>21</td>
</tr>
<tr>
<td>Assumptions Underlying the Study</td>
<td>24</td>
</tr>
<tr>
<td>Limitations of the Study</td>
<td>26</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>28</td>
</tr>
<tr>
<td>2. REVIEW OF THE LITERATURE</td>
<td>29</td>
</tr>
<tr>
<td>Metacognition</td>
<td>30</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>32</td>
</tr>
<tr>
<td>Reading for Remembering</td>
<td>38</td>
</tr>
<tr>
<td>Reading-Writing Connections</td>
<td>46</td>
</tr>
<tr>
<td>Parallel Process</td>
<td>48</td>
</tr>
<tr>
<td>Interactive Processes</td>
<td>51</td>
</tr>
<tr>
<td>Transactional Processes</td>
<td>55</td>
</tr>
<tr>
<td>Study Skills</td>
<td>63</td>
</tr>
<tr>
<td>Underlining</td>
<td>67</td>
</tr>
<tr>
<td>Annotation</td>
<td>73</td>
</tr>
<tr>
<td>Summarizing</td>
<td>78</td>
</tr>
<tr>
<td>Summary</td>
<td>81</td>
</tr>
<tr>
<td>3. DESIGN OF THE STUDY</td>
<td>84</td>
</tr>
<tr>
<td>Purpose</td>
<td>84</td>
</tr>
<tr>
<td>Subjects</td>
<td>84</td>
</tr>
<tr>
<td>Passages</td>
<td>85</td>
</tr>
<tr>
<td>Science Passage</td>
<td>86</td>
</tr>
<tr>
<td>History Passage</td>
<td>87</td>
</tr>
<tr>
<td>Instruments</td>
<td>89</td>
</tr>
<tr>
<td>Multiple Choice Measures</td>
<td>91</td>
</tr>
<tr>
<td>Procedures for Training</td>
<td>92</td>
</tr>
<tr>
<td>Training in Annotation</td>
<td>92</td>
</tr>
<tr>
<td>Training in Underlining and Main Idea</td>
<td>93</td>
</tr>
<tr>
<td>Selection</td>
<td>93</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS, continued

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedures for Data Collection</td>
<td>94</td>
</tr>
<tr>
<td>Pilot Study</td>
<td>95</td>
</tr>
<tr>
<td>Major Study</td>
<td>99</td>
</tr>
<tr>
<td>Treatment Groups</td>
<td>99</td>
</tr>
<tr>
<td>Design and Experimental Procedures</td>
<td>100</td>
</tr>
<tr>
<td>Training</td>
<td>100</td>
</tr>
<tr>
<td>Testing</td>
<td>101</td>
</tr>
<tr>
<td>Procedures for Scoring</td>
<td>103</td>
</tr>
<tr>
<td>Data Analysis Procedures</td>
<td>104</td>
</tr>
<tr>
<td>4. ANALYSIS OF THE DATA</td>
<td>106</td>
</tr>
<tr>
<td>Metacognition Questionnaire</td>
<td>107</td>
</tr>
<tr>
<td>Presentation of Findings</td>
<td>111</td>
</tr>
<tr>
<td>Annotation versus Underlining</td>
<td>116</td>
</tr>
<tr>
<td>Annotation Training</td>
<td>118</td>
</tr>
<tr>
<td>Underlining Training</td>
<td>122</td>
</tr>
<tr>
<td>Influence of Recall</td>
<td>124</td>
</tr>
<tr>
<td>Genre Differences</td>
<td>125</td>
</tr>
<tr>
<td>Prior Knowledge: Immediate Retellings</td>
<td>128</td>
</tr>
<tr>
<td>Retention</td>
<td>130</td>
</tr>
<tr>
<td>Prior Knowledge: Delayed Retellings</td>
<td>148</td>
</tr>
<tr>
<td>Summary of the Findings</td>
<td>149</td>
</tr>
<tr>
<td>Discussion</td>
<td>153</td>
</tr>
<tr>
<td>5. SUMMARY, CONCLUSIONS, AND IMPLICATIONS</td>
<td>156</td>
</tr>
<tr>
<td>The Research Problem</td>
<td>156</td>
</tr>
<tr>
<td>Related Literature</td>
<td>158</td>
</tr>
<tr>
<td>Research Design</td>
<td>163</td>
</tr>
<tr>
<td>Findings of the Study</td>
<td>164</td>
</tr>
<tr>
<td>Conclusions</td>
<td>167</td>
</tr>
<tr>
<td>Implications for Practice</td>
<td>168</td>
</tr>
<tr>
<td>Implications for Research</td>
<td>169</td>
</tr>
<tr>
<td>APPENDIX A: SCIENCE READING PASSAGE</td>
<td>172</td>
</tr>
<tr>
<td>APPENDIX B: HISTORY READING PASSAGE</td>
<td>177</td>
</tr>
<tr>
<td>APPENDIX C: MULTIPLE CHOICE TEST OF PRIOR KNOWLEDGE</td>
<td>181</td>
</tr>
<tr>
<td>APPENDIX D: STUDENT INFORMATION QUESTIONNAIRE</td>
<td>185</td>
</tr>
<tr>
<td>APPENDIX E: METACOGNITION QUESTIONNAIRE</td>
<td>187</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS, continued

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>PROMPTS</td>
<td>188</td>
</tr>
<tr>
<td>G</td>
<td>RETELLING PROFILE</td>
<td>191</td>
</tr>
<tr>
<td>H</td>
<td>MULTIPLE CHOICE POSTTEST</td>
<td>192</td>
</tr>
<tr>
<td>I</td>
<td>ANNOTATION HANDOUT</td>
<td>195</td>
</tr>
<tr>
<td>J</td>
<td>UNDERLINING HANDOUT</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>REFERENCES</td>
<td>204</td>
</tr>
</tbody>
</table>
LIST OF ILLUSTRATIONS

Page

1. Research Conditions  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 96
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Analysis of Variance of Multiple Choice Pretest Scores for Science</td>
<td>113</td>
</tr>
<tr>
<td>2.</td>
<td>Analysis of Variance of Multiple Choice Pretest Scores for History</td>
<td>113</td>
</tr>
<tr>
<td>3.</td>
<td>Analysis of Variance of Multiple Choice Posttest Scores for Science</td>
<td>114</td>
</tr>
<tr>
<td>4.</td>
<td>Analysis of Variance of Multiple Choice Posttest Scores for History</td>
<td>114</td>
</tr>
<tr>
<td>5.</td>
<td>Comparison of Immediate Retelling Scores for Annotation (PAR) Versus Underlining (PHR)</td>
<td>117</td>
</tr>
<tr>
<td>6.</td>
<td>Comparison of Immediate Retelling Scores for Annotation (PAR) Versus Control with Recall (RRO)</td>
<td>120</td>
</tr>
<tr>
<td>7.</td>
<td>Comparison of Immediate Retelling Scores for Underlining (PHR) Versus Control with Recall (RRO)</td>
<td>123</td>
</tr>
<tr>
<td>8.</td>
<td>Comparison of Mean Scores for Immediate Retellings for Annotation (PAR), Underlining (PHR), and Control with Recall (RRO)</td>
<td>127</td>
</tr>
<tr>
<td>9.</td>
<td>Comparison of Delayed Retelling Scores for Annotation (PAR) and Underlining (PHR)</td>
<td>132</td>
</tr>
<tr>
<td>10.</td>
<td>Amounts and Percentages of Loss from Immediate Retellings to Delayed Retellings for Annotation (PAR) and Underlining (PHR)</td>
<td>134</td>
</tr>
<tr>
<td>11.</td>
<td>Comparison of Delayed Retelling Scores for Annotation (PAR) Versus Control with Recall (PHR)</td>
<td>135</td>
</tr>
<tr>
<td>12.</td>
<td>Amounts and Percentages of Loss From Immediate Retellings to Delayed Retellings for Annotation (PAR) and Control With Recall (PHR)</td>
<td>137</td>
</tr>
</tbody>
</table>
### LIST OF TABLES, continued

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Comparison of Delayed Retelling Scores for Annotation (PAR) Versus Control Without Recall (RO)</td>
<td>138</td>
</tr>
<tr>
<td>14.</td>
<td>Comparison of Delayed Retelling Scores for Underlining (PHR) Versus Control With Recall (RRO)</td>
<td>141</td>
</tr>
<tr>
<td>15.</td>
<td>Amounts and Percentages of Loss From Immediate Retellings to Delayed Retellings for Underlining (PHR) and Control With Recall (RRO)</td>
<td>143</td>
</tr>
<tr>
<td>16.</td>
<td>Comparison of Delayed Retelling Scores for Underlining (PHR) Versus Control Without Recall (RO)</td>
<td>145</td>
</tr>
<tr>
<td>17.</td>
<td>Comparison of Delayed Retelling Scores for Control Without Recall (RO) Versus Control With Recall (RRO)</td>
<td>147</td>
</tr>
</tbody>
</table>
ABSTRACT

The purpose of this study was to examine the effects on reading comprehension and information retention of training in two text processing methods, annotation and underlining.

Subjects in the study were 67 students in four study skills classes. The four groups were divided as follows: One group received training in annotation of text, and one group received training in underlining main ideas. Both these groups and one of the control groups wrote recalls immediately following the reading of two text passages, a science passage and a history passage. A fourth group, also a control group, read both passages but did not write recalls. All groups were given multiple choice pretests and posttests over the information in the passages. All groups wrote delayed recalls of the information four weeks after the initial readings.

Recalls were scored by raters who used the Mitchell-Irwin Retelling Profile (1990). Scores for the multiple choice pre- and posttests were analyzed using ANOVAs; data from the recalls were analyzed using t tests to compare groups.

Findings of the study indicated that there were significant effects based on the recall scores for both
treatment groups over the control group which did not write recalls. The scores for the control group which did write recalls were the highest of the four groups, however. These findings suggest that writing in connection with reading offers benefits to students in comprehension and retention not offered by reading alone. Further, students who self-select study strategies which include a reading-writing component may derive the greatest of those benefits.

Implications for further study include recommendations for replication of the study including an annotation group and an underlining group which do not write recalls, in addition to the four groups used here, in order to test the effects of written recalls on comprehension and retention.
CHAPTER 1

INTRODUCTION

The purpose of this chapter is to present the following: (1) the background of the study, (2) the statement of the problem, (3) the significance of the study, (4) the assumptions underlying the study, (5) the limitations of the study, and (6) the definition of terms.

Background of the Study

The problem of helping students read, understand, and retain information from textbooks becomes particularly acute at the college level since texts may be much more difficult than those with which students have had to cope in high school. The skills needed for success in reading are very different from those previously required (Wade & Reynolds, 1989). Further, college reading requires that reading be no longer an end in itself, but a means for learning information for performing well on tests or other required tasks (Anderson & Armbruster, 1984). Additionally, college students face the necessity of teaching themselves much of the material in their texts, since in-class time is not sufficient for covering all that they are required to learn.
One way of helping students acquire the necessary skills for learning from their textbooks involves the use of metacognitive strategies to help students learn to monitor their own comprehension and retention. Metacognition, defined by Cross and Paris (1988) as "self-appraised knowledge about cognition and self-management of one's thinking" (p. 131) implies the ability on the part of the student (1) to assess when he/she does not comprehend material and (2) to enlist a repertoire of strategies to assist in making the material meaningful. Baker and Brown (1984) separate metacognitive research into two broad areas: reading for meaning (comprehension) and reading for remembering (studying) (p. 355). Both of these areas have implications for the training of college students, who may lack effective means of appraising their progress in learning. Several researchers (Cross & Paris, 1988; Haller, Child, & Walberg, 1988; Johnston, 1985; Long & Long, 1987; Lundeberg, 1987; Wade & Reynolds, 1989) have stressed the value of instruction in metacognitive awareness for students' efficient and successful learning.

Combining reading with writing as a method of promoting active learning seems to offer an approach to improving comprehension and retention that may be superior to other study methods. Stotsky's 1983 synthesis of reading-writing studies cites a number of studies in which
the use of paraphrase and summary writing have been shown to improve the overall comprehension of students who were taught to use those methods. Doctorow, Wittrock, and Marks (1978) conducted a study with sixth-grade students whose comprehension and recall were significantly improved when they wrote a one-sentence summary after each paragraph they read. Wittrock (1983) discusses the possibility of improving comprehension through generative activities which help students connect parts of a text and which help connect text and experience. Hayes (1987) conducted a study which indicated that "the way writing is combined with reading differentially impacts students' remembering a topic under study" (p. 346). Marshall (1987) found that writing extensively about literary selections significantly improved students' posttest scores. Collins (1985) found that writing used in conjunction with reading instruction improved reading comprehension to a greater degree than reading instruction without writing.

The effectiveness of combining writing with reading in the study process has been the subject of a number of studies. Two studies (Nist & Hogrebe, 1987; Nist & Simpson, 1988) have compared text annotation techniques to underlining as a way of helping students learn and retain textual information. The study conducted by Nist and Hogrebe seemed to confirm the von Restorff effect, a theory
that says that when an item is isolated against a homogenous background, that item is remembered more readily than other items. This study indicated that students remembered more of the underlined items than they remembered other items, regardless of whether the underlined items were, in fact, significant or not. The Nist and Simpson study showed increased recall for students who were taught annotation methods, and also showed an increased efficiency factor, with the added benefit that the annotation group spent less time in learning the material.

Both of these studies may support the conclusions of Armbruster and Anderson (1981) who state that the effectiveness of any study technique is dependent on the depth of processing involved in learning the material, (a factor which may tie closely to the use of metacognitive strategies) and upon the training given to students in the use of study techniques. Further implications are that less underlining rather than more may improve students' recall (McAndrew, 1983), and that for annotation to be effective, students have to be trained to use forms of encoding which offer depth of processing, as opposed to verbatim transcription of text material (Armbruster & Anderson, 1981). Further, in order for any study strategy to be effective, students must recognize (1) what to study,
(2) how best to learn it, and (3) how to recognize when and to what extent they have learned it (Wade & Reynolds, 1989), all components of successful metacognitive instruction.

Statement of the Problem

The primary purpose of this study was to look at whether training students in using text annotation and underlining to process reading material would result in greater retention and comprehension of information. It also examined students' use of metacognitive strategies in reading expository material. Students read two types of passages, one from a science text and one from a history text. Comprehension and retention of information were measured by use of (1) a written retelling immediately following the reading, (2) a multiple choice test given after both selections had been read, and (3) a delayed written retelling given four weeks after both selections were read.

Research Questions

The following research questions were addressed by use of the written retellings and the multiple choice test:

1. Do students who are trained in a reading-writing text annotation procedure demonstrate greater comprehension than
students who are trained in underlining main idea passages (annotation versus underlining)?

2. Do students who are trained in a reading-writing text annotation procedure demonstrate greater comprehension than students who are not trained but who are asked to read, remember, and write recalls of the same passages (annotation versus control with recall)?

3. Do students who are trained in a reading-writing text annotation procedure demonstrate greater comprehension than students who are not trained but who are asked to read and remember the same passages (annotation versus control without recall)?

4. Do students who are trained in underlining main idea passages demonstrate greater comprehension than students who are not trained but who are asked to read, remember, and write recalls of the same passages (underlining versus control with recall)?

5. Do students who are trained in underlining main idea passages demonstrate greater comprehension than students who are not
trained but who are asked to read and remember the same passages (underlining versus control without recall)?

6. Do students who are not trained but who are asked to write recalls of the information they have read demonstrate greater comprehension than students who are not trained and who do not write recalls of the information they have read (control with recall versus control without recall)?

7. Are there differences between scores for the history passage and the science passage as measured by multiple choice tests, immediate retellings, and delayed retellings among the four groups (annotation, underlining, control with recall, and control without recall)?

8. Are there differences in retention as measured by delayed retellings among the four groups (annotation, underlining, control with recall and control without recall)?

Hypotheses

For the purposes of this study, the following research hypotheses were generated:
1. There will be no significant differences between scores of students who receive annotation training and students who receive underlining training.

2. There will be no significant differences between scores of students who receive annotation training and students who receive no training, but who write recalls of passages.

3. There will be no significant differences between scores of students who receive annotation training and students who receive no training and who do not write recalls of passages.

4. There will be no significant differences between scores of students who receive underlining training and students who receive no training but who write recalls of passages.

5. There will be no significant differences between scores of students who receive underlining training and students who receive no training and do not write recalls of passages.
6. There will be no significant differences between scores of students who do not receive training but who are asked to write recalls of the information they have read and students who do not receive training and who are not asked to write recalls of the information they have read.

7. There will be no differences between scores on the history passage and the science passage on multiple choice tests, immediate recall, or delayed recall for any of the four groups (annotation, underlining, control with recall, and control without recall).

8. There will be no significant differences in retention among the four groups (annotation, underlining, control with recall and control without recall) as measured by delayed retellings.

Significance of the Study

This study is important for five reasons. First, use of annotation as a means to improvement of comprehension and retention of information appears not to have been investigated in significant detail. No studies have been located which compare use of underlining to use of
annotation in a controlled study with the limitations of this project. Second, most of the studies concerning underlining or annotation have tended to make use of only one type of text for processing, and most have focused on materials from the social sciences. This study uses texts from two very different disciplines. Third, most studies have tended to focus on one measure of comprehension, usually an objective test. This study looks at two measures in its data collection, a multiple choice test and written retellings of both passages. Fourth, no studies located have looked at the effects of annotation as opposed to underlining after a delay of some weeks. This study compares rates of retention as measured by delayed retellings written four weeks after the treatment. Fifth, no studies have looked at metacognitive training as a component of annotation and underlining instruction as does this study.

Several studies have investigated the use of underlining as an aid to learning, and a few have looked at annotation in the same way, but very few have compared the two as to their relative effectiveness in helping with comprehension and retention. Further, those which did look at both methods, did so under conditions in which students had unlimited time constraints on their processing of the text. This study maintains equal time limitations on text
processing in each condition. Students could opt to spend less than the maximum amount of time with the text passages; they were unable to spend more.

The studies which have looked at annotation have tended to look at its use with limited types of texts. The study done by Nist and Simpson (1988), for instance, used texts from history, sociology, and psychology, all social sciences. This study uses passages from history (as a representative social science text) and science textbooks in order to determine whether there are effects for two very different types of reading materials. Differences between the structures of the two types of texts might be significant in determining the way students approach learning information from each. History textbooks tend to be written in a narrative style and a chronological sequence. Science textbooks present information by topic, relying heavily on definition and building from a cumulative base. It would be possible, perhaps, to open a history textbook at any point and comprehend the selection without having read the preceding material. Science texts do not lend themselves to such reading, as it is much more difficult to understand what is presented midway through a science text without having read and understood what has been presented before.
Most of the studies surveyed indicated that the measure most commonly used to assess comprehension was a multiple choice test over the material read. This study uses written retellings as well, since multiple choice measures offer limited indication of students' understanding and interpretation of reading material. Written retellings allow readers to use the essay form in addition to the objective form for testing; additionally, retellings allow students the opportunity to express themselves on any material not covered by the objective measure. This procedure offers two measures of immediate comprehension for this study, as well as one measure of delayed retention.

Finally, no study located has indicated any assessment of the delayed effects of annotation or underlining. This study has students repeat the written retellings four weeks after the treatment to assess any differences in amounts of material retained, given the different methods employed in text processing. This measure comprises the assessment of retention of information over time.

Assumptions Underlying the Study

This study was based on the following assumptions:

1. Students have not previously read the texts from which the passages are to be taken.
2. All students are able to adequately decode the texts and the test questions.
3. No special expertise is required to read and comprehend the texts used in this study.
4. College students are able to write written recalls given directions to "write as much information as you remember from the selection you just read."
5. The history and science passages used in this study are as nearly characteristic of the genre of such materials used in college level courses as can be determined.
6. Answers to questions on the multiple choice measure are a suitable comprehension measure and reflect the students' actual text comprehension.
7. Written retellings generated by students after processing the texts are a suitable measure of comprehension and reflect student's actual text comprehension.
8. Delayed written retellings are an appropriate measure of retention of information.
Limitations of the Study
This study is subject to the following limitations:

1. Since students in this study include only those students enrolled in a study skills practicum, results may not be generalizable to students in other classes.

2. Since participants in this study included only students enrolled in one major southwestern university, results may not be generalizable to other populations.

3. Since passages used for assessment included only selections from a history text and a science text, results may not be generalizable to other types of texts.

4. Only two types of comprehension measures (multiple choice and written retellings) were used to measure the reading comprehension of the students in the sample.

5. Since students wrote retellings in their own words, writing ability may have affected the quality of the retellings.

6. Since the classes were scheduled at different times of the day, the hour at which the class was held may have affected the results of the comprehension measures.
7. Students' comprehension may have been affected by the fact of having different instructors for the class sections.

8. Both the reading of the history passage and the science passage may have been affected by the test of prior knowledge.

9. The multiple choice post test may have been affected by the interaction of the treatment with the written retellings.

10. Delayed retellings may have been affected by the questions on the multiple choice measure.

11. Collection of delayed retellings after only four weeks may not accurately assess long-term retention.

12. Differences in amounts of time each student spent with the passages may have affected the outcomes on the assessment measures.
Definition of Terms

1. **Annotation**: the writing of summaries, key words, or main ideas in the margins of texts.

2. **Underlining**: used interchangeably with highlighting to denote any method of marking text to insure that main ideas stand out from the rest of the text.

3. **Study Strategy**: any purposeful approach to reading which involves a set of repeated procedures and which is used with the stated purpose of learning and retaining information.

4. **Metacognition**: student's awareness of his/her own methods of processing information and ability to recognize which of those methods is being used and in what context.

5. **Reading Passage**: an excerpt from a textbook which contains a single, complete unit of information and which is self-contained.

6. **Notetaking**: writing notes based on what has been read in a text passage or on the basis of what has been heard in a lecture.
CHAPTER 2
REVIEW OF THE LITERATURE

The purpose of this chapter is to review the literature which is relevant to the following areas: (1) metacognition, (2) reading-writing connections, and (3) study strategies, particularly those dealing with annotation and underlining.

The first of these areas of concern, metacognition, deals with the ways in which students assess their comprehension and ways in which they overcome comprehension deficits (Baker & Brown, 1984; Flavell, 1978; Haller, Child, & Walberg, 1988; Paris & Myers, 1981). A portion of this study is directed at determining what metacognitive strategies students in the study skills courses being researched already had, as well as whether instruction in the study methods of annotation and underlining made a difference in their levels of comprehension.

The second area, the reading-writing connection, relates to the study directly by addressing the question of whether the use of reading in conjunction with writing promotes greater comprehension and retention than does the use of reading and underlining or reading alone. Stotsky (1983) has noted the successful use of writing activities
to promote increased reading comprehension, a finding which underlies the use of the annotation procedure in this study.

The third area, study strategies, looks at those areas of research which consider various methods of learning material from text, especially those methods which deal with the use of underlining or annotation. The two instructional methods used in this study taught annotation to one group and selective underlining to a second group. Research which looks at those two study methods as well as summarization will be considered in this review.

Metacognition

One area which needs consideration in any study of the learning behaviors of students is metacognition. Origination of that term is generally credited to Flavell (Haller, Child, & Walberg, 1988), and he has defined it as "the acquisition in children of knowledge and cognition about cognitive phenomena" (1978, p. 232). Baker and Brown (1984) point out that Flavell’s definition implies two clusters of activities: knowledge about cognition and regulation of cognition. Cross and Paris (1988) have defined it this way:

Metacognition is the knowledge and control children have over their own thinking and learning activities, including reading. The term
metacognition includes two broad categories of mental activities, self-appraised knowledge about cognition and self-management of one's thinking (p. 131).

Baker and Brown (1984) list several items as indexes of metacognition used by active learners in their problem solving attempts: (1) checking the outcome of any attempt to solve the problem; (2) planning the next move; (3) monitoring the effectiveness of any attempted action; (4) testing, revising, and evaluating one's strategies for learning (p. 354).

Paris, Lipson, and Wixson (1983) have referred to three categories of metacognitive thought: (1) declarative knowledge--knowing what factors are influential; (2) procedural knowledge--understanding how skills operate or are applied; (3) conditional knowledge--recognition of when and why particular strategies are used (p. 303).

Paris and Myer (1981) list three components of comprehension monitoring: evaluation, planning, and regulation. Evaluation is the reader's attempt to determine whether what is being read makes sense. Planning begins when comprehension failure occurs, and involves selection of corrective strategies. Regulation employs the plan or selected strategy.
Common to all of these definitions or explanations of metacognition are elements of recognition of comprehension failure, and knowledgeable selection and employment of alternative strategies to cope with comprehension failure. In other words, most researchers agree that students with high metacognitive skills can recognize when they don’t understand their reading material, have a repertoire of strategies for coping with that failure of understanding, and can select the appropriate strategies for overcoming their comprehension difficulties.

Application of metacognitive theory has been researched in two broad areas: reading for meaning (comprehension), and reading for remembering (studying) (Baker & Brown, 1984). These categories overlap in many ways; for instance, both include three main types of metacognitive skills: awareness, monitoring, and regulation (virtually synonymous with Paris and Myers’ evaluation, planning, and regulation) (Baker & Brown, 1984; Haller, Child, & Walberg, 1988). Nevertheless, most studies of metacognition can be classified as being concerned with either reading comprehension or with studying.

**Reading Comprehension**

Use of metacognition in reading is concerned with helping students learn to use strategies which will help
them overcome comprehension failure. Baker and Brown’s (1984) analysis of studies of metacognition listed three possible sources of failure to comprehend reading material: (1) inadequate schemata—the reader knew too little about the subject to understand the text, (2) unclear text—the author failed to provide adequate information to insure comprehension, and (3) misinterpretation—the reader believes he/she understands, but the interpretation is not the one the author intended (p. 356).

In assessing whether students can be successfully taught to overcome these barriers to comprehension, Haller, Child, and Walberg (1988) looked at 20 studies of metacognitive instruction. They concluded that metacognitive instruction is helpful at all grade levels, but that the effects were greatest for seventh and eighth grades, the ages at which Piaget has said formal logical operations reach full maturity (p. 7). These findings would suggest that the most complete use of metacognitive instruction, then, could be made by those students whose development as readers was most nearly complete. This conclusion is supported by Paris, Lipson, and Wixson (1983), who stress that strategic reading is accomplished both developmentally and instructionally, with "thinking about one’s thinking" at the center of strategic behavior (p. 295).
Several studies suggest that successful use of metacognitive strategies may be a differentiating factor between good and poor readers (Paris & Myers, 1981; Paris, Lipson, & Wixson, 1983; Baker & Brown, 1984; Duffy, Roehler, Meloth, Polin, Rackliffe, Tracy, & Vavrus, 1987). The reasons why this is so are less obvious than is the fact that the difference exists. Paris and Myers have noted that good readers attend more to meaning than do poor readers, who tend to concentrate on decoding with little emphasis on overall comprehension (p. 6). Paris, Lipson, and Wixson have said that "a major distinction between experts and novices in any domain is self-controlled strategic behavior" (p. 294). Baker and Brown point out that younger and poorer readers may not know that they must put forth some effort to make meaning from the words they decode (p. 359). Armbruster and Brown (1984) note that "metacognitive skills develop gradually and emerge later than most other cognitive skills" (p. 275).

If metacognitive abilities seem to be a differentiating factor between good and poor readers, then there would appear to be some value in teaching students to apply metacognitive strategies. In fact, some studies indicate that reading comprehension can be improved by the teaching of such strategies.
Wham (1987) suggests teaching students to use headings and subtitles, paragraph organization, and use of summarization skills. Johnston (1985) says that strategies taught readers should improve the students' ability to comprehend, not just improve comprehension of the instructional text. The carryover effect, the ability to generalize from text to text, should be the instructional goal and should drive teaching methodology. To that end, Johnston suggests teaching students to use text genres to develop expectations and self-questioning to promote active comprehension and to activate prior knowledge.

Brown, Campione, and Barclay (1979) support the case for generalizable strategies. They point out that while training in specific uses of strategies virtually always yields significant results, training in generalizable strategies is more difficult but more rewarding. Two components of any metacognitive teaching routine, they say, should be the development of generalizable elements and the emphasis to the student that generalization is expected (p. 502).

Armbruster and Brown (1984) advocate the approach of using cognitive training with awareness. They point out the value of informing students as to why, when, where, and how they should use a strategy (p. 279).
A particularly interesting study with older students which takes the approach suggested by both Johnston and Brown, Campione, and Barclay is a study by Lundeberg (1987) which looks at the way reading is used by novices and experts in the legal profession. Lundeberg investigated differences in the ways that experts—in this case law professors and practicing attorneys—and novices—beginning law school students—read legal cases. By observing and questioning the experts, she was able to determine specific strategies they employed in reading. She then trained beginning law students to use those strategies, and was able to help them increase their comprehension of legal case readings significantly.

Lundeberg's work is consistent with the findings of Duffy et al. (1987) who determined that explicit instruction in the use of metacognitive strategies improved students' reading achievement. The study conducted by Duffy et al. looked at whether teaching teachers to be explicit in their instructions to students on how to use basic text skills would help those students to improve their awareness of lesson content and specific reading strategies. They found that improved instruction did, indeed, help students become more aware of their purposes for reading. They say that students are more likely to use what teachers teach if they are consciously aware of what
the teacher is teaching (p. 225), and they add, "Reading is a strategic process, and reading instruction should develop the associated awareness and reasoning" (p. 243).

Cross and Paris (1988) confirm the conclusions of Duffy et al. with a study of third and fifth graders who were instructed in metacognitive strategies. Students in experimental classes made significant gains in use of metacognitive and reading strategies as a result of explicit instruction and feedback in the use of those strategies.

It would appear to be important to this study, then, to note that research supports several of the bases for instruction in the areas to be analyzed. If use of metacognitive strategies is one of the areas in which good and poor readers are differentiated, teaching poor readers to use those strategies which good readers use would appear to have value. Indeed, by implication, teaching good readers to make conscious use of such strategies offers the possibility of increasing their immediate comprehension. Further, teaching such strategies has been shown to be successful in practice. Use of text processing techniques such as this study proposes would seem to be consistent with the kinds of metacognitive procedures recommended by researchers of reading comprehension instruction. In addition, students who are informed as to why, when, and
how to use particular study strategies seem to be more willing to use and more competent at using those strategies in actual study situations.

Reading for Remembering

Reading for remembering, that area of metacognition which deals with studying, is the research area most closely aligned with the objectives of this study. Reading instruction at the college level must have as one of its primary objectives the use of effective strategies for remembering what is read. Students who have reached the college level need techniques which will help them understand what they read, but comprehension, for them, has little value if they cannot recall text content.

Palincsar (1986) says this about the metacognitive aspects of study:

Metacognitive knowledge is indicated when a student notes that it is necessary to prepare differently for essay and true/false tests. When a student plans her approach to studying, for example, by writing the main idea and supporting detail statements for each segment of text; monitors how effectively this approach is working; and evaluates the outcome of using such a strategy, the student is regulating cognition. It is not sufficient for teachers to merely
instruct learners about strategies that enhance learning, the students must monitor and regulate their own use of these strategies (p. 119).

Locke (cited in Baker & Brown, 1984) has spoken of the use of "study monitoring," an activity with metacognitive implications:

Studying actually requires a double or split mental focus. On the one hand, you need to be focused on the material itself (that is, on learning it). At the same time, however, you need to be constantly checking to see that you are actually performing those mental operations that produce learning. In short, you need to monitor your mental processes while studying (Locke, 1975, p. 126).

A number of studies have addressed the instructional implications of metacognition instruction. Johnston (1985) says that the intent of strategy instruction is to have students (a) recognize a strategy, (b) find it effective in attaining a desired goal, (c) adopt the strategy for their own use, and (d) generalize it to other situations. The major emphasis here is on a transfer of control of the
learning routine from the teacher to the students (pp. 639-640).

Wade and Reynolds (1989) say that students can learn to control their own learning by being aware of (1) task--what to study in a given situation; (2) strategy--how best to study; and (3) performance--whether and how well they’ve learned (p. 6).

They stress that students should be made aware of the difference between internal and external criteria of importance. That is, information in which students are interested or which is personally relevant (internal) is easier to learn than information that is being learned only for school-related tasks (external) (p. 7). Student awareness of the difference between levels of learning difficulty based on internal and external criteria of importance can enhance effective strategy selection.

These sources support the need to make use of metacognitive strategies in reading for remembering, or studying, with particular emphasis on those strategies which are generalizable to various situations or study activities.

Baker and Brown’s (1984) study of metacognition considers five areas which comprise study activity: concentrating on main ideas, making use of logical structure in the material, self-interrogation during
studying, self-testing the results of studying, and employing macrorules to ensure comprehension and retention (p. 368).

The last of these, the use of macrorules, deals with the use of summarization for learning. Summarizing is a skill which several studies support as beneficial for students who are reading to remember. Baker and Brown say that skillful summarization to check for test preparedness (that is, the use of macrorules) includes five steps: delete redundancy, delete trivia, provide superordinates, select topic sentences, and invent topic sentences where missing (p. 373). They point out that the first two of these steps involve the elimination of unnecessary material. The third, providing superordinates, teaches students to group lists under common headings. If, for instance, a list contained milk, cheese, butter, and cream, the items could be listed under dairy products. Students can be taught to locate topic sentences in paragraphs, and when no topic sentence is given, to invent their own.

Several studies have made use of these principles to teach students generalizable rules for summarizing material they are required to learn.

Palincsar and Brown (1984) have developed a procedure called reciprocal teaching, a teacher/student dialogue which includes these features: summarizing, question
generating, clarifying, and predicting. These strategies incorporate many of the study components listed above. The procedure particularly depends on the students' ability to summarize their reading. They note, "If the reader cannot produce an adequate synopsis of what she is reading, this is a clear sign that comprehension is not proceeding smoothly and that remedial action is called for" (p. 121). Reciprocal teaching involves having students take turns with the instructor in teaching classmates certain texts. Students are required to lead dialogues with the class, summarizing what has been read and what the other students have said. Students learn from teacher modeling and practice, and the researchers found this a highly effective way of developing the students' skills in summarization and prediction.

Palincsar (1986) discusses the need to influence the way that the learner interacts with the learning situation. It isn't enough, she says, to teach strategies; what is required is that students know which strategies to use at what time, and how to monitor their effectiveness.

In another study which looks at the use of summarization, Jenkins, Heliotis, Stein, and Haynes (1987) trained students to use paragraph restatements in an effort to increase comprehension. They were also concerned with measuring the transfer of the metacognitive strategies they
were teaching. In other words, would students use the restatement procedure in circumstances in which they were not specifically instructed to do so? They found that students who were trained to use paragraph restatements showed significantly higher comprehension than the control group, and they also showed more willingness to transfer the use of the procedure to other subjects and tasks than did students not trained in, but introduced to, the strategy. Students who were taught to monitor their own comprehension and who were told why the strategy was valuable seemed more willing to adopt the use of the strategy than those who were merely told about it but given no rationale for its use.

Palincsar (1986) makes a similar point regarding the application of summarization techniques. She notes that as a student reads for the purpose of locating the main ideas and their supporting details, comprehension is facilitated. Conversely, if a student is unable to summarize material in his or her own words, lack of understanding may be indicated (pp. 121-122).

In addition to summarization, other studies consider various aspects of metacognitive instruction. Long and Long (1987) cite studies to support their contention that teaching learners to use strategies relevant to the task will enhance student performance. They suggest teaching
students to anticipate tests, to use metacomprehension strategies, and to ask themselves what the purposes of their assignments are.

Heller (1986) suggests the use of teacher modeling to help activate schema, enabling students to determine what they knew before, what they now know (as a result of their reading), and what they do not know. Heller's work, done with seventh-grade students, is supported at the college level by Malena and Coker (1987). They point out that metacognitive training can help students become aware of whether they have the skills necessary to accomplish a given task. They also suggest the use of instructor modeling in prereading, reading, and postreading activities.

Feathers and White (1987) used student journals in order to promote concentration on and awareness of metacognitive processes, and note that the reflexive thought involved in the use of such writing seems to promote conscious awareness of the uses and understanding of learning strategies.

Bean, Singer, Sorter, and Frazee (1986) paired metacognitive instruction with use of graphic organizers and found that students who had both instruction in metacognition and instruction in the use of graphic organizers did not score higher on quizzes than other
groups until teacher prompting was phased out; at that time, the organizer/metacognition group scored significantly higher than the other groups in the study. Further, students in this group showed a much more positive attitude toward the use of the study strategy than students in other groups.

Certain commonalities can be found in all of these studies, and they have implications for the present research project. All suggest or imply that when students are made aware (or make themselves aware) of the requirements of the assigned task, they are better able to complete it. When they are able to monitor their own learning and comprehension, they remember significantly more than when they are unable to determine the extent of their learning. Techniques which enable students to account for their comprehension and learning are effective in helping them to know what they know, to assess with some accuracy their degree of learning and retention.

Other implications for this study deal with those techniques to be taught to students in the experimental groups. Student in this study were taught either to summarize their texts in marginal notations or they were taught to underline main ideas in the texts, both ways of delineating information which they believe to be important enough to remember. Students should be able to assess the
extent of their learning and use the notes or underlining for self-testing; based on current research, these methods should be effective in helping students determine the degree to which they have learned text information and should allow them to determine whether what they are learning is relevant to the requirements of the learning situation.

**Reading-Writing Connections**

One of the dominant areas of research which offers support to this study is the interconnection of reading and writing as a vehicle for learning from text. Emig (1977) has spoken of the use of writing as a learning tool in this way:

> Writing represents a unique mode of learning--not merely valuable, not merely special, but unique. Writing serves learning uniquely because writing as process-and-product possesses a cluster of attributes that correspond uniquely to certain powerful learning strategies (p. 122).

In her 1983 synthesis of research on reading/writing relationships, Stotsky notes the high correlation between reading scores and writing ability; that is, although there are some exceptions, better readers tend to be better writers, and vice versa. While she says that there is little evidence to suggest that instruction in reading
improves writing significantly, or the reverse, she stresses that the combined use of writing activities together with reading activities has proved highly successful in improving reading comprehension and retention (p. 636).

This last area, the combined use of reading and writing activities to improve comprehension and retention of text material, is the basis for the reading/writing focus undertaken in this study. Sternglass (1987) notes that studies of the reading/writing relationship have tended to adopt one of three conceptual models: reading and writing as parallel processes, as interactive processes, or as transactional processes. While Sternglass implies a hierarchical relationship among these processes, suggesting that the transactional process represents the most desirable method of relating reading and writing, a review of other studies which fall into one of the three models indicates that the purpose for which the process is used is a more reasonable determinant of its desirability than the type of process chosen. Consequently, this study will look at research which falls within each of the three conceptual models proposed by Sternglass with a view to assessing the purpose for which each model is best suited.
Parallel Processes

Sternglass (1987) identifies the parallel process model of the reading/writing connection as using both reading and writing in classroom activities, but keeping the activities themselves relatively separate. This might involve increasing the amount of reading the students are required to do, or using readings as models for imitation by students in their own writing (p. 185). Other activities such as sentence combining exercises are essentially parallel process activities, also.

There is some value, however, in understanding ways in which the reading and writing processes are parallel in order to foster more understanding of ways to structure each of them. Aulls (1985) goes to some lengths to describe ways in which strategies used in reading and writing are parallel in such areas as planning, constructing meaning, and rereading/revision. He points out that much of our schooling "has relied too much on telling and explaining and too little on showing students how to learn" (p. 43). His framework is designed to offer a basis for showing students how to approach the integration of reading and writing.

Although Kucer (1985) probably tends toward the transactional school of thought in his concept of the practice of reading/writing connections, his explanation of
the ways in which the practices are parallel is one which deals with the "cognitive basics" (p. 332) common to both. He bases his explanation on the commonalities of text construction in both activities, dealing with schema as the "building block" of text production and discussing reading and writing as intentional acts. He suggests the development of literacy curricula to maximize the reading/writing relationship and the development of teacher strategies which would enable better integration of the processes.

Other authors, less theoretical and more strategy oriented, suggest ways of using the parallel nature of the reading/writing process in practice. Trotsky and Wood (1982) offer a writing-reading linkage chart (similar to Aulls' charts of parallel processes) which suggests ways to make use of combining the two activities. Lehr (1981) looks at many of the teaching strategies which combine parallel reading-writing activities and suggests teaching methodology to employ those activities in the classroom.

Ferris and Snyder (1986) point up the need for "alerting students to commonalities between the comprehension of reading and the composing of writing" (p. 755). The study they conducted looked at whether the use of extensive writing activities would improve students' reading scores. They found that while their experimental
writing group made significant gains in their writing skills, they could find no differences between the experimental group and the control group on reading scores. They found that without direct instruction, there was no transfer of the information taught for writing, for instance, to the reading process. They suggest "consistent and specific reminders to students about the related facets of reading and writing" (p. 755).

Culp and Spann (1987) found that the use of reading and writing in their reading classes resulted in greater gains in reading comprehension for the experimental group than for the control group which used no writing, but they caution that the advice to "integrate" the language arts is hardly specific, and that more analyses of the cognitive processes involved in various modes of writing would be most helpful.

The use of the parallel process model, in terms of this study, has its greatest value in relating to students the ways that reading and writing connect. Most of the research surveyed here indicates that when students have an indication of the ways in which reading and writing are parallel, they are better able to make use of those interconnections in constructing appropriate learning situations for themselves. This parallel process, moreover, links with the metacognitive process in giving
students some valid ways of looking at how they learn through writing and how they may make writing an aid to their study reading.

Interactive Processes

Sternglass (1987) points out that the shift from the use of reading and writing as parallel processes to a perspective which views them as interactive processes was based on the change from looking at reading as a passive skill and writing as an active one, to a viewpoint which saw both as constructive activities (pp. 186-187). Squire has noted that schools have often failed to make use of the connection between reading and writing because they have not recognized that "composing and comprehending are process-oriented thinking skills which are basically interrelated" because "basic to all reading and writing is skill in processing language" (p. 23).

Reading/writing instruction based on the interactive mode requires students to "reconstruct as accurately as possible the meaning and intent of the author" (Sternglass, 1987, p. 187). This process results in the sort of "information transfer" which may be most useful to students who need ways of learning for specific recall. It includes, for instance, use of summarization and precise writing activities. (It is important to note, at this point, the distinction between Sternglass's interactive
reading/writing model and the interactive reading process model discussed by Ruddell and Speaker (1985). Ruddell and Speaker refer to the "construction of the Text Representation" in their delineation of the interactive reading process model. The use of the term "construction" by Ruddell and Speaker and the term "reconstruction" by Sternglass could lead to some confusion. However, if the reader assumes that Ruddell and Speaker's "construction" refers to reading, and the Sternglass's "reconstruction" refers to writing, the two models seem not to be contradictory.)

A number of studies have reported positive results from using summary writing as an aid to learning and retention. Doctorow, Wittrock, and Marks (1978) found that sixth graders who were taught to generate paragraph summary sentences almost doubled recall and comprehension. Haynes and Fillmer (1984) found high positive correlation between students' abilities to paraphrase sentences and their reading comprehension scores.

Armbruster, Anderson, and Ostertag (1987) conducted research in which fifth graders were taught to summarize social studies material using a problem/solution structure. They found that students trained in using the structure recalled about 50% more of the ideas on which they were given an essay test than did the traditionally trained
Further, the structure trained group generated significantly more main ideas than did the traditional group. Jenkins, Heliotis, Stein, and Haynes (1987) worked with learning disabled elementary students who were trained to write brief restatements of main ideas in paragraphs as they read. They found that the students who used the strategy had better comprehension scores than the control group on both near and remote transfer tests.

Whether use of summarization is effective as an aid to comprehension and retention may depend on whether students are given adequate instruction in summarizing strategies. Guido and Colwell (1987) suggest use of a training structure similar to Baker and Brown's macrorules (1984), because, as they point out, summarizing is difficult, particularly for young students, who may not be able to discriminate between important and trivial information. Taylor (1984) makes the same points, and adds that summarizing for narrative material differs from summarizing for expository material, and that students have to learn to read these texts differently in order to produce adequate summaries. Both of these studies suggest intensive use of teacher modeling to support students' summarization efforts.

Moxley (1984), in advocating an integrated language arts curriculum, suggests a compositional approach to
reading, an approach that includes various methods of assessing comprehension, from very simple sentence completion exercises to more sophisticated written and oral critiques and summaries.

Stotsky (1982) advocates summary or precis writing, also, but mentions as well the uses of dictation, reproduction (paraphrasing without access to the text), paraphrasing (with access to the text), and copying. These activities, as well as Collins' (1985) use of expressive writing to improve reading in her reading comprehension classes, attempt to promote the development of what Smith (1983) refers to as "reading like a writer." Smith argues that the use of drills and grammar exercises are essentially useless in learning to write. He says, "We learn to write without knowing we are learning or what we learn. Everything points to the necessity of learning to write from what we read" (p. 49).

Another interactive view of reading and writing has been studied from the perspective of rereading one's own writing during the composing process. Perl (1979) noted that rereading served as a "clarifying effect" on the composition process, stating, "Writers know more fully what they mean only after having written it" (p. 433).

The interactive process in the reading/writing connection offers some specific instructional applications
for students in the present study. If reading and writing are both constructive activities, then students who are led to see the use of writing as a way of reconstructing their knowledge about texts may be able to make particularly helpful use of both. This process, moreover, may be the most helpful to students of the three models suggested by Sternglass. While it is useful to students to understand reading and writing as parallel processes and as transactional processes (the third of Sternglass's models), most college courses require that students be able to "reconstruct as accurately as possible the meaning and intent of the author" (Sternglass, p. 187). A few courses require that students develop personal reactions to the material (a component of the transactional process, below), but virtually all courses require that students be able to understand and recall the texts they have read. The interactive process, then, may be the model most closely approximating the requirements of the college learning situation.

**Transactional Processes**

The transactional process of reading and writing is based on the coming together of the learner and the text from the perspective of reader or of writer. Tierney and Pearson (1983) have said of the process, "Few would disagree that writers compose meaning . . . we argue that
readers also compose meaning (that there is no meaning on the page until the reader decides there is) (p. 34). They speak of "reader revision," in which readers reread with different alignments, annotate texts with reactions and questions, asking whether "the model they have built is the one they really want" (p. 41). Sternglass (1987) says of the transactional process, "Central to this perspective has been the notion that readers must discover the meaning of a reading for themselves, and then, hopefully, they will be able to incorporate their unique stance into their writing" (pp. 191-192).

Sternglass's perspective is at the core of the reading/writing curriculum devised by Bartholomae and Petrosky (1987) in the course they designed at the University of Pittsburgh. In requiring students to write in response to their readings, they force students to bring their own experience to bear on their interpretations of text and to make meaning of what they read by writing about it: constructing meaning in reading by constructing meaningful writing.

Huot (1988) says, "The key point in understanding reading and writing as a transactive process is to view these two separate processes as necessary to cement the connection between author and audience" (p. 93).
Troyka (1987) presents two propositions on which she bases her theory of the reading/writing connection:

1. At no time are the acts of reading and writing as inextricably bound to one another as when a person writes.

2. When ineffective writers are helped to become conscious of the interactive language process between writing and reading, their writing quickly becomes more expert (p. 308.)

Emig (1977) points out that writing "requires the establishment of systematic connections and relationships" (p. 126), that it requires the "shuttling among past, present, and future" to connect "the three major tenses of our experience to make meaning" (p. 127). Newell (1986) has noted that the use of writing as a means of learning can lead to the generation of new knowledge.

Easley (1989) says that writing works well in learning because, among other things, it "requires a conscious search for meaning out of meaninglessness" (p. 11). She believes that if students are taught to use writing for thinking and reflection that it can lead them to make meaning of experience—learning.

Pearse (1985) says that one of the most important contributions writing to learn had made to his classroom
was to help students take more responsibility for their own learning and to remove him, as teacher, from the position of being the sole dispenser or "doler" of information.

The arguments for the integration of reading and writing are strengthened by the work of such writers as Shanahan (1984) and Langer (1986). Shanahan's study investigated the nature of the reading/writing relationship at the elementary school level. He found that the reading/writing relationship changes for students as their skills develop, and that as students become more proficient readers, they are more able to take advantage of the interconnections of reading and writing. He suggests integrating writing curricula directly into materials used for teaching reading in order to allow for maximum achievement in both areas (p. 475).

Langer's (1986) study looks at the ways in which students in third, sixth, and ninth grades make meaning in their reading and writing. She used retrospective and think-aloud procedures to induce students to talk about what they did to make meaning as they read and as they wrote. She concludes that though reading and writing are similar in many ways, they invoke essentially different patterns of reasoning operations. Both Shanahan (1984) and Langer argue that the provision of instruction in either area (reading or writing) is insufficient to produce gains
in the other. The implication in both these studies is that the nature of the construction of meaning needs both learning patterns required by the separate reading-writing activities, and that those curricula which include both patterns are most likely to benefit students in their long-term comprehension.

The transactional process model of reading/writing activities is largely the model upon which the writing-across-the-curriculum movement has been based. Gere (1985), in a collection of essays based on writing across disciplines, distinguishes between "writing to learn" and "writing to show learning," and comments on writing as a "powerful means of learning" (p. 2). She says that education "should provide students a way of thinking, not a set of facts" (p. 3), and speaks of using writing "in a way that enables students to make connections with the material" (p. 4).

Langer and Applebee (1987) conducted an extensive study of learning from writing in secondary schools, a project extended over three years, which looked at the ways writing is used in high schools and also examined the effects different kinds of writing might have on learning. They observed in eight secondary classrooms in four subject areas (science, social studies, English, and home economics). Essentially, they wanted to see what kinds of
writing activities the teachers were using and whether enhancing those writing activities resulted in greater learning for students. They reached the following conclusions:

There is clear evidence that activities involving writing (any of the many sorts of writing we studied) lead to better learning than activities involving reading and studying only. Writing assists learning. Beyond that, we learned that writing is not writing is not writing; different kinds of writing activities lead students to focus on different kinds of information, to think about that information in different ways, and in turn to take quantitatively and qualitatively different kinds of knowledge away from their writing experiences (p. 135).

They list three different ways in which subject-area writing can be used productively: (1) to gain relevant knowledge and experience in preparing for new activities, (2) to review and consolidate what is known or what has been learned, and (3) to reformulate and extend ideas and experiences (p. 136).

In an earlier study, Langer (1986) had listed three kinds of writing activities which might be used by
instructors and the ways those activities could assist learning:

1. Short answer study questions: use of these questions is helpful in learning specific information and can be used most effectively to aid in recall of factual information which requires no integration of content.

2. Notetaking: use of notetaking compels students to cut across sentence boundaries to integrate larger units of information, but does not require reorganization of the material.

3. Essay writing: use of essay writing requires students to engage in more complex reorganization of material and leads to more complete integration of content concepts (p. 406).

Langer (1986) points out the need to help students learn to judge which of these activities will most nearly fulfill the requirements of the learning tasks they are assigned.

Feathers and White (1987) followed the progression of their students from concrete to abstract engagement through use of writing as one of their learning strategies. They found that writing about their use of study methods tended
to generate the sort of metacognitive awareness which led them to expand their knowledge about reading and learning (p. 273).

Marshall (1987) found that students who completed extended writing assignments as a part of their study of literature achieved significantly higher posttest scores, regardless of whether the writing activity involved personal analytical writing or formal analytical writing. His posttests included two essay examinations over stories students had read as part of a literature unit. His discovery that students who were required to respond to short answer questions had lower scores than students who did longer writing assignments led to his conclusion that the short answer question requirements, "by discouraging the students' construction of a coherent and elaborated representation of the story, may have interfered with their developing sense of the story's meaning" (p. 59).

The transactional model of the reading-writing connection offers a number of implications for this study. First, virtually all studies indicate that more learning occurs when writing is used to help make meaning from reading than when reading is done with no writing. Second, because reading and writing involve different methods of processing material, use of both appears to offer enhanced learning opportunities. If both reading and writing are
viewed as ways of constructing meaning, an implication of this viewpoint is that the more ways text material is approached, the greater the understanding and absorption of information.

Study Skills

Drawing a line between studying and the other activities outlined to this point—metacognitive activities, reading/writing activities—is not easily done, nor would an attempt to set rigid boundaries about what constitutes studying serve any useful purpose. Nevertheless, some definitions of studying may help to limit those activities which are considered study skills. Baker and Brown (1984) have defined studying as "reading for remembering" (p. 367). Anderson and Armbruster (1984) say that studying differs from "ordinary reading" in that "studying is associated with the requirement to perform identifiable cognitive and/or procedural tasks" (p. 657). This performance component leads students to the development of particular learning habits referred to as study skills. Barron, McCoy, Cuevas, Cuevas, and Rachal (1983) have defined study skills as "those learner-selected objectives, strategies, and habits that facilitate independent learning" (p. 329).

Anderson and Armbruster (1984) have differentiated between what they term state variables and processing
variables in the study process. State variables include those related to the student and the text, such as knowledge of the criterion task, knowledge of content to be studied, motivation, and those variables of the text which cause it to be more or less readable. Processing variables are those which are "involved in getting the information from the written page into the student's head" (p. 657). While this study is primarily concerned with those activities included under the processing variables label, the state variables cannot be ignored since those will determine which of the processing variables is used and to what extent. Anderson and Armbruster say this about the meshing of the two sets of variables:

Studying will be effective if students process the right information in the right way, where "rightness" is defined in relationship to the criterion task. In other words, studying will be facilitated to the extent that students know the performance requirements of the criterion task and encode the information in an optimal form to meet those requirements (p. 665).

If the choice of a study skill is dictated by the demands of the performance, there are also other state variables which help determine the process selected by the learner.
One such influence on choice of process has to do with the perceived efficiency of the study technique. Paris, Lipson, and Wixson (1983) observe that even though a student might see a skill as relevant and useful, the student will probably not choose to use that skill if he/she sees it as too time consuming or demanding. Nist and Simpson add that students will use a strategy only if it is cost-beneficial in terms of time required. If another strategy is as effective with the same time investment, "students will opt for whatever situation offers the best payoff" (p. 252). Studies which point out the benefits of analytic writing in learning (Langer, 1986; Langer & Applebee, 1987) also make the point that different kinds of writing are appropriate for different purposes, implying a use for a variety of ways of processing texts, some of which would involve the efficiency required by studying.

Another influence on the choice of process may have to do with the depth of processing required by the technique. Armbruster and Anderson (1981) point out that "any study technique can help if it enables students to process the right information in the right way" (p. 155), but that the "right way" probably will involve more depth of processing than less effective methods. Depth of processing, they explain, demands that students think through the material
being studied in ways may require them to reorganize the material or restructure the concepts presented.

Elrod (1987) employed the "depth of processing" principle in developing an instructional package to be used by instructors of learning disabled students to teach active reading. The package described nine steps to be used for completing content area reading assignments, and included such activities as purpose setting, prereading, forming questions, and summarization. He suggests that for students who have less than adequate skills for processing texts—in this case, LD students—specific instruction and practice in the application of active reading techniques are necessary to insure depth of processing.

Depth of processing is perhaps a function of "active learning" (Elrod, 1987; Jenkins, Heliotis, Haynes, & Beck, 1986; Singer & Donlan, 1982). Singer and Donlan's study taught students to generate questions as they read in an effort to help them activate schema. They found short story comprehension improved significantly by use of this technique. Jenkins et al. looked at whether using a restatement procedure would improve reading comprehension for learning disabled students. Although they found no significant differences in improvement between the learning disabled students and the average students, they found both groups improved comprehension as a result of the "active
learning" technique of jotting down important content as they read.

Many of the techniques involved in the active learning procedures fall into the category of study skills. Such skills as notetaking, summarizing, and questioning are listed among the active study techniques investigated by Anderson and Armbruster (1984). Of the six techniques they surveyed (the others are underlining, outlining, and techniques for representing text diagrammatically), those which have implications for this study are underlining, notetaking, and summarizing, and each of those will be discussed below.

**Underlining**

Two studies which have looked at research on underlining (Anderson & Armbruster, 1984; Nist & Hogrebe, 1987) point out that while underlining is the most popular study aid used by students, there is little evidence to support its effectiveness as a learning technique. Nist and Hogrebe say that there is some evidence to show that student-generated underlining is more valuable in increasing recall over experimenter-generated underlining, but that may depend on the depth of processing students are using during underlining. If they are actively encoding information, underlining may be beneficial. If they are only using underlining to help their concentration, it may
not be. Anderson and Armbruster say that the benefit of underlining occurs when the student makes a choice of what to underline.

Two authors who have investigated research in underlining for applications to instruction have largely supported these conclusions. McAndrew (1983) mentions the von Restorff effect, which says that material isolated against a homogeneous background is more easily recalled than other information. He says that for underlining to be effective, students should be taught which material to underline. Specific training in underlining should stress marking of only more important, higher level sentences. Requiring students to choose the important ideas in text paragraphs forces greater depth of processing and increases student recall. Overmarking of text tends to reduce recall.

Blanchard (1985) says that the "search and selection" (p. 200) process involved in underlining is intended by students to help them select the most important ideas in a text, but if they are simply underlining without clear-cut goals, it will serve little purpose. He suggests teaching students to use underlining as one of a repertoire of study aids and to make underlining one part of timely review processes.
These conclusions are largely supported by the research of Hartley, Bartlett, and Branthwaite (1980). In looking at studies done on underlining, they cite seven which indicate positive effects from underlining, fourteen which show neutral effects, and one which indicates a negative effect. Hartley, Bartlett, and Branthwaite conducted a study with sixth graders in which they compared student's recall of information when they read passages with main ideas highlighted by the researchers and when they read plain passages. They found that the scores for the highlighted passages were significantly higher, a finding that tends to support the claims of the von Restorff effect.

Support for the claims of the von Restorff effect are more easily found, however, than are conclusions as to its value. Most studies which look at highlighted material can show that students remember best those ideas which are highlighted, whether researcher generated or student generated. For instance, Nist and Hogrebe (1987) cite the von Restorff effect in their study of the learning from underlined texts. One group was given materials with previously underlined main ideas, one group was given materials with previously underlined low relevancy ideas, and one group self-generated underlining. The researchers found that students tended to score higher on tests of the
underlined material, whether it was important or not. Further, there was little difference among scores of the two groups using underlined passages and the group which self-generated underlining. The researchers suggest that if students are underlining material which is important, probably they learn it more easily. If the material they've underlined is insignificant, it may be of no help to them.

The varied results of underlining are noted in a number of other studies which look at the efficacy of underlining, either alone or as compared to other study skills. Hoon (1974) found little difference among college level groups which employed read-underline, read-write-notes, and read-only strategies. Idstein and Jenkins (1972) compared college students who were assigned to an underlining group and a rereading group. They found no difference in posttest scores for the two groups.

Fowler and Barker (1974) also endorse the von Restorff effect; yes, they say, students do tend to remember more of what is highlighted, but their study generated another interesting idea about what students consider important to remember. They compared groups in which college students highlighted their own material, studied material highlighted by another student, studied instructor generated highlighting, or studied non-highlighted
material. Students did score higher on highlighted ideas, but, regarding previously highlighted material, they say, "The degree of enhanced retention of isolated material by passive readers may ultimately depend on the amount of faith they have in the judgment of the person who did the highlighting" (p. 363). An implication of this study is that students will tend to remember material previously highlighted, since they may assume the highlighting was done by an expert.

A study conducted by Rickards and August (1975) offers interesting insights into the ways in which underlining may or may not be effective. Their six groups of college students included three groups which used self-generated underlining in three conditions: students were to underline one sentence in each paragraph of high structural importance, or of low structural importance, or any sentence they chose. Students in the other three groups were given passages with experimenter-generated underlining of one sentence in each paragraph of either high structural importance, low structural importance, or no highlighting at all. Their conclusions were that limiting students in their underlining was beneficial when the students were allowed to choose the material they underlined. Subject generated underlining was no more effective than experimenter underlining in sentences of high structural
importance. Underlining of low structural importance was actively detrimental to students' learning, whether done by the students or the experimenters. Apparently, they conclude, the natural inclination of readers is to underline important material, and when they are instructed to focus on unimportant material, that disrupts their learning process. Students who were free to choose sentences to underline seemed to choose those which best fit their own learning and cognitive styles; students instructed to underline the most important sentences tended to be thrown off by their search for "exactly what sentences the experimenter wanted them to underline" (p. 864).

Finally, whether underlining is successful as a strategy may relate closely to students' maturity as readers. Brown and Smiley (1978) point out that "young children or novices find it more difficult to ignore irrelevant or less informative material" (p. 1076). Their study of students' patterns of underlining and notetaking indicate that students below seventh grade have great difficulty making use of text organization and essential elements of texts. Above that age (or, by implication, level of maturity), they are able to make use of increased study time and instruction in ways of using text features.
Several ideas from these studies are relevant to this study. Most studies indicate that students do tend to remember what is underlined; the value of the underlining would seem to hinge on whether students are underlining those items which are relevant to their studies. Moreover, underlining of irrelevant information would appear to have a detrimental effect on learning, leading to support of McAndrew's (1983) conclusion that less underlining may be more effective than more. Finally, there is indication that while mature students may benefit from instruction in main idea selection, students who are allowed to make their own choices about which ideas they will remember are more likely to benefit from the underlining process than are students who are required to underline specific information.

Annotation
Annotation is a component of the more general category of notetaking. While notetaking embraces all forms of taking notes, including taking notes from lectures and taking notes from reading, this study is most concerned with those forms of notetaking which involve learning from written texts, and particularly those forms which involve marginal annotation of texts as students process their reading material. For the purposes of this research, therefore, the term notetaking will denote any method of
taking notes from written texts; annotation will be used to mean specifically making marginal notes within the text. Other uses of either term will be clearly defined.

Anderson and Armbruster say that although notetaking has, theoretically, great potential as a study aid, research has failed to show that it is any more effective than any other study strategy. Support from reading theorists such as Tierney and Pearson (1984) who suggest "reader revision" in the form of annotations and questions, and Wittrock (1984) who states that "reading comprehension and retention can, sometimes at least, be enhanced by encouraging readers to construct summaries, interpretations, main ideas, and images or pictures as they read," would seem to validate the use of notetaking or text annotation as a sound device. However, as with all study strategies, the key to the success of its use may be the depth of processing involved. Guido and Colwell (1987) state that "there needs to be the element of active involvement and restructuring of the text" for learning to be most effective (p. 91). Armbruster and Anderson (1981) stress that if students just copy the text in a very superficial way, there is little depth of processing occurring. Hayes (1987) says that there is evidence that "brief writing tasks that involve reorganization of texts
tend to engage more of the students' own intellectual resources in the study of those texts" (p. 348).

In devising a method to help content area teachers improve student comprehension, Richgels and Hansen (1984) found use of gloss notations to be of significant value in helping students learn content material. They report that teachers and students found gloss sheets particularly helpful to students in preparing for exams. Gloss notations, or marginal notes designed to direct readers' attention, were made up on sheets separate from the text and keyed to the text by numbered brackets. Students were required to process the text by filling in blanks in the gloss. As they are more highly focused than study guides, gloss sheets are tied closely to expository reading. Further, with training and practice, students might be moved into creation of their own gloss sheets as an approach to text annotation.

Anderson and Armbruster (1984) point out that the effectiveness or lack of effectiveness of notetaking may depend on three factors: (1) whether it encourages the sort of focusing and processing which is compatible with the criterion task, (2) whether students are concentrating on information unrelated to the criterion task, and (3) whether the notetaking elicited sufficient depth of processing (p. 670).
Bretzing and Kulhavy (1979) looked at four levels of notetaking from shallow to deep. The levels included (1) letter search, in which students wrote down all words beginning with capitals; (2) verbatim, in which students extracted and copied important sentences; (3) paraphrase, in which students wrote down main ideas from each page as it was read; and (4) summary, in which students recorded the main points from a page after it was read. They found that students who used the paraphrase and summary methods recalled significantly more information on comprehension posttests than did students in the other two groups.

Although a study by Nist and Hogrebe (1987) comparing the use of text annotation to underlining showed no significant differences in student test performance, a subsequent study of the use of text annotation by Nist and Simpson (1988) indicated that students using the text annotation over time achieved higher test scores and spent significantly less time studying than students using underlining.

In studies which look at general notetaking skills, Carter and Van Matre (1975) found more benefit from having notes than from taking notes, and say that the efficiency effect of recall from notes is based in the review of relevant material and the inhibition of irrelevant
material. "Note taking alone," they say, "is of questionable value" (p. 903).

However, in Rickards and Friedman's study (1978), the researchers discuss the two functions of notetaking. The first, encoding, "suggests that the act of taking notes results in a transformation of passage material" (p. 136). The encoding process, in some fashion, may enable students to remember more of what they have read/heard, even if they do not look at their notes again. The second function is called the "external storage" of material. This theory suggests that the use of notes is only or primarily beneficial in the review procedure, that notetaking itself is not especially beneficial, but that the review of notes facilitates recall in ways which include reconstruction of material on which no notes were taken. The study conducted by these researchers involved groups of college students who were assigned to one of three conditions: take notes and review them before a test, take notes and mentally review the material before the test, or take no notes and mentally review the material before the test. Additionally, half the students were told they would be given an essay test, half were told they would be given a multiple choice test. They found that both encoding and external storage functions of notetaking were applicable, with the latter seeming to be a more important function.
Further, they found that review of the notes (external storage function) served to help with the reconstruction process. They found, moreover, that the quality of the notes taken seemed to improve with the expectation of essay tests.

The implications of notetaking studies for the research being conducted here have to do with both the encoding and external storage components of learning. This study theorizes that students will learn from the act of notetaking; further, review of those notes should be of significant value in preparing for tests. Students who are taught the annotation procedure for processing text should obtain some value from reading and restating the information in their texts. They should obtain further value from rereading those marginal notes in preparation for recalling the information. The studies of notetaking with regard to texts are mixed, and the study undertaken here will provide further evidence to clarify the value of notetaking as a study aid.

**Summarizing**

As is pointed out by Anderson and Armbruster (1984), use of summarization as a study skill has been little researched. Most studies of summary writing are done in research which uses summary writing as an aide to reading comprehension (see above). Anderson and Armbruster do
point out, however, that summary writing seems to be most effective as a study strategy in those cases in which students are (1) given specific instruction in how to produce summaries and (2) the task at hand is one which uses the type of processing called for in summary writing. Guido and Colwell (1987) have supported these conclusions and have noted that "summary writing can be an arduous task that requires self-discipline and intellectual effort" (p. 96). Perhaps for these reasons, research which has looked at summarizing as a study strategy has shown positive results, but perhaps for these reasons it seems not to be used very much.

Rinehart, Stahl, and Erickson (1986) trained sixth-grade students in summarization procedures and found that the training significantly improved their recall of major information from their reading over the control group. They suggest that summarization training coupled with main idea recognition strategies may offer benefits to students and teachers of content area courses.

Summarization more directly applicable to a study technique is offered in a strategy called PORPE (Simpson, Stahl, & Hayes, 1989). PORPE is an acronym for Predict, Organize, Rehearse, Practice, and Evaluate, and is a study strategy developed to help students prepare for essay exams. Students predict possible essay questions, organize
information to answer those questions, rehearse their answers through recitation, practice writing answers to questions, and evaluate whether the answers generated are adequate. Since the strategy teaches students to organize and summarize material in preparation for essay tests, researchers anticipated that the experimental group using PORPE would produce superior essays to the control group which did not use this method. They found, however, that the experimental group also scored higher on the multiple choice posttest. These results tend to confirm the findings of Meyer (1936) who found that students who studied for essay exams by making summary statements tended to do better on all kinds of tests.

Summarization is one of the bases for the text annotation procedure being investigated by this study. Students who are trained in text annotation are instructed to "reduce and restate" the information in the reading passages. In other words, they need to learn to summarize the information and paraphrase it, both components of effective summarization procedures. It is anticipated that the use of summarization will be effective in helping students locate and encapsulate those ideas which will be most useful in comprehension and retention of the material.
Summary

A survey of the related literature in the areas of research connected with this study indicates several areas which are applicable to the experiment being undertaken. Research on metacognition, for instance, supports the value of students' self-knowledge about their study methods and the effectiveness of those methods. Students who are able to (1) recognize when they are learning what they intend to learn and (2) make adjustments to compensate for the times when they are not doing so are the most effective at comprehending and retaining the information they read. Since metacognition appears to be developmental in nature, college level students should be the most effective employers of metacognitive strategies. Instruction in metacognition should be most effective with students at the college level, and they should be the most competent at assessing their levels of both comprehension and learning in preparation for testing.

Metacognition research also indicates that college level students should be able to take advantage of knowledge of what the task requires, what strategies are most applicable, and whether they have performed to the level required.

The reading/writing connection involved in this study indicates that students should be able to use reading and
writing to their best advantage by understanding how those seemingly separate activities combine. Use of the parallel process approach to reading and writing should indicate to students how reading and writing are similar; use of the interactive process of reading and writing can help students learn to reconstruct the information presented in the text material; use of the transactional approach can help them see how their own ideas relate to the meaning of the text at hand. All of these processes provide evidence that the use of reading and writing together is more effective than the use of each separately. In terms of this study, the annotation procedure offers a way of using writing in conjunction with reading in a way which might promote more learning than could be accomplished without the use of writing. The use of a reading only procedure (underlining) and a reading/writing procedure (annotation) may offer interesting insights into differences in ways students use and benefit from the two study strategies.

Finally, those study skills which are most applicable to this study include the use of underlining and annotation or notetaking. Underlining has been shown to be most effective when it is used with the understanding of what is being underlined; that is, students who choose the main idea or the most important idea in a passage tend to have greater recall than do those students who underline
indiscriminately. Annotation or notetaking has also been found to be effective only when used to promote depth of processing and particularly when used in connection with significant review. Summarizing is a significantly useful process in study, helpful in both the metacognitive aspects of learning and the study skill area. Summarizing involves the recognition of those important aspects of learning and the method in which those points can be rephrased. Summarization is related to this study in that the annotation procedure particularly emphasizes the condensation of information into the words of the reader, reducing them to the most important concepts to be learned. Summarization is required in retelling, one of the two measures of comprehension used by the study.
CHAPTER 3
DESIGN OF THE STUDY

Purpose

The purpose of this study is to determine whether students who read two different types of texts are able to comprehend and retain more information when they (1) annotate or write about the material, or (2) underline main ideas, or (3) read and write recalls of the material, or (4) only read the material. This chapter will present the following:

1. a description of the subjects
2. a description of the materials
3. a description of procedures for training
4. the procedures to be used for data collection
5. a description of the pilot study
6. the procedures to be used for data analysis

Subjects

Subjects used in the study were 67 students enrolled in FCR 194, a study skills practicum at a major southwestern university. The practicum is a seven-week course offering two semester units of credit. The course is an elective, and students who enroll in the class self select it. The course is designed primarily to assist
students in learning methods of study which will enable them to become independent learners. To this end, major units of study in the course include time management, notetaking, text book reading methods, test preparation methods, test taking skills, and test anxiety management.

Students attend three hours of lecture per week and one hour per week of lab work. Classes are limited to twenty-five students each and are taught by instructors and graduate assistants in the Academic Learning Strategies Center on campus. Labs are taught by student instructors and consist of practice in application of topics introduced in lecture sections. Students enrolled in the course are ordinarily freshmen, although the course is open to and includes students from all classes. Students taking the course are there for a variety of reasons. Students may be enrolled in the course on the advice of financial aid counselors or other student advisors.

Research for this project focuses on the text book reading section of the course. Currently, students are taught a method of text annotation which was developed by Simpson and Nist (1987) and which involves the students in reading text passages, then making marginal notations summarizing the main ideas in each paragraph. The study conducted by Simpson and Nist indicated that when this method was used as a study technique, students trained in
the annotation method of text processing scored one grade higher on posttests than students using other methods of text processing. Further, those students using the text annotation method self-reported that they used 40% less time in studying than did the other students. Other studies (Armbruster & Anderson, 1981; Hayes & Diehl, 1982; Nist & Hogrebe, 1987) indicate that greater depth of processing, including summarizing and paraphrasing, results in greater retention and higher post-test scores than do reading only and reading with underlining only.

Passages

Passages used with these groups were of two types. One passage was selected from an introductory level chemistry text and served as the science passage. The other, selected from a freshman level history text, was the social science text. Passages were chosen in collaboration with professors of history and chemistry who provided the texts from which the passages were selected and who provided technical expertise in their respective fields of study. The researcher provided the criteria for passage selection, which included the following requirements:

1. Length of the passages was to be about 1000 words.
2. Texts were to be for introductory courses
which covered information basic to the course.

3. Passages were to be general in nature so that students were not required to have a great deal of prior knowledge for understanding the texts.

4. Passages should be written in a style which could be considered representative of the genre (science or social studies).

5. Any graphics should be typical of texts for that subject matter.

6. Passages would be scaled according to the Fry Readability measure (Burns, Roe, & Ross, 1984, p. 309).

The professors who provided the texts were asked to read the final selections to assist in determining the appropriateness of the passage for the student population in the study. Both passages were reviewed by graduate students who were reading specialists.

Science Passage

The passage chosen for the science selection (Appendix A) was taken from College Chemistry: An Introduction to General, Organic, and Biochemistry, 4th edition, a text typical of those used for Chemistry 101. Chemistry 101 is described in the University of Arizona
Record: General Catalog as a course designed for nonmajors such as pre-nursing and allied health majors, and nonscience students. The passage chosen was taken from a chapter titled "Elements and Compounds." It contains approximately 1100 words, exclusive of tables, and has a Fry Readability score of 11th grade. This selection includes sections labeled "Elements," "Distributions of Elements," "Names of the Elements," and "Symbols of the Elements." There are no illustrations in the text, but there are four tables including the following: (1) distribution of the elements in the earth's crust, seawater, and atmosphere; (2) average elemental composition of the human body; (3) symbols of the most common elements; (4) symbols of the elements derived from early names. There is one figure included, typical alchemists' symbols. The passage was photocopied on five pages, reproduced on one side only, and stapled in the upper left corner.

History Passage

The passage selected for the history text (Appendix B) was taken from The American Pageant: A History of the Republic, Vol. 1, 7th edition, a text typical of those used in History 106. History 106 is described in the University of Arizona Record: General Catalog as the "political, economic, and social history of the American people from the founding of colonial Jamestown to 1877" (p. 169). The
passage chosen was taken from a chapter titled "Shaping the National Economy, 1790-1860." It contains approximately 1150 words, and has a Fry readability score of 12th grade. This selection includes sections labeled "The March of Mechanization," and "Whitney Ends the Fiber Famine." Illustrations were removed from the text in order to make it parallel with the science passage. The copy of the text distributed to the students was produced by cutting and pasting the photocopied text into four pages, allowing sufficient margin space for annotations. The text was photocopied on one side only, and stapled in the upper left hand corner.

Instruments

There are five types of instruments used with this study:

1. a prereading prior knowledge measure,
2. a prereading student information questionnaire,
3. a postreading metacognition questionnaire,
4. a postreading written retelling measure, and
5. a postreading multiple choice comprehension measure.

The prereading test of prior knowledge (Appendix C) is a pencil and paper group measure of thirty items, ten on history, ten on science, and ten foils. The prereading student information questionnaire (Appendix D) was used to
gather data on the individual students by requesting such information as student major, year and semester in school, grade-point average, SAT or ACT test scores, areas of subject matter interest, ethnicity, and subject matter interests. The postreading metacognition questionnaire (Appendix E) asks students to describe the methods they used to process the passage they have just read and to describe any difficulties they had in reading or comprehending the text. Both the student information questionnaire and the metacognition questionnaire were developed in collaboration with professors of reading from the Division of Language, Reading, and Culture.

The postreading written retelling consisted of having students write recalls of the passage read. Students were directed to write as much of the information as they could remember from the passage they read (see Appendix F for written and oral prompts). They were given no training in writing recalls, nor had they written them before. Retellings are assessed by use of the Retelling Profile (Mitchell & Irwin, 1990, Appendix G). The posttest (Appendix H) consists of twenty multiple choice items, ten for each passage. These items are the same items as were used for the test of prior knowledge, but the foils are eliminated on the final test.
Multiple Choice Measures

The questions on the test of prior knowledge for both passages were developed by a collaborative effort on the part of several doctoral students in reading in the College of Education at the University of Arizona. The graduate students were given the passages and asked to develop ten questions for each selection. They were instructed to use the following criteria for development of the questions:

1. Questions were to be multiple choice.
2. Both inferential and factual (literal) questions were to be written.
3. Items were to have one correct choice and three distractors, making four-item multiple choice questions.

The group then met and chose the appropriate items and foils to be used on the pretest. Thirty items were selected for the pretest. Twenty of those items were items selected from the reading passages. The twenty items, ten on each passage, were selected from a pool of forty items, twenty on each passage. Of the selected items, six of the history questions were factual or literal questions and four were inferential. Of the ten selected items on the history passage, seven were literal items and three were inferential. The remaining ten items, the foils, were chosen from the final exam administered each quarter in the
study skills practicum, picked from a pool of thirty items. Items were ordered randomly in the pre- and posttests, drawn from a container in which items were mixed. Items were surveyed to insure that no single answer (a, b, c, or d) was used with undue frequency.

Procedures for Training

There are two training procedures involved in this study:

1. training in previewing and annotation and
2. training in previewing, locating and underlining main ideas.

Training in Annotation

Students in Group 1 were trained in procedures for previewing and annotating text. Students were given a handout outlining these methods (Appendix I). Students were to follow these steps in annotating the text:

1. Preview text by reading introductory paragraphs, boldface headings, and summary paragraphs.
2. Read the text one or two paragraphs at a time, noting key ideas in the margins in their own words.
3. Use annotations which enumerate multiple ideas, list possible test questions, and
The procedure was modeled by the instructor using the opening paragraphs on a practice selection. Students were then instructed to continue work on the selection on their own for the remainder of the 50-minute period. The instructor moved around the room observing the students' work to insure that they understood and were using the method correctly. Students who were not using the method as instructed were corrected individually by the instructor. Students were assigned to take the passage home, complete the annotations on it, and turn it in for homework.

Training in Underlining and Main Idea Selection

Students in the underlining and main idea selection group were instructed in previewing, locating, and underlining main ideas from their texts. They were given a handout containing the instructions for previewing and main idea selection (Appendix J) and were talked through the preview procedure and instructed to do the following:

1. Preview material by reading the introduction, boldface headings, and summaries.
2. Read one or two paragraphs and locate what they believed to be the main ideas in those paragraphs.
3. Underline or highlight those ideas.
4. Review those main ideas after the selection was completed.

The procedure was modeled by the instructor, and students were given the same practice selection as was given to Group 1. After the instruction using the first few paragraphs, students were allowed to work on their own as the instructor moved among them to determine whether they were following the correct procedure. Students not following the procedure as taught were corrected by the instructor. They were required to take the passage home, complete it, and return it as a homework assignment.

Procedures for Data Collection

Data collected for this study consist of multiple choice pretests, prereading questionnaires, post reading metacognition questionnaires, postreading written retellings, and multiple choice posttests, and delayed written retellings. The pretest data were gathered on day 2 of the 7-week class; the written retellings were done on days 8 and 9. The multiple choice posttest was given on day 10. Delayed retellings were administered on day 20. In counting class days, only days the class meets are
counted; as the classes are held three days per week, 2 or 3 days intervene between meetings. (see Figure 1 for data collection schedule.)

In this study, students were involved in one of four conditions, depending on the class section in which they were enrolled. Those conditions were as follows:
(1) reading with use of annotation and written recall,
(2) reading with underlining and written recall,
(3) reading with written recall, and (4) reading. All groups read both science and history selections, and all groups completed multiple choice posttests and metacognition questionnaires.

Prior to this study, a pilot study was conducted using two classes. The purpose and the procedures used in the pilot study will be explained in the following section.

Pilot Study

The pilot study was undertaken for the following purposes:

1. To test the teaching procedures to be used for the annotation group and for the underlining group,
2. To develop standardized lesson plans for both groups,
3. To ascertain whether the length of the reading passages was appropriate,
<table>
<thead>
<tr>
<th>Day 1</th>
<th>PAR</th>
<th>PHR</th>
<th>RRO</th>
<th>RO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course Introduction</td>
<td>Course Introduction</td>
<td>Course Introduction</td>
<td>Course Introduction</td>
</tr>
<tr>
<td>Day 2</td>
<td>Test of Prior Knowledge Test of Prior Knowledge Test of Prior Knowledge Test of Prior Knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Info Questionnaire</td>
<td>Info Questionnaire</td>
<td>Info Questionnaire</td>
<td>Info Questionnaire</td>
</tr>
<tr>
<td>Day 3-6</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
</tr>
<tr>
<td>Day 7</td>
<td>Annotation Training</td>
<td>Underlining Training</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
</tr>
<tr>
<td>Day 8</td>
<td>Read and Annotate Read and Annotate Read Passage 1 Metacognition Quest. Read Passage 1 Passage 1 Metacognition Quest. Metacognition Quest. Written Recall Metacognition Quest. Written Recall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Passage 2 Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
</tr>
<tr>
<td>Day 9</td>
<td>Read and Annotate Read and Underline Read Passage 2 Metacognition Quest. Written Recall</td>
<td>Read Passage 2 Metacognition Quest. Written Recall</td>
<td>Read Passage 2 Metacognition Quest. Written Recall</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
<td>Metacognition Quest. Written Recall</td>
</tr>
<tr>
<td>Day 10</td>
<td>Multiple Choice Quiz</td>
<td>Multiple Choice Quiz</td>
<td>Multiple Choice Quiz</td>
<td>Multiple Choice Quiz</td>
</tr>
<tr>
<td>Day 11-19</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
<td>Regular Schedule</td>
</tr>
<tr>
<td>Day 20</td>
<td>Delayed Recall</td>
<td>Delayed Recall</td>
<td>Delayed Recall</td>
<td>Delayed Recall</td>
</tr>
<tr>
<td>Day 21</td>
<td>Course Final</td>
<td>Course Final</td>
<td>Course Final</td>
<td>Course Final</td>
</tr>
</tbody>
</table>
4. To ascertain whether the time allotments were sufficient,
5. To test the clarity of written prompts and testing instructions,
6. To test the clarity of oral prompts and instructions, and
7. To determine whether other variables needed to be considered for the experimental study.

The pilot study was conducted using two sections of practicum classes held during the first half of the Spring Semester, 1990, in a major southwestern university. The researcher for the proposed study was the instructor in both classes. Students in both classes were given tests of prior knowledge on the second day of class. The students in Group 1 were taught the annotation procedure on day 9 of the class. They were given either a history selection or a science selection of approximately 1000 words to read and annotate on day 10. On day 11, they were given the passage they had not read. The reading selections were assigned at random. Following the reading and annotation of each selection, students were asked to complete a questionnaire on metacognitive procedures used in the annotation, and to write a retelling of the information they recalled from the passage. On day 12, the group was given a multiple choice test over the information from the two passages.
Students in Group 2 were taught the underlining procedure on day 9 of class. On days 10 and 11, they received the same science and history selections as Group 1, and were asked to read the selections and underline the main ideas. Following their readings, this group also completed the metacognition questionnaire and the written recalls. On day 12, Group 2 was given the multiple choice test.

The results of the pilot study indicated that the length of the passages and the time allotted for both procedures appeared to be appropriate. Directions and written prompts appeared to be clear; there were no requests for additional information or clarification. Students appeared to understand both written and oral instructions, and none of the collected material indicated any misunderstandings of directions.

Two alterations in the proposed study were deemed necessary as a result of the pilot, however. The first problem involved the lesson plans constructed for teaching the procedure. More time was spent teaching the annotation procedure than was devoted to the underlining procedure. Time of teaching needed to be more carefully monitored and geared to producing parallel teaching procedures. Part of this difficulty no doubt sprang from the instructor's familiarity with the annotation procedure and lack of
experience teaching the underlining procedure, as well as the demands of the procedures themselves.

The second consideration that needed to be addressed in the major study was that students who annotated took a much greater amount of time with the reading passage than did those students who underlined. The time factor needed to be considered as a variable in the study. This was a fairly easy problem to address, as the researcher decided simply to note the time of day on each annotated or underlined passage as the student exchanged it for the questionnaire at the end of the reading.

**Major Study**

The major study was conducted during the second half of the Spring Semester, 1990. Total data collection was done over a period of seven weeks, with the main portion of the experimental treatment conducted in four class sessions, sessions 7, 8, 9, and 10 (see Figure 1).

**Treatment Groups**

The sample consisted of 67 students at the University of Arizona who were enrolled in four FCR 194 classes. The two treatment groups and one control were taught by the researcher. The two treatment groups were taught preview, annotation, and recall (PAR) and preview, underline, and recall (PHR). The third group, also taught by the
researcher, did reading and recall only (RRO), and the final group, taught by a different instructor, did reading only (RO). All groups completed the final multiple choice test. All groups took the test of prior knowledge, completed the metacognition questionnaire, and completed the information questionnaire. All groups completed delayed retellings.

Design and Experimental Procedures

This study was conducted over seven weeks. All students took the test of prior knowledge on day 2 of the class term. All students completed the information questionnaire.

Training

On day 7 of the class term, the students being trained in the annotation (referred to hereafter as the PAR group) and underlining (referred to hereafter as the PHR group) procedures received approximately the same instruction and training as outlined in the pilot study. Students received handouts outlining the procedures involved in the annotation or underlining strategies. Approximately 25 minutes of instruction was devoted to covering the handout information. The instructor modeled each procedure and gave in-class time for practice, allowing time to observe that each student was applying the procedure correctly.
All students were given a homework assignment for practice in strategy application.

Students in the control group which was to do reading and recall only (RRO) and the control group to do reading only (RO) received no reading instruction on day 7. Students in those classes received instruction in notetaking and memory on day 7.

**Testing**

On day 8, students in the PAR, PHR, RRO, and RO groups received the first of two reading selections to process. The selection was either the science passage or the history passage. These passages were assigned to individual students at random. Groups were given the following instructions:

1. The PAR group was told to read the selection and apply the annotation procedures. Students were instructed to try to remember as much of the passage as possible. They were told that the instructor was interested in how they remembered the information as well as what they remembered. When they had completed the annotation of the passage, they were to turn it in to the instructor and pick up a short questionnaire to complete. The questionnaire asked for the
metacognitive strategies they used, and also instructed them to write as much of the information from the passage as they remembered.

2. The PHR group was told to read the selection and underline or highlight the main ideas. Students received the same instructions as the PAR group as to completion of the selection and the questionnaire. They were also asked to complete the written recall.

3. The RRO group was given the reading selection and asked to read it in order to remember as much of it as possible. Students were told that they might process the material in any way they liked, and that their instructor was interested in how they read the material to remember it, as well as what they remembered from it. They were given the same instructions as the other groups with regard to the completion of the selection and the questionnaire. They were also be asked to complete the written recall.

4. The RO group was given the reading selection and asked to read it in order to remember as
much of it as possible. Students were told, as was the RRO group, that they might process the material in any way they liked, and that their instructor was interested in how they read the material to remember it. They completed the metacognition questionnaire. They did not write recalls. Students did not have the texts available during either the retellings or the multiple choice tests.

Day 9 was organized in the same way as day 8, except that students read the passage they had not read previously.

On day 10, all students completed a 20-item multiple choice quiz over the material in both passages.

Procedures for Scoring

The researcher and four graduate students trained in holistic scoring of written retellings scored all retellings. Multiple choice items were scored by the researcher at the end of the data collection.

Written retellings were scored using the Mitchell-Irwin Retelling Profile (1990) (Appendix G). The profile includes three domains consisting of four assessment areas in each domain. Items 1-4 look at the reader’s text-based comprehension; items 5-8 assess reader response and
reaction to text; items 9-12 indicate the reader's language use. Individual items are scored holistically on a scale of 0 (none) to 3 (high degree). Thus, a total score of 12 points per domain is possible.

The multiple choice test consists of twenty items, each item scored at one point. The test was scored in two sections, one section for the history portion and one section for the science portion, for a high score of ten points on each section.

Data Analysis Procedures

The following analyses were used to determine the effectiveness of the annotation training as a means of improving comprehension and retention of text material:

1. An ANOVA was used to analyze the tests of prior knowledge to determine whether there were significant differences among the groups in terms of background information.

2. An ANOVA was used to analyze multiple choice posttest scores to determine whether there were differences among the groups in comprehension.

3. Written retelling scores were analyzed by use of t tests to determine whether there were significant differences in
comprehension between the groups being compared.

4. Written retelling scores were analyzed by use of t tests to determine whether there were significant differences in retention between the groups being compared.

5. A correlation between science test scores and history test scores was assessed.
The purpose of this study was to assess whether there were differences in reading comprehension and text retention among four groups of students. The two experimental groups, one trained to use text annotation and one trained to underline main ideas, both wrote recalls of the information as soon as they had completed their reading. The two control groups were untrained; one group wrote immediate recalls, one did not. All groups took multiple choice tests over the text passages, and all groups wrote delayed recalls of the information four weeks after the initial readings. A total of 96 students began the study, but only those students who completed all sections of the study were included in the final data. A total of 67 students completed all portions of the study, a loss of 29 students. Of those 29 students, 5 were absent during training in the experimental groups, 6 were absent during the first reading, 6 were absent during the second reading, 6 missed the multiple choice posttest, 3 did not complete delayed retellings, and 3 withdrew from the class.

This chapter will present observations concerning the metacognition questionnaire administered to all
participating students immediately following their reading of each text passage. This chapter will also present analyses of the multiple choice tests and the immediate recalls as measures of comprehension, and analyses of the delayed recalls as the measure of retention.

Metacognition Questionnaire

The metacognition questionnaire administered to all groups immediately following their readings of the text passages (Appendix E) essentially asked students to describe their thinking about their reading in three areas: whether they found the reading difficult or easy, and why; how they chose main ideas in the reading selections; and how they went about learning and remembering the information in the passages.

The responses of the students, across all four groups, were similar, with a few exceptions. For this reason, the responses of the first group to complete the questionnaire will be described in some detail, and the responses of other groups will be noted as they differ significantly from the descriptions presented.

The majority of students in the group trained in annotation (PAR) indicated that they found the science selection easy to read. Four of the 22 students said it was difficult because "I hate chemistry;" "I don’t like science;" "Science is my weak point;" "I’ve had less
Among those who found the selection easy, six referred to having studied chemistry before. Others pointed out qualities of the text which made reading easy, such as use of examples, tables, definitions, short sentences, and "everyday" language.

The question of how they chose main ideas elicited answers which tended to fall into three broad categories. Several students said they looked for such factual information as names, dates, theories, laws, rules. A second group noted the use of the questions at the beginning of the reading. The largest group referred to the use of titles, headings, boldfaced print, charts, and graphs.

On the third question, which asked how they remembered the information, the largest group mentioned using annotation, a response which could be expected with this group. Four students said they made lists or charts of the information, and three said they made up questions and looked for the answers.

After reading the history selection, only one student said that the reading was difficult. That student said it was "boring, and it was difficult to pay attention." Others indicated that they were not interested in the subject matter, but unlike those who found the science reading difficult because they disliked science, they didn’t seem
to find that their lack of interest interfered with their ability to comprehend the passages. Four students indicated that they were familiar with the information from prior studies, and five said it was easy because the vocabulary was not difficult and the information was straightforward.

Because there were fewer headings or other kinds of graphic aids in the history passage than in the science passage, fewer students mentioned using titles and subtitles to locate main ideas, although four students did mention those. The method most frequently mentioned was a search for topic sentences; nine students spoke of looking for the main idea in each paragraph. A search for names, dates, and inventions was the third method most mentioned as a way of selecting main ideas.

For remembering information, the annotation method was the most frequently mentioned method, as expected with this group, although three students mentioned rereading as something they did to remember the material.

Responses of the underlining group (PHR) were similar to those of the PAR group, with the exception of the fact that, as might be expected, the most commonly mentioned technique for remembering was the use of underlining, and the rereading of the underlined material.
The control group with recall (RRO) responded similarly to the first two questions, although they responded to question three in some interesting ways. First, their responses indicated the use of a combination of underlining and annotation. A look at their papers confirms this; most used some variation of the annotation method. Second, two students mentioned the use of "mnemonic devices," a topic this group studied the week before in a memory training unit. The use of mnemonic devices is probably not unusual, since many students make up phrases, rhymes, or sentences to help in remembering factual information. The use of the term itself may be unusual, however, since the term "mnemonics" seems not to be a common vocabulary term.

Responses of the control group without recall (RO) were, again, similar to the other groups on the first two questions, but their responses to the last question regarding ways they remembered information were interesting when compared to their papers. On the science reading, several indicated that they had underlined or highlighted, and six papers supported those responses. On the history reading, four students mentioned underlining, and five had done so. Some strategies mentioned, such as "created associations between reading and prior knowledge," have strong support from metacognitive theory; unfortunately,
there was no evidence on the papers as to how this was done. Since many of the papers (four science, seven history) had no marks at all, it must be assumed that many of the strategies used were similar to those used by the student whose method of remembering was "making mental notes."

The responses to the metacognition questionnaire indicate several interesting points. For instance, it appears that a dislike of science may be more disruptive to students' learning than a dislike of history. Students who said that they found history boring or distasteful did not indicate difficulty learning the subject; students who hated science seemed to have trouble learning it. Another interesting point is that while some students indicate knowledge of sophisticated metacognitive strategies, they may or may not make use of them. In other words, there appears to be some difference between what they say they do and what they actually do.

Presentation of Findings

In analyzing the data for this study, ANOVAs were used to address overall differences, and a series of t tests were used to compare separate groups.

All students were given tests of prior knowledge in the form of multiple choice pretests on the science and history passages. The results of those pretests were
compared by use of ANOVAs which are presented in Tables 1 and 2.

In these tests, \( p = 0.05 \) was selected as the minimum significance level. As these tables show, there were no significant differences among the four groups in the scores for the science and history pretests. This means that the groups were essentially equal in their prior knowledge of the text material to be covered by the reading passages.

After the groups had completed the readings, the multiple choice tests were repeated. Results of those tests are shown in the ANOVAs in Tables 3 and 4.

Again, using a significance level of \( p = 0.05 \), the results of the ANOVAs indicate that there were no significant differences among the scores of the four groups on either the science or the history posttests.

The other measure of comprehension used in this study was based on recalls written by students immediately following their readings of the history and science passages. T tests were used to compare the groups' scores on the written recalls.

The Mitchell-Irwin Retelling Profile (1990) provided the basis for scoring the written recalls (Appendix G). Scores on the Retelling Profile are based on twelve items which are classified into three domains. The three domains, each containing four items, include (1) the
## TABLE 1
Analysis of Variance of Multiple Choice Pretest Scores for Science

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F Ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>0.148</td>
<td>3</td>
<td>0.049</td>
<td>0.022</td>
<td>0.996</td>
</tr>
<tr>
<td>Error</td>
<td>143.852</td>
<td>63</td>
<td>2.283</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAR</td>
<td>5.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHR</td>
<td>5.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRO</td>
<td>5.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## TABLE 2
Analysis of Variance of Multiple Choice Pretest Scores for History

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F Ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>1.785</td>
<td>3</td>
<td>0.595</td>
<td>0.218</td>
<td>0.883</td>
</tr>
<tr>
<td>Error</td>
<td>171.827</td>
<td>63</td>
<td>2.727</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAR</td>
<td>4.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHR</td>
<td>4.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRO</td>
<td>4.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 3
Analysis of Variance of Multiple Choice Posttest Scores for Science

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F Ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2.154</td>
<td>3</td>
<td>0.718</td>
<td>0.504</td>
<td>0.681</td>
</tr>
<tr>
<td>Error</td>
<td>89.786</td>
<td>63</td>
<td>1.425</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAR</td>
<td>7.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHR</td>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRO</td>
<td>7.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 4
Analysis of Variance of Multiple Choice Posttest Scores for History

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F Ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>11.754</td>
<td>3</td>
<td>3.918</td>
<td>1.364</td>
<td>0.262</td>
</tr>
<tr>
<td>Error</td>
<td>180.932</td>
<td>63</td>
<td>2.872</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAR</td>
<td>6.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHR</td>
<td>6.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RRO</td>
<td>7.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.86</td>
</tr>
</tbody>
</table>
reader's text based comprehension, (2) the reader's response and reaction to the text, and (3) the reader's language fluency. Each item is scored on a scale of 0-3, 0 indicating total absence of the quality measured; 3 indicates a high degree of that quality.

Retellings were scored by the researcher and four raters. The recalls were typed into a computer and printed out to avoid difficulties with handwriting styles. Recalls were coded and interleaved so that delayed recalls and recalls from various classes were mixed and not identifiable by raters. The researcher read and scored all of the recalls. Two raters scored the history recalls, with each rater reading half the total. Two other raters scored the science recalls, each reading half. The researcher met with raters to reconcile scores to achieve rater agreement. Arrangements were made for a third reader to rate those recalls upon which agreement could not be reached, but no third readings were necessary.

T tests comparing the recall scores are discussed below. T tests were used to compare scores in two of the three domains, text-based comprehension, and language use. The third domain, reader response, had such low scores across all treatment groups that significant findings could not be accomplished by statistical analysis. Only one item in the reader response domain, the item relating to the
reader’s prior knowledge, had scores above 0. Consequently, use of an item analysis to show differences in the way prior knowledge was exhibited among groups and between history and science passages will be discussed following statistical analyses for immediate retellings (comprehension) and following statistical analyses for delayed retellings (retention).

A significance level of $p = 0.05$ was used for all t tests.

Annotation versus Underlining

Research question one asked whether there were differences between the two experimental groups: the group trained in annotation of text (PAR) and the group trained in underlining main ideas (PHR). The issue of whether either training method produced significantly better comprehension is addressed in this analysis. In Table 5, results of recall scores for immediate retellings are presented.

As Table 5 indicates, no significant differences in retelling scores for the PAR group and the PHR group were found for text comprehension and language use for the science and history passages. In terms of understanding the material read and in terms of immediate recall, it would appear that there is little difference between the effects of the two treatment methods. These findings
TABLE 5
Comparison of Immediate Retelling Scores for Annotation (PAR) Versus Underlining (PHR)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th></th>
<th>PHR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>5.55</td>
<td>2.61</td>
<td>6.15</td>
<td>2.12</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>5.95</td>
<td>2.65</td>
<td>5.62</td>
<td>1.89</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>3.45</td>
<td>2.77</td>
<td>3.38</td>
<td>2.14</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>4.32</td>
<td>3.39</td>
<td>5.23</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>.75</td>
<td>.46</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>.46</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
support the conclusions of Hoon (1974), who found no differences in comprehension among reading, reading with underlining, and reading with notetaking, and McAndrew (1983) who contended that underlining is as effective as other study methods when students are instructed in its most efficient use.

The reading times for the PAR group were 27.73 minutes for the science passage and 29.18 minutes for the history passage, as opposed to the PHR group’s reading times of 18.38 minutes for science and 19.69 minutes for history. The PAR group took 9.45 minutes longer than the PHR group to process the science passage and 9.64 minutes longer to process the history passage. These time differences may be an indication that the use of strategic underlining is an efficient way of learning material for tests of immediate recall.

Annotation Training

Questions two and three examine the comparison between the group trained in annotation and untrained groups. Question two looks at whether a group of students trained in annotation (PAR) demonstrates greater comprehension than an untrained group which writes immediate recalls (RRO). Question three asks whether the PAR group shows greater comprehension than an untrained group which does not write recalls (RO). The multiple choice posttests did not show
significant differences among groups as indicated by ANOVAs (Tables 3 and 4). Table 6 displays t test results of the comparison of immediate recall scores for PAR and RRO. As the RO group did not write immediate recalls, the group is not represented in this table. Results of the delayed recall scores for the RO group (and for all groups) will be discussed in connection with question 8.

It should be noted that reading times for the PAR and RRO groups were almost equal. Science reading time for the PAR group was 27.73 minutes; for the RRO group it was 27.83 minutes. History reading time for the PAR group was 29.18 minutes; for the RRO group it was 29.33 minutes. Reading times kept for the RO group showed a mean of 10.79 for the science passage and 10.14 for the history passage.

The interesting aspect of Table 6 is that there are significant differences on three of the four measures listed, and the fourth approaches significance. These differences, however, do not occur in the direction that might have been expected. The control group, RRO, scored significantly higher in text comprehension of history and in language use for both science and history passages than did the experimental group. While these scores are unexpected, they are not entirely inexplicable. First, as Rickards (1980) says, "Experimental manipulations may well represent an artificial situation for a certain proportion
<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>T</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td><strong>Text Comp Sci</strong></td>
<td>5.55</td>
<td>2.61</td>
<td>6.94</td>
<td>1.95</td>
<td>-1.93</td>
<td>.061</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Text Comp Hst</strong></td>
<td>5.95</td>
<td>2.65</td>
<td>8.00</td>
<td>1.68</td>
<td>-2.97</td>
<td>.0053</td>
<td>S</td>
</tr>
<tr>
<td><strong>Lang Use Sci</strong></td>
<td>3.45</td>
<td>2.77</td>
<td>6.28</td>
<td>2.67</td>
<td>-3.27</td>
<td>.0024</td>
<td>S</td>
</tr>
<tr>
<td><strong>Lang Use Hst</strong></td>
<td>4.32</td>
<td>3.39</td>
<td>8.17</td>
<td>2.46</td>
<td>-4.16</td>
<td>.0002</td>
<td>S</td>
</tr>
</tbody>
</table>
of the students involved, thereby leading to artificial results" (p. 6). Armbruster and Anderson (1981) say, "There is some evidence that students who can already study effectively may find training in a new strategy to be more harmful than helpful" (p. 155), and suggest reserving training for those students who do not have effective study techniques.

This second thought suggests that the effects of self-selected study strategies should also be considered in explaining these unexpected results. Of the 18 students in the RRO group, 16 spontaneously selected annotation as the text processing method on the science passage, and 15 used the annotation method on the history text. Although these students were not instructed in the use of annotation prior to the reading for this study, either they had been given instruction in its use at some time prior to taking the study skills practicum, or they had developed the use of annotation on their own as an answer to their reading needs. Since the time spent on the reading by both these groups is virtually identical, these results might, in theory, be used in support of the text annotation method for reading comprehension as enhancing immediate recall.

A third hypothesis which might be used to explain these results concerns the timing of the treatment with the RRO group. The students in this group were given no
explanation for why they were to read and remember the material, but the class had just completed a study unit on memory and memory techniques. If the class members assumed that they were to make use of the memory techniques they had just been taught, the group may have made an extra effort to remember the material in the reading passages. This might be a partial explanation as to why the means for the RRO group are higher than the means for the PAR group. (In fact, the means for the RRO group are higher than for all other groups as study of the comparison tables will show.)

Underlining Training

Questions four and five focus on the comparison of the group trained in a main idea underlining strategy with the control groups which were untrained. These questions ask whether the students trained in underlining (PHR) demonstrate greater reading comprehension than students untrained but writing recalls (RRO) or students untrained and not writing recalls (RO). Table 7 looks at the comparison on immediate retellings between PHR and RRO groups. The RO group, which did not write immediate recalls, will be compared to both groups on delayed recalls in answer to question eight.

As Table 7 indicates, significant differences were found between the PHR group and the RRO group, and again
TABLE 7

Comparison of Immediate Retelling Scores for Underlining (PHR) Versus Control With Recall (RRO)

<table>
<thead>
<tr>
<th></th>
<th>PHR</th>
<th></th>
<th>RRO</th>
<th></th>
<th></th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>T</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>6.15</td>
<td>2.12</td>
<td>6.94</td>
<td>1.95</td>
<td>-1.06</td>
<td>.30</td>
<td>NS</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>5.62</td>
<td>1.89</td>
<td>8.00</td>
<td>1.68</td>
<td>-3.62</td>
<td>.004</td>
<td>S</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>3.38</td>
<td>2.14</td>
<td>6.28</td>
<td>2.67</td>
<td>-3.34</td>
<td>.0024</td>
<td>S</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>5.23</td>
<td>2.42</td>
<td>8.17</td>
<td>2.46</td>
<td>-3.31</td>
<td>.0027</td>
<td>S</td>
</tr>
</tbody>
</table>
the differences indicate that the control group scored significantly higher on three of the four measures analyzed here. While there was no significant difference in the text comprehension for the science reading, scores for text comprehension in history, and for language use in both history and science were significantly higher for the RRO group. In this case, time might be considered as a factor, since the mean time spent by the RRO group for the science reading was 27.83 minutes, 9.45 minutes longer than the mean of 18.38 minutes for the PHR group. The RRO group's history reading time was 29.33 minutes, 9.64 minutes longer than the mean of 19.69 for the PHR group. Again, it may be important to note that the longer time used by the RRO group was probably accounted for by the extensive use by this group of spontaneous annotation, another factor which may deserve some consideration in a comparison of these two groups, at least as it concerns immediate recall. Also, as with the comparison to the PAR group, the RRO group had just completed a memory training unit, which might account for a part of this group's success in recall of the reading passages.

Influence of Recall

Question six addresses the effects of written recalls on comprehension as measured by multiple choice tests. This question asks whether students who are untrained in
the experimental reading procedures, but who write recalls of the information (RRO), demonstrate greater comprehension than students who are also untrained but who do not write recalls of the information (RO).

Since subjects in the RO group did not participate in writing recalls immediately following their reading, initial comprehension was assessed by a multiple choice posttest. The RRO group achieved means of 7.55 for the history posttest and 7.22 for the science posttest. The RO group had means of 6.86 for history and 6.46 for science; these scores, while lower, were not statistically significant when computed in ANOVAs (see Tables 3 and 4).

Genre Differences

Question seven examines whether the four groups differ in the comprehension of information from two different subject areas, in this instance science and history. This question addresses whether students understand and retain information from one area more easily or in more detail than from the other.

A Pearson correlation coefficient of .845 between scores on immediate retellings of science and history indicates a high correlation between retelling scores on those subjects, suggesting that there was little difference in the levels of comprehension for science and history. It is interesting to note, however, that scores in the
language use area of the retelling profile are higher for history than for science in all t test tables. A comparison of mean scores is given in Table 8 for history and for science on immediate retellings for the three groups which wrote immediate retellings.

It is interesting to note that the text-based comprehension mean scores for the three groups vary between history and science in terms of which mean is higher. The PAR group and the RRO group both had higher mean scores in history than in science. The PHR group had higher mean scores in science. In all three groups, however, language use scores were higher for history than for science.

Raters who read science recalls commented on the tendency of students to make lists of pertinent information when writing about the science passages rather than adopt the narrative style common to textbooks. This tendency is reflected in the lower scores for the science retellings, since students are rated in the language domain of the Retelling Profile for fluency, compositional qualities, sense of audience, and mechanics. Use of lists might accomplish for the writer a high score on text-based information, but retellings using lists would not be rated highly in the area of language use.

By contrast, the higher scores in history may suggest that students who retell history passages tend to adopt the
TABLE 8

Comparison of Mean Scores for Immediate Retellings for Annotation (PAR), Underlining (PHR), and Control With Recall (RRO)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th>PHR</th>
<th>RRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text Comp Sci</td>
<td>5.55</td>
<td>6.15</td>
<td>6.28</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>5.95</td>
<td>5.62</td>
<td>8.00</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>3.45</td>
<td>3.38</td>
<td>6.28</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>4.32</td>
<td>5.23</td>
<td>8.17</td>
</tr>
</tbody>
</table>
narrative style of history textbooks. As history is most often written in chronological order, a sequential style, students may be inclined to adopt this style when they retell segments of a history text. The mean scores for history in the language use segment of the Retelling Profile suggest that students find the narrative form of history texts one which is more easily adopted than the topic-oriented style of science texts. Another influence on students' choice of retelling styles for these two texts may have been the inclusion in the science texts of four informational tables. As tables are, themselves, lists of information, their inclusion in the science passage, in opposition to the history passage which had no tables, may have suggested to the students that the use of lists is an appropriate form for the presentation of scientific information.

Prior Knowledge: Immediate Retellings

As was noted above, one of the domains on the Retelling Profile which was not included in the statistical analyses was the domain which looks at reader response. The four items in this domain concern prior knowledge, generalizations based on real-world experiences, individualistic or creative impressions, and affective involvement. Students' scores in this domain were so low for both text types that there seemed little to be gained
from statistical comparisons among the groups. One reason for this may be that the metacognition questionnaire elicited reader response, especially in the area of affective involvement, to the extent that students did not think it necessary to repeat themselves. Another reason may be that the prompts used (Appendix F) asked only for text-based information.

One item in this domain, use of prior knowledge, does deserve some mention. Although scores for use of prior knowledge were quite low, some prior knowledge was indicated on a number of immediate recalls in all four groups. For example, on the science recalls, some subjects mentioned terms (e.g., *periodic table*) and symbols for chemical compounds (e.g., \( \text{H}_2\text{O} \)) which were appropriate to the content, but not mentioned in the text. Interestingly, the prior knowledge was used almost exclusively on the recalls for the science passage. For the PAR group, 11 recalls in science indicated prior knowledge; only 1 history recall made use of that item. For the PHR group, 6 science recalls and 1 history recall used prior knowledge. For the RRO group, prior knowledge was scored on 8 science recalls, and 0 history recalls.

There may be a number of reasons for this difference. The science selection may have made use of such basic information (discussion of chemical elements) that students
who had studied chemistry found difficulty separating what they already knew from what they had read. The history passage (covering the Industrial Revolution) may have been less familiar. A passage more familiar to students (say, something dealing with the American Revolution or the Civil War) may have stimulated more prior knowledge interaction.

The nature of the texts themselves may have been a factor in the use of prior knowledge. It may be that history texts lend themselves more readily to being segmented into self-contained narrative units than do science texts. It may be that science texts rely more on the cumulative and sequential use of knowledge, so that indeed, prior knowledge is more necessary to the reading of science texts.

For whatever reason, prior knowledge was clearly more in evidence in the retellings of the science text than in the retelling of the history text.

Retention

Question eight addresses the issue of retention. This question asks whether groups differ in the amount of information retained four weeks after the initial reading of the text passages, as indicated by information produced on written recalls. All four groups wrote delayed recalls; t tests between the various groups assessed degrees of difference between levels of recall.
Table 9 compares the scores for the delayed recalls of the annotation and underlining groups.

Although there were no significant differences in the delayed recalls between the experimental group using text annotation (PAR) and the experimental group using main idea underlining (PHR) in three of the four areas, it is interesting to note that there is a significant difference between the amount of text-based information recalled from the science passage by the two groups. The group using annotation shows greater retention of information after the four-week delay than does the group using underlining. Differences in recall of the history passage, by contrast, were too small to be significant. It is also interesting to note that in the delayed recalls as well as in the immediate recalls, language use scores for history are higher than for science.

In comparing the delayed retellings for these groups to the immediate retellings (Table 5), it can be observed that all means are lower for both groups. While it is understandable that the means dropped after a four-week delay, a comparison of the amounts of change is interesting. In most cases, the PHR group had greater losses than did the PAR group. As has been noted, these losses were not great enough to account for statistical significance in any area except text-based comprehension of
### TABLE 9
Comparison of Delayed Retelling Scores for Annotation (PAR) and Underlining (PHR)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th>PHR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>3.82</td>
<td>2.15</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>3.00</td>
<td>2.56</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.91</td>
<td>1.97</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>2.77</td>
<td>3.49</td>
</tr>
</tbody>
</table>
science, but the differences in amounts and percentages of loss are displayed in Table 10.

While both groups lost a minimum of almost one-third in all areas, the PHR group lost almost twice as much as the PAR group in the area of text-based comprehension for the science passage. The PHR group lost less than the PAR group, however, in the area of text-based comprehension for history. The loss for the PHR group was also greater than the loss for the PAR group in language use for science recall. Losses for both groups in language use for history were about equal.

Indications from these figures may suggest that underlining is a more successful strategy for history than for science. It may be that science information is retained more readily when students use the annotation method.

Table 11 looks at a comparison of retention rates of the annotation group (PAR) the control with recall group (RRO). The comparison asks whether the group which was trained in annotation (PAR) retained more information after four weeks than the group which was not trained, but was asked to write immediate recalls (PHR).

As Table 11 indicates, there was no significant difference between the experimental text annotation group (PAR) and the control group writing recalls (RRO) on the
### TABLE 10

Amounts and Percentages of Loss From Immediate Retellings to Delayed Retellings for Annotation (PAR) and Underlining (PHR)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th></th>
<th></th>
<th>PHR</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amt.</td>
<td>% Loss</td>
<td>Amt.</td>
<td>% Loss</td>
<td></td>
</tr>
<tr>
<td>Text Comp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sci</td>
<td>1.73</td>
<td>31</td>
<td>3.61</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Text Comp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hst</td>
<td>2.95</td>
<td>49</td>
<td>1.70</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Lang Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sci</td>
<td>1.54</td>
<td>44</td>
<td>2.00</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Lang Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hst</td>
<td>1.55</td>
<td>35</td>
<td>1.77</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 11

Comparison of Delayed Recall Scores for Annotation (PAR) Versus Control With Retelling (PHR)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th></th>
<th>RRO</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>3.82</td>
<td>2.15</td>
<td>3.33</td>
<td>1.78</td>
<td>.78</td>
<td>.44</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>3.00</td>
<td>2.56</td>
<td>5.50</td>
<td>2.26</td>
<td>-3.28</td>
<td>.0023 S</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.91</td>
<td>1.97</td>
<td>3.89</td>
<td>2.47</td>
<td>-2.76</td>
<td>.0096 S</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>2.77</td>
<td>3.49</td>
<td>5.78</td>
<td>3.41</td>
<td>-2.75</td>
<td>.0094 S</td>
</tr>
</tbody>
</table>
first item, text-based comprehension of the science text. However, significant differences exist between the groups in all of the other areas measured. Students in the control group scored higher in delayed recalls of text-based information from the history passage, and displayed better use of language in writing about both passages.

A comparison of mean scores for immediate recalls with mean scores for delayed recalls again shows a predictable drop in the mean scores for the delayed recalls. Table 12 shows the amounts and percentages of loss for the PAR and RRO groups from the immediate recalls to the delayed recalls.

The changes for these two groups, while worth noting, seem to show a smaller range than the changes for the two experimental groups (PAR and PHR). The greatest drop was for the RRO group, which lost 52% on the text-based comprehension of science. In text-based comprehension for history, the RRO group lost close to one-third, while the PAR group lost almost half. Losses in the language use scores are closer. There appears to be a treatment effect for the processing of the text-based information in science, but no such effect for history.

Table 13 compares the group in which students were trained in use of the annotation procedure (PAR) with the
Table 12

Amounts and Percentages of Loss From Immediate Retellings to Delayed Retellings for Annotation (PAR) and Control With Recall (PHR)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th></th>
<th>RRO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amt. Loss</td>
<td>% Loss</td>
<td>Amt. Loss</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>1.73</td>
<td>31</td>
<td>3.61</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>2.95</td>
<td>49</td>
<td>2.50</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.54</td>
<td>44</td>
<td>2.39</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>1.55</td>
<td>35</td>
<td>2.39</td>
</tr>
</tbody>
</table>
TABLE 13

Comparison of Delayed Retelling Scores for Annotation (PAR) Versus Control Without Recall (RO)

<table>
<thead>
<tr>
<th></th>
<th>PAR</th>
<th>RO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>3.82</td>
<td>2.15</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>3.00</td>
<td>2.56</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.91</td>
<td>1.97</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>2.77</td>
<td>3.49</td>
</tr>
</tbody>
</table>
control group without recall (RO), in which students were asked to read passages and remember them. The RO group did not write recalls.

As Table 13 indicates, there are significant differences between the amounts of information remembered by these groups after four weeks. Clearly the group using text annotation recalled much more information than did the group which did not use any writing procedure. This difference may be accounted for in part by the differences in time spent with the material. The PAR group used 27.73 minutes to process the science passage as compared to the RO groups' time of 10.79 minutes, a difference of 16.94 minutes. The PAR group spent 29.18 minutes with the history passage, as compared to the RO groups' time of 10.14 minutes, a difference of 19.04 minutes. Certainly time spent with the material must be considered as a factor in explaining the differences between these groups.

However, the effect of the treatment must also be considered here. As the PAR group had much higher scores than the RO group, the training that the PAR group received in annotation for remembering the information on both texts must be credited, in part, with the superior scores which that group achieved. Retention appears to be positively affected by the use of the annotation procedure as a measure to enhance the reading of texts.
Another factor must also be considered, and that is the effect of writing on remembering. Students in the RO group were told that they might mark or process the material in any way they chose, but most did not indicate any in-depth processing of the passage. Of the 14 students in the group, 4 who read the science passage made no marks on their papers; 6 used some underlining; 4 made some notations in the margins of their papers. On the history passage, 7 made no marks on their papers; 5 used underlining; 2 made fairly extensive marginal notations. Of the 2 who made marginal notations on the history passage, one of those students was the only member of the group to receive a score higher than 2 on any portion of the delayed retelling for history. Scores for this student were 7 for text recall on history and 8 for language use. It is also interesting to note that this student made few notations on the science passage; the science score for this student's delayed retelling was quite low.

The following table, Table 14, makes a comparison of the delayed recall scores of the underlining group (PHR) and the scores of the control group with recall (RRO).

Table 14 indicates little difference between the delayed retelling scores for the experimental group trained in main idea underlining (PHR) and the control group which wrote recalls (RRO). The only significant difference
### TABLE 14

Comparison of Delayed Retelling Scores for Underlining (PHR) Versus Control With Recall (RRO)

<table>
<thead>
<tr>
<th></th>
<th>PHR Mean</th>
<th>PHR SD</th>
<th>RRO Mean</th>
<th>RRO SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text Comp Sci</td>
<td>2.54</td>
<td>1.45</td>
<td>3.33</td>
<td>1.78</td>
<td>-1.37</td>
<td>.18 NS</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>3.92</td>
<td>2.43</td>
<td>5.50</td>
<td>2.26</td>
<td>-1.84</td>
<td>.079 NS</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.38</td>
<td>1.19</td>
<td>3.89</td>
<td>2.47</td>
<td>-3.74</td>
<td>.0010 S</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>3.46</td>
<td>3.23</td>
<td>5.78</td>
<td>3.41</td>
<td>-1.93</td>
<td>.065 NS</td>
</tr>
</tbody>
</table>
occurs in the area of language use in science retellings. The control group had significantly higher scores here. It is interesting to compare these scores with the scores for immediate retellings for these two groups (Table 7). On immediate retellings, the RRO group scored higher than the PHR group on all measures. Significant differences were observed for language use for both science and history texts and for text-based comprehension for history. On the retention measure, while only the language use for science was significant, scores for RRO were higher than for PHR. This means that after four weeks, the RRO group was clearly superior to the PHR group, indicating that the longer time spent with the passages by the RRO group, the extensive spontaneous annotations done by that group, or both, were influential in increasing the scores for the control group. Further, the memory training unit that group received may have had an effect on the recall. Still, it should be noted that, although the scores for text-based comprehension for history and language use for history are not significant, both approach significance.

Table 15 compares the drop in mean scores for the PHR group to the drop in mean scores for the RRO group, based on the differences in scores from the immediate retellings to the delayed retellings.
TABLE 15

Amounts and Percentages of Loss From Immediate Retellings to Delayed Retellings for Underlining (PHR) and Control With Recall (RRO)

<table>
<thead>
<tr>
<th></th>
<th>PHR</th>
<th></th>
<th>RRO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amt.</td>
<td>%</td>
<td>Loss</td>
<td>Amt.</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>3.61</td>
<td>58</td>
<td>3.61</td>
<td>52</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>1.70</td>
<td>30</td>
<td>2.50</td>
<td>31</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>2.00</td>
<td>59</td>
<td>2.39</td>
<td>38</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>1.77</td>
<td>33</td>
<td>2.39</td>
<td>29</td>
</tr>
</tbody>
</table>
A comparison of the drop in mean scores from the immediate recalls to the delayed recalls for these groups shows anticipated losses, when levels of significance are considered. The largest losses, for both groups, occurred in the domain of text-based comprehension for science. Both groups lost about one-third, a loss which seems to be typical, for the text-based comprehension of history. In the only significant area, language use for science, the PHR group lost considerably more than the RRO group. It may be that this greater loss is attributable to the lack of writing done by the PHR group, and to the considerable spontaneous annotation of the RRO group.

Table 16 compares the retention scores of the underlining group (PHR) to the retention scores of the control group without recall (RO).

Table 16 looks at the delayed retelling scores achieved by the experimental group using the main idea underlining procedure (PHR) and the control group which read the passages but did not write recalls (RO). In this comparison, the PHR group showed significantly higher scores in all areas measured. A part of this difference may be accounted for by the longer times the experimental group spent with the material. The PHR group spent a mean of 18.38 minutes with the science passage, as compared with 10.79 minutes for the RO group, a difference
<table>
<thead>
<tr>
<th></th>
<th>PHR</th>
<th></th>
<th>RO</th>
<th></th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>2.54</td>
<td>1.45</td>
<td>.929</td>
<td>.730</td>
<td>-3.60</td>
<td>.0022</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>3.92</td>
<td>2.43</td>
<td>1.43</td>
<td>1.70</td>
<td>-3.07</td>
<td>.0058</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>1.38</td>
<td>1.19</td>
<td>.143</td>
<td>.535</td>
<td>-3.45</td>
<td>.0033</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>3.46</td>
<td>3.23</td>
<td>.64</td>
<td>2.13</td>
<td>-2.65</td>
<td>.015</td>
</tr>
</tbody>
</table>
of 7.59 minutes; for the history passage, the PHR group had a mean of 19.69 minutes, to 10.14 minutes for the RO group, a difference of 9.55 minutes.

That difference which cannot be attributed to time spent with the material, however, may be accounted for by the treatment procedure which required a greater depth of processing by the PHR group. This theory is supported by Armbruster and Anderson (1981) who state that "performance on criterion tasks requiring comprehension and recall is facilitated to the extent that students attend to, interact with, and elaborate on the underlying 'meaning' of the text" (p. 154). It would seem that the PHR procedure required that interaction with text which resulted in greater recall for that group than for the control group.

Table 17 shows significant differences in delayed recalls in all areas between the RO group (control reading but without recall) and the RRO group (control with reading and written recall). A number of factors may account for these differences. As has been noted, the RRO group made extensive use of voluntary annotation in processing the text passages; the RO group used little annotation or underlining in processing the same passages. The effects of the memory training preceding the treatment for the RRO group has been noted; the RO group did not have the memory unit in the same proximity to the reading of the passages.
### TABLE 17

Comparison of Delayed Retelling Scores for Control Without Recall (RO) Versus Control With Recall (RRO)

<table>
<thead>
<tr>
<th></th>
<th>RO</th>
<th>RRO</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Text Comp Sci</td>
<td>.929</td>
<td>.730</td>
<td>3.33</td>
<td>1.78</td>
</tr>
<tr>
<td>Text Comp Hst</td>
<td>1.43</td>
<td>1.70</td>
<td>5.50</td>
<td>2.26</td>
</tr>
<tr>
<td>Lang Use Sci</td>
<td>.143</td>
<td>.535</td>
<td>3.89</td>
<td>2.47</td>
</tr>
<tr>
<td>Lang Use Hst</td>
<td>.64</td>
<td>2.13</td>
<td>5.78</td>
<td>3.41</td>
</tr>
</tbody>
</table>
Time must also be considered as a factor. The RRO group spent a mean time of 27.83 minutes on the science unit, as opposed to the RO group’s 10.79 minutes, a difference of 17.04 minutes. The RRO group spent a mean time of 29.33 minutes on the history passage, as opposed to the RO group’s 10.14 minutes, a difference of 19.19 minutes. However, the final factor which must be considered in comparing these groups is the effect of writing about material read compared to no writing about material read. The RRO group did extensive writing about the material, both in the form of annotations on the reading passages and in written recalls. The RO group did almost no writing. That writing experience must be considered a factor in the significant differences posted for these groups.

Prior Knowledge: Delayed Retellings

The results of the scores for prior knowledge for delayed recalls mirror those same scores for the immediate recalls. For the PAR group, 12 science recalls showed some use of prior knowledge; 1 history recall showed such use. The PHR group had 9 science recalls which made use of prior knowledge, but no history recalls using prior knowledge. Six of the science recalls for the RRO group used prior knowledge; none of the history recalls did so. For the RO group, 4 science recalls and 1 history recall made use of prior knowledge.
Of the 12 science recalls showing use of prior knowledge for the PAR group, 9 were the same students (of 11) who showed use of prior knowledge on the immediate recalls. Of the 9 students using prior knowledge on delayed recalls for the PHR group, the same 6 students who showed use of prior knowledge on immediate recalls also used prior knowledge on the delayed recalls. On the RRO group, only 3 of the 8 students using prior knowledge on immediate recalls were also scored for using it on the delayed recalls.

The persistence of prior knowledge in the recalls of the treatment groups (PAR and PHR), as opposed to the inconsistency of its appearance with the control group which wrote recalls (RRO) may be noteworthy. While it is difficult to account for these results, it may be that the two treatments elicited prior knowledge in the application of the annotation and underlining procedures, while the RRO group, which was not taught a systematic strategy, did not make consistent use of prior knowledge.

Summary of the Findings

Question one asked whether students who are trained in a reading-writing text annotation procedure demonstrate greater comprehension than students who are trained in underlining main idea passages (annotation versus underlining). Results of the data analysis indicate that
there is little or no difference between these groups in comprehension. No significant differences were found between the groups on either the multiple choice measure or the immediate retelling scores.

Question two asked whether students trained in a reading-writing text annotation procedure demonstrate greater comprehension than students who are not trained but who are asked to read, remember, and write recalls of the same passages (annotation versus control with recall). Results of the data analysis indicated little difference between the groups on the multiple choice measure, but significant differences between the groups on the immediate retelling measure. The group not trained but writing recalls (RRO) scored higher than the group trained in annotation of text in all areas measured except text-based comprehension of science.

Question three asked whether students trained in a reading-writing text annotation procedure demonstrate greater comprehension than students not trained but asked to read and remember the same passages (annotation versus control without recall). The multiple choice measure, the only comparison of these procedures, indicated no statistically significant differences in comprehension.

Question four asked whether students trained in underlining main idea passages demonstrate greater
comprehension than students who are not trained but who are asked to read, remember, and write recalls of the same passages (underlining versus control with recall). Statistical analyses indicated that the group asked to read, remember, and write recalls of the information (RRO) scored significantly higher than the group using the underlining procedure (PHR) in all areas except text-based comprehension of the science text.

Question five asked whether students who are trained in underlining main idea passages demonstrate greater comprehension than students who are not trained but who are asked to read and remember the same passages (underlining versus control without recall). Analyses of multiple choice test scores for both groups indicate no statistically significant differences between the groups.

Question six asked whether students who are not trained but who are asked to write recalls of the information they have read demonstrate greater comprehension than students who are not trained but who do not write recalls of the information (control with recall versus control without recall). Analyses of the multiple choice measure indicate no statistically significant differences in comprehension between the groups.

Question seven asked whether there were differences between scores for the history passage and the science
passages as measured by multiple choice tests, immediate retellings, and delayed retellings for the four groups (annotation, underlining, control with recall, control without recall). Analyses of the multiple choice tests indicated no significant differences, and a Pearson correlation coefficient of the immediate retellings indicated a strong correlation between scores on the immediate retellings for science and for history. A comparison of mean scores for immediate retellings showed that language use scores for history were higher for all groups than language use scores for science. This same trend was consistent with the language use scores in the delayed retellings.

Question eight asked whether there were differences in retention as measured by delayed retellings among the four groups (annotation, underlining, control with recall, control without recall). A comparison of the PAR (annotation) and PHR (underlining) groups showed that the only area which had significant differences was in recall of text-based information in science. A comparison of the PAR (annotation) group with the RRO (control with recall) group showed that the RRO group scored significantly higher than the PAR group in all areas except recall of text-based information in science. The PAR (annotation) group scored significantly higher than the RO (control without recall)
in all areas. The comparison between the PHR (underlining) group and the RRO (control with recall) group indicated no significant differences in any area except language use in science. The PHR (underlining) group, when compared to the RO group (control without recall), scored significantly higher in all areas. Finally, the RRO group (control with recall) group scored significantly higher in all areas than did the RO (control without recall) group.

Discussion
The findings of this study may be accounted for by examining several facets relating to the treatment groups and the control groups.

First, there were significant treatment effects for both the annotation (PAR) group and the underlining (PHR) group when compared to the control group without recall (RO). Both groups' scores indicated that use of the strategies taught in the treatment is better than reading with no application of such strategies. Since the control group with recall scored significantly better than the RO group, it may be that writing recalls provides the depth of processing which is also afforded by the treatment procedures.

Second, the question of time spent with the reading passages must be considered in looking at the results of the study. Since the group which was least successful in
writing recalls of the information (the RO group) was also the group which spent the smallest amount of time with the readings, that factor cannot be ignored in these findings. On the other hand, it must be noted as well that the RO group had available the same amount of time as the RRO group which was the most successful of the groups being observed.

Time cannot fully account for the success of the RRO group, either. Mean times for the PAR group and for the RRO group were almost equal, yet the RRO group had significantly higher scores than the PAR group in most areas analyzed. Again, the cautions noted by Armbruster and Anderson (1981) and Rickards (1980) must be mentioned. Students who have effective study strategies may be deterred from their best use if they are required to use a new method. The voluntary choice of the annotation procedure by the RRO group and the subsequent high scores of that group seem a validation of the procedure's usefulness when students choose to use that as a most effective method.

Additionally, it should be noted that those students in the RRO group who chose to use the annotation procedure may have done so because this was a method that they had used before to good advantage. The students who were trained in the procedure may well have been neophytes who
were just learning the annotation method. It is to be expected that when students choose a method for study that they have used with some proficiency before, they will be better at using it than students attempting that method for the first time.

The RRO group's treatment, juxtaposed to that group's memory training has been commented on above. There is reason to believe that this juxtaposition accounts, in part, for this group's superior performance. Reference to "mnemonic devices" in the metacognition questionnaires lends support to this hypothesis.

Scores of the PHR group support the theory that training students in effective underlining procedures can be helpful in offering students efficient methods for processing texts. Although there were some indications that the annotation procedure is more effective for retention, the underlining method seems to offer a way of processing text that is faster and almost as effective in the short term. For the long term, particularly with the science texts, annotation appears to be the better choice.
CHAPTER 5
SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this chapter is to present a summary of
(1) the research problem, (2) the related literature,
(3) the research design, and (4) the data analysis.
Additionally, this chapter will consider conclusions and
implications for practice and further research.

The Research Problem

The problem outlined in this study was to determine
whether the use of training procedures in text annotation
and underlining would result in greater comprehension and
retention of text information for students using those
strategies. The research questions addressed in this study
were as follows:

1. Do students who are trained in a reading-
writing text annotation procedure
demonstrate greater comprehension than
students who are trained in underlining main
idea passages (annotation versus
underlining)?

2. Do students who are trained in a reading-
writing text annotation procedure
demonstrate greater comprehension than
students who are not trained but who are asked to read, remember, and write recalls of the same passages (annotation versus control with recall)?

3. Do students who are trained in a reading-writing text annotation procedure demonstrate greater comprehension than students who are not trained but who are asked to read and remember the same passages (annotation versus control without recall)?

4. Do students who are trained in underlining main idea passages demonstrate greater comprehension and retention than students who are not trained but who are asked to read, remember, and write recalls of the same passages (underlining versus control with recall)?

5. Do students who are trained in underlining main idea passages demonstrate greater comprehension than students who are not trained but who are asked to read and remember the same passages (underlining versus control without recall)?

6. Do students who are not trained but who are asked to write recalls of the information
they have read demonstrate greater comprehension than students who are not trained and who do not write recalls of the information they have read (control with recall versus control without recall)?

7. Are there differences between scores for the history passage and the science passage as measured by multiple choice texts, immediate retellings, and delayed retellings among the four groups (annotation, underlining, control with recall, and control without recall)?

8. Are there differences in retention as measured by delayed retellings among the four groups (annotation, underlining, control with recall, control without recall)?

Related Literature

Literature relevant to this study was reviewed in three areas: metacognition, reading/writing connections, and study strategies.

Metacognition is defined as the knowledge which students have about their thinking and learning processes, and the control which they are able to exert over those processes (Baker & Brown, 1984; Cross & Paris, 1988;
Flavell, 1978; Palincsar, 1986; Paris & Myers, 1981). Metacognitive theory has been researched in the two broad areas of reading comprehension and reading for remembering (studying), according to Baker and Brown (1984), and studies which are related to both those areas were reviewed. Research in the area of reading comprehension supports the practice of teaching poor readers to use the strategies common to good readers, and of teaching good readers the conscious use of those strategies they may be using without being aware of so doing. Reading for remembering (studying) recognizes the necessity for having students make conscious use of strategies to attain desired goals, including how to study and how to recognize when they have learned what they wish to learn (Baker & Brown, 1984; Wade & Reynolds, 1989).

The review of literature in the reading/writing connection was based on models delineated by Sternglass (1987), who described three bases for connecting reading and writing: parallel processes, interactive processes, and transactional processes. The parallel process model demonstrates ways reading and writing are similar by looking at frameworks designed by such researchers as Aulls (1985) and Trotsky and Wood (1982). The interactive model, which includes summary writing, has strong support from such researchers as Doctorow, Wittrock, and Marks (1978),

Studying has been defined by Baker and Brown (1984) as "reading for remembering" (p. 367), and Anderson and Armbruster (1981) say that studying is associated with the requirement for the performance of identifiable tasks. Influences on students' choice of study techniques have to do with such factors as the efficiency of the study method (Nist & Simpson, 1988; Paris, Lipson, & Wixon, 1983) and perceived depth of processing (Armbruster & Anderson, 1981). Depth of processing determines whether students are actively encoding information in ways which will enable them to retain the information. The three components of the study skills addressed by this study are underlining, annotation (referred to in most of the literature under the category of notetaking), and summarizing.

Studies of the use of underlining show mixed results. Several studies cite the von Restorff effect (Fowler &
Barker, 1974; McAndrew, 1983; Nist & Hogrebe, 1987) which says that any information isolated against a homogenous background is more easily remembered than other information. The von Restorff effect helps account for students' remembering more of what is underlined that what is not underlined. While studies show that students remember more of what is underlined, whether they do the underlining themselves or whether it is done for them (Fowler & Barker, 1974; Hartley, Bartlett, & Branthwaite, 1980; Nist & Hogrebe, 1987), the key to whether underlining is effective lies in whether what is underlined is important to remember (Rickards & August, 1975). Underlining of irrelevant information may be detrimental to students' learning.

A number of studies have looked at notetaking as a method of learning material. (Notetaking, as differentiated from annotation, denotes any method of taking notes from written texts; annotation refers to the use of marginal notes made while reading the text.) The results of studies of notetaking as a study strategy are mixed. Hoon (1974) found notetaking no more effective than underlining. Nist and Simpson (1988) found annotation to be an effective study strategy, offering students greater depth of processing with less study time required than was necessary when students used underlining. Bretzing and
Kulhavy (1979), in looking at four levels of notetaking from shallow to deep, found that students who used the deepest levels of processing recalled significantly more information than did students who used shallow methods. Rickards and Friedman (1978) suggest that the act of notetaking may help students remember material by making use of the encoding process involved in translating material into the students' own words.

Summarization, a technique which has been little researched as a study method, is used best by those students who are instructed in how to produce summaries and in cases in which the requirements of the task use the processing called for in summary writing (Anderson & Armbruster, 1984). Rinehart, Stahl, and Erickson (1986) used summarization training with sixth graders and found that the training improved the students' recall significantly over that of the control group. Simpson, Stahl, and Hayes (1989) have incorporated summarization into the PORPE strategy (PORPE is an acronym for Predict, Organize, Rehearse, Practice, and Evaluate) in order to help students learn to prepare for essay tests. They found that a side effect of the use of the PORPE strategy was that their students also did better than the control group on multiple choice tests. This same finding had been noted as early as 1936 by Meyer, who found that students who used
summary statements in preparing for essay exams also did better on objective tests.

Research Design

This study was designed to use four groups for observation, two treatment groups and two control groups. The four groups were four classes of a study skills practicum. Three of the classes were taught by the researcher, and the control group without recall (RO) was taught by another instructor. When the study began, 96 students were involved, but 29 students were dropped as the study proceeded, leaving a total of 67 subjects in the study.

Students were to read and process a science passage and a history passage on two separate occasions, and they were tested on their comprehension and retention to determine whether there were differences among the groups.

The four groups in the study were divided as follows: One group (PAR) was taught a method of reading text in which students read the material and annotated, or summarized, the material in their own words. A second group (PHR) was taught to underline or highlight main ideas in each paragraph of their reading passages. A third group (RRO) was not taught a procedure, but students were instructed to use whatever method of reading and remembering text they ordinarily used. All three groups
wrote recalls of the information immediately following their readings. A fourth group (RO) read the same passages and was allowed to process them in any customary way, but did not write recalls of the information. All groups were given metacognition questionnaires. All groups were given multiple choice pretests and posttests. All groups wrote delayed recalls after four weeks' time.

Results of multiple choice pretests and posttests were analyzed by use of ANOVAs. Results of immediate and delayed recalls were scored by use of the Mitchell-Irwin Retelling Profile (1990) and were analyzed by t tests to compare group scores.

Findings of the Study

Analysis of the data for this study showed the following results:

1. No significant differences were found on comprehension measures between the annotation group (PAR) and the underlining group (PHR). Neither the multiple choice measure nor the analysis of immediate retellings indicated significant differences.

2. Significant differences were found between the PAR group and the control group with recall (RRO) on three of the four measures
of the immediate recall which were analyzed. On three of the four measures, the RRO group scored higher. Only text-based comprehension on the science recalls were not significant. No significant differences were found on the multiple choice measures.

3. No significant differences between the PAR group and the control group without recall (RO) were found on the multiple choice measures.

4. Significant differences were found between the PHR group and the RRO group on three of the four immediate recall analyses. Only the analysis of text-based comprehension of science was not significant. On all other measures, the RRO group scored higher. The multiple choice measures were not significant.

5. No significant differences were found between the PHR group and the RO group on the multiple choice measures of comprehension.

6. No significant differences were found between the RRO group and the RO group on
the multiple choice measures of comprehension.

7. No significant differences were found between the comprehension of the science passages and the history passages, although it was noted that mean scores for language use were consistently higher for the history recalls than for the science recalls.

8. The delayed recalls which served as a measure of retention revealed several areas of significant difference. Between the PAR group and the PHR group, there were significant differences in the area of text-based comprehension for science, the area in which the PAR group had higher scores. Text-based comprehension for science was the only non-significant area in a comparison of the PAR group and the RRO group. All other areas showed significantly higher scores for the RRO group. All areas of comparison between the PAR group and the RO group were significantly higher for the PAR group. The PHR group, as compared to the RRO group for retention, was not significantly different in any area except language use for science,
an area in which the RRO group had higher scores. The PHR group was significantly higher in all areas than the RO group in retention. Finally, the RRO group was significantly higher in all areas than the RO group for retention.

Conclusions

1. When students are taught to annotate their texts and to underline main ideas, there may be little difference in the results in terms of immediate recall, but students may have better retention of material in science when they use the annotation procedure.

2. Students who write about the material they are attempting to learn are likely to have higher rates of comprehension and higher rates of recall than students who read the material but do not attempt to write about it.

3. Students who write about material tend to have lower rates of loss on delayed recalls than those who do not; loss of information for those who do not write tends to be greater for science recalls than for history recalls.
4. Use of prior knowledge in recalls is more evident in science recalls than in history recalls; language use scores tend to be higher for history recalls than for science recalls.

5. Students who select text processing strategies which have proved to be successful for them in the past may have greater success than students who are encouraged to adopt unneeded new strategies.

6. Students who are instructed in selection of main idea underlining techniques may have higher rates of comprehension and retention than students who underline randomly.

Implications for Practice

1. Students who are not currently using some form of writing to supplement their reading procedures should be taught methods for combining the two practices. Clearly the combined use of reading and writing provides superior comprehension and retention to the use of reading alone.

2. When students are being instructed in underlining procedures, it may be best to teach them that strategic underlining--
underlining of main ideas only—is the most helpful process to use in underlining.

3. Students should be taught to use new methods primarily in those cases in which their own study strategies are ineffective. If their own methods work well, it may be best to advise them to continue what they are currently practicing.

Implications for Research

1. The superior scores of the RRO group in this study suggest that a study designed specifically to compare students' self-selected study methods with the experimental annotation and underlining methods might be appropriate.

2. In this study, it was impossible to separate the results of the writing of recalls from the results of the two experimental methods. A study replicating this one, but adding an annotation group without recall and an underlining group without recall would be likely to provide more information regarding the effects of the recalls.

3. A study which separated the RRO group from the effects of the memory training might
provide more accurate data regarding the specific effects of recall.

4. Most students found the texts used in this study to be easily comprehended. A study using more difficult texts might provide more specific information about the uses of comprehension and retention techniques.

5. A study which used genres other than history and science might provide more information about the uses of annotation and underlining with different kinds of texts.

6. Most of the students in this study were traditional, college-age students. A study which considered different age groups might provide additional information.

7. Students in this study were enrolled at a university which applies selective admission standards. A study like this one which treated a different population, for instance, community college students, might achieve different findings.

8. A comparison of a student population enrolled in study skills courses to a population not enrolled in study skills courses might be considered.
9. A study which looked at the use of different kinds of writing in conjunction with reading (for example, notetaking from texts, which did not involve marginal annotations) might also offer more insights into the uses of writing to learn.
Elements and Compounds

After studying Chapter 4, you should be able to:

1. Understand the new terms listed in Question A at the end of the chapter.
2. List in order of abundance the five most abundant elements in the earth's crust, seawater, and atmosphere.
3. List in order of abundance the six most abundant elements in the human body.
4. Classify common materials as elements, compounds, or mixtures.
5. Write the symbols when given the names or write the names when given the symbols of the common elements listed in Table 4.3.
7. Understand how symbols, including subscripts and parentheses, are used to write chemical formulas.
8. Differentiate among atoms, molecules, and ions.
9. List the characteristics of metals and nonmetals.
10. Name binary compounds from their formulas.
11. Balance simple chemical equations when the formulas are given.
12. List the elements that occur as diatomic molecules.

Elements

All the words in the English dictionary are formed from an alphabet consisting of only 26 letters. All known substances on earth—and most probably in the
4.2 Distribution of Elements

universe, too—are formed from a sort of “chemical alphabet” consisting of 108 presently known elements. An element is a fundamental or elementary substance that cannot be broken down by chemical means to simpler substances. Elements are the building blocks of all substances. The elements are numbered in order of increasing complexity beginning with hydrogen, number 1. Of the first 92 elements, 88 are known to occur in nature. The other four—technetium (43), promethium (61), astatine (85), and francium (87)—either do not occur in nature or have only transitory existences during radioactive decay. With the exception of number 94, plutonium, elements above number 92 are not known to occur naturally but have been synthesized, usually in very small quantities, in laboratories. The discovery of trace amounts of element 94 (plutonium) in nature has been reported recently. The syntheses of elements 107 and 109 were reported in 1981 and 1982; element 108 has not been reported. No elements other than those on the earth have been detected on other bodies in the universe.

Most substances can be decomposed into two or more simpler substances. We have seen that mercury(II) oxide can be decomposed into mercury and oxygen and that water can be decomposed into hydrogen and oxygen. Sugar can be decomposed into carbon, hydrogen, and oxygen. Table salt is easily decomposed into sodium and chlorine. An element, however, cannot be decomposed into simpler substances by ordinary chemical changes.

If we could take a small piece of an element, say copper, and divide it and subdivide it into smaller and smaller particles, we finally would come to a single unit of copper that we could no longer divide and still have copper. This ultimate particle, the smallest particle of an element that can exist, is called an atom. An atom is also the smallest unit of an element that can enter into a chemical reaction. Atoms are made up of still smaller subatomic particles. But these subatomic particles (described in Chapter 5) do not have the properties of elements.

Distribution of Elements

Elements are distributed very unequally in nature. At normal room temperature two of the elements, bromine and mercury, are liquids; eleven elements, hydrogen, nitrogen, oxygen, fluorine, chlorine, helium, neon, argon, krypton, xenon, and radon, are gases; all the other elements are solids.

Ten elements make up about 99% of the weight of the earth’s crust, seawater, and atmosphere. Oxygen, the most abundant of these, constitutes about 50% of this mass. The distribution of the elements shown in Table 4.1 includes the earth’s crust to a depth of about 10 miles, the oceans, fresh water, and the atmosphere but does not include the mantle and core of the earth, which are believed to consist of metallic iron and nickel. Because the atmosphere contains relatively little matter, its inclusion has almost no effect on the distribution shown in Table 4.1. But the inclusion of fresh and salt water does have an appreciable effect since water contains about 11.1% hydrogen. Nearly all of the 0.87% hydrogen shown is from water.
4 Elements and Compounds

Table 4.1 Distribution of the elements in the earth's crust, seawater, and atmosphere

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight percent</th>
<th>Element</th>
<th>Weight percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>49.20</td>
<td>Chlorine</td>
<td>0.19</td>
</tr>
<tr>
<td>Silicon</td>
<td>25.67</td>
<td>Phosphorus</td>
<td>0.11</td>
</tr>
<tr>
<td>Aluminum</td>
<td>7.50</td>
<td>Manganese</td>
<td>0.09</td>
</tr>
<tr>
<td>Iron</td>
<td>4.71</td>
<td>Carbon</td>
<td>0.08</td>
</tr>
<tr>
<td>Calcium</td>
<td>3.39</td>
<td>Sulfur</td>
<td>0.06</td>
</tr>
<tr>
<td>Sodium</td>
<td>2.63</td>
<td>Barium</td>
<td>0.04</td>
</tr>
<tr>
<td>Potassium</td>
<td>2.40</td>
<td>Nitrogen</td>
<td>0.03</td>
</tr>
<tr>
<td>Magnesium</td>
<td>1.93</td>
<td>Fluorine</td>
<td>0.03</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0.87</td>
<td>All others</td>
<td>0.47</td>
</tr>
<tr>
<td>Titanium</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2 Average elemental composition of the human body

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>65.0</td>
</tr>
<tr>
<td>Carbon</td>
<td>18.0</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>10.0</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>3.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>2.0</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1.0</td>
</tr>
<tr>
<td>Traces of several other elements</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The average distribution of the elements in the human body is shown in Table 4.2. Note again the high percentage of oxygen.

Names of the Elements

The names of the elements came to us from various sources. Many are derived from early Greek, Latin, or German words that generally described some property of the element. For example, iodine is taken from the Greek word iodes, meaning violetlike. Iodine, indeed, is violet in the vapor state. The name of the metal bismuth had its origin from the German words weisse masse, which means white mass. Miners called it wismat; it was later changed to bismat, and finally to bismuth. Some elements are named for the location of their discovery—for example, germanium, discovered in 1886 by Winkler, a German chemist. Others are named in commemoration of famous scientists, such as einsteinium and curium, named for Albert Einstein and Marie Curie, respectively.
4.4 Symbols of the Elements

Symbols of the Elements

We all recognize Mr., N. Y., and Ave. as abbreviations for mister, New York, and avenue. In like manner, chemists have assigned an abbreviation to each element; these are called symbols of the elements. Fourteen of the elements have a single letter as their symbol, five have three-letter symbols, and the rest have two letters. A symbol stands for the element itself, for one atom of the element, and (as we shall see later) for a particular quantity of the element.

Rules governing symbols of elements are as follows:

1. Symbols are composed of one, two, or three letters.
2. If one letter is used, it is capitalized.
3. If two or three letters are used, the first is capitalized and the others are lowercase letters.

Examples: Sulfur S Barium Ba

The symbols and names of all the elements are given in the table on the inside back cover of this book. Table 4.3 lists the more commonly used symbols. If we examine this table carefully, we note that most of the symbols start with the same letter as the name of the element that is represented. A number of symbols, however, appear to have no connection with the names of the elements they represent (see Table 4.4). These symbols have been carried over from earlier names (usually in Latin) of the elements and are so firmly implanted in the literature that their use is continued today.

Special care must be used in writing symbols. Begin each with a capital letter and use a lowercase second letter if needed. For example, consider Co, the symbol for the element cobalt. If through error CO (capital C and capital O) is

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Element</th>
<th>Symbol</th>
<th>Element</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>Al</td>
<td>Fluorine</td>
<td>F</td>
<td>Phosphorus</td>
<td>P</td>
</tr>
<tr>
<td>Antimony</td>
<td>Sb</td>
<td>Gold</td>
<td>Au</td>
<td>Platinum</td>
<td>Pt</td>
</tr>
<tr>
<td>Argon</td>
<td>Ar</td>
<td>Helium</td>
<td>He</td>
<td>Potassium</td>
<td>K</td>
</tr>
<tr>
<td>Arsenic</td>
<td>As</td>
<td>Hydrogen</td>
<td>H</td>
<td>Radium</td>
<td>Ra</td>
</tr>
<tr>
<td>Barium</td>
<td>Ba</td>
<td>Iodine</td>
<td>I</td>
<td>Silicon</td>
<td>Si</td>
</tr>
<tr>
<td>Bismuth</td>
<td>Bi</td>
<td>Iron</td>
<td>Fe</td>
<td>Silver</td>
<td>Ag</td>
</tr>
<tr>
<td>Boron</td>
<td>B</td>
<td>Lead</td>
<td>Pb</td>
<td>Sodium</td>
<td>Na</td>
</tr>
<tr>
<td>Bromine</td>
<td>Br</td>
<td>Lithium</td>
<td>Li</td>
<td>Strontium</td>
<td>Sr</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Cd</td>
<td>Magnesium</td>
<td>Mg</td>
<td>Sulfur</td>
<td>S</td>
</tr>
<tr>
<td>Calcium</td>
<td>Ca</td>
<td>Manganese</td>
<td>Mn</td>
<td>Tin</td>
<td>Sn</td>
</tr>
<tr>
<td>Carbon</td>
<td>C</td>
<td>Mercury</td>
<td>Hg</td>
<td>Titanium</td>
<td>Ti</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl</td>
<td>Neon</td>
<td>Ne</td>
<td>Tungsten</td>
<td>W</td>
</tr>
<tr>
<td>Chromium</td>
<td>Cr</td>
<td>Nickel</td>
<td>Ni</td>
<td>Uranium</td>
<td>U</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Co</td>
<td>Nitrogen</td>
<td>N</td>
<td>Zinc</td>
<td>Zn</td>
</tr>
<tr>
<td>Copper</td>
<td>Cu</td>
<td>Oxygen</td>
<td>O</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4 Elements and Compounds

Table 4.4 Symbols of the elements derived from early names: These symbols are in use today even though they do not correspond to the current name of the element.

<table>
<thead>
<tr>
<th>Present name</th>
<th>Symbol</th>
<th>Former name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>Sb</td>
<td>Stibium</td>
</tr>
<tr>
<td>Copper</td>
<td>Cu</td>
<td>Cuprum</td>
</tr>
<tr>
<td>Gold</td>
<td>Au</td>
<td>Aurum</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe</td>
<td>Ferrum</td>
</tr>
<tr>
<td>Lead</td>
<td>Pb</td>
<td>Plumbum</td>
</tr>
<tr>
<td>Mercury</td>
<td>Hg</td>
<td>Hydrargyrum</td>
</tr>
<tr>
<td>Potassium</td>
<td>K</td>
<td>Kalium</td>
</tr>
<tr>
<td>Silver</td>
<td>Ag</td>
<td>Argentum</td>
</tr>
<tr>
<td>Sodium</td>
<td>Na</td>
<td>Natrium</td>
</tr>
<tr>
<td>Tin</td>
<td>Sn</td>
<td>Stannum</td>
</tr>
<tr>
<td>Tungsten</td>
<td>W</td>
<td>Wolfram</td>
</tr>
</tbody>
</table>

written, the two elements carbon and oxygen (the formula for carbon monoxide) are represented instead of the single element cobalt. Another example of the need for care in writing symbols is the symbol Ca for calcium versus Co for cobalt. The letters must be distinct or else the symbol for the element may be misinterpreted.

Knowledge of symbols is essential for writing chemical formulas and equations. You should begin to learn the symbols immediately because they will be used extensively in the remainder of this book and in any future chemistry courses you may take. One way to learn the symbols is to practice a few minutes a day by making side-by-side lists of names and symbols and then covering each list alternately and writing the corresponding name or symbol. Initially it is a good plan to learn the symbols of the most common elements shown in Table 4.3.

The experiments of alchemists paved the way for the development of chemistry. Alchemists surrounded their work with mysticism, partly by devising a system of symbols known only to practitioners of alchemy (see Figure 4.1). The symbol R (from the Latin recipe) is still used in medicine and was established during this time. In the early 1800s the Swedish chemist J. J. Berzelius (1779–1848) made a great contribution to chemistry by devising the present system of symbols using letters of the alphabet.

![Figure 4.1 Some typical alchemists' symbols](image-url)
APPENDIX B
HISTORY READING PASSAGE

Shaping the National Economy, 1790–1860

The progress of invention is really a threat [to monarchy]. Whenever I see a railroad I look for a republic.

RALPH WALDO EMERSON, 1866

The March of Mechanization

A gifted group of British inventors, beginning about 1750, perfected a series of machines for the mass production of textiles. This enslavement of steam multiplied the power of man’s muscles some ten thousandfold, and ushered in the modern factory system.

The so-called Industrial Revolution has been misnamed. It was not a revolution in the sense of an overnight change or upheaval. The machines developed in England were gradually improved over several decades, and the people there were scarcely aware that a significant shift was taking place. Nor was the Industrial Revolution solely industrial. It was accompanied by a no less spectacular transformation in the methods of transportation and communication.

The factory system gradually spread from England—“the world’s workshop”—to other lands. It took a generation or so to reach western Europe, and then the United States. Why was the youthful American Republic, destined to be an industrial giant, so slow to embrace the machine?
For one thing, virgin soil in America was cheap. Land-starved descendants of land-starved peasants were not going to coop themselves up in smelly factories when they might till their own acres in God's fresh air and sunlight. Labor was therefore generally scarce, and enough nimble hands to operate the machines were hard to find. Money for capital investment, moreover, was not plentiful in pioneering America. Raw materials lay undeveloped, undiscovered, or unsuspected. The Republic was one day to become the world's leading coal producer, but much of the coal burned in colonial times was imported all the way from England.

Just as labor was scarce, so were consumers. The young country at first lacked a domestic market large enough to make factory-scale manufacturing profitable.

Long-established British factories, which provided cutthroat competition, posed another problem. Their superiority was attested by the fact that a few unscrupulous Yankee manufacturers, out to make a dishonest dollar, learned to stamp their own products with faked English trademarks.

The British also enjoyed a monopoly of the textile machinery, whose secrets they were anxious to hide from foreign competitors. Parliament enacted laws, in harmony with the mercantilistic system, forbidding the export of the machines, or the emigration of mechanics able to reproduce them.

Despite all these drawbacks, a surprising amount of small-scale manufacturing existed when the Republic was launched. As early as 1791, Alexander Hamilton reported that the wheels of seventeen different kinds of enterprises were humming. Yet the future industrial colossus was still snoring. Not until well past the middle of the next century did the value of the output of the factories exceed that of the farms.

**Whitney Ends the Fiber Famine**

Samuel Slater has been acclaimed the “Father of the Factory System” in America, and seldom can the paternity of a movement more properly be ascribed to one person. A skilled British mechanic of twenty-one, he was attracted by bounties being offered to English workmen familiar with the textile machines. After memorizing the plans for the
machinery, he escaped in disguise to America, where he won the backing of Moses Brown, a Quaker capitalist in Rhode Island. Laboriously reconstructing the essential apparatus with the aid of a blacksmith and a carpenter, he put into operation in 1791 the first efficient American machinery for the spinning of cotton thread.

The ravenous mechanism was now ready, but where was the cotton fiber? Handpicking 1 pound (0.45 kilogram) of lint from 3 pounds (1.36 kilograms) of seed was a full day's work for one slave, and this process was so expensive that cotton cloth was relatively rare. In 1785 eight bales of cotton were seized for fraudulent entry at Liverpool, England. The officials charged that so much cotton could not have been produced in America.

Another mechanical genius, Massachusetts-born Eli Whitney, now made his mark. After graduating from Yale College, he journeyed to Georgia to serve as a private tutor while preparing for the law. There he was told that the poverty of the South would be relieved if someone could only invent a workable device for separating the seed from the short-staple cotton fiber. Within ten days, in 1793, he constructed a crude machine which was fifty times more effective than the handpicking process. The cotton gin (short for engine) was so simple that rivals infringed on his patent, and he was to net only relatively small profits from this particular brainchild.

Few machines have ever wrought so wondrous a change. The gin affected not only the history of America but that of the world. Almost overnight the raising of cotton became highly profitable, and the South was tied hand and foot to the throne of King Cotton. Human bondage had been dying out, but the insatiable demand for cotton riveted the chains on the limbs of the luckless Southern blacks.

South and North both prospered. Slave-driving planters cleared more acres for cotton, pushing the Cotton Kingdom westward off the depleted tidewater plains, over the Piedmont, and onto the black loam bottomlands of Alabama and Mississippi. Humming gins poured out avalanches of snowy fiber for the spindles of the Yankee ma-
The American phase of the Industrial Revolution, which first blossomed in cotton textiles, was well on its way. Yet many decades were to pass before the old-fashioned spinning wheel was driven into the attic, and from there into the antique shops.

Early textile factories merely spun the fiber into cotton thread. The actual weaving into cloth was done laboriously by hand in the home or by contract weavers. Not until 1814, at Waltham, Massachusetts, was the first dual-purpose plant established: it spun the fiber and wove the finished cloth under the same roof. Water power and steam power were gradually supplanting mother-and-daughter power.

Factories at first flourished most actively in New England, though branching out into the more populous areas of New York, New Jersey, and Pennsylvania. The South, increasingly wedded to the production of cotton, could boast of comparatively little manufacturing. Its capital was bound up in slaves; its local consumers for the most part were desperately poor.

New England was singularly favored as an industrial center for several reasons. Her narrow belt of stony soil discouraged farming and hence made manufacturing more attractive than elsewhere. A relatively dense population provided labor; shipping brought in capital; and snug seaports made easy the import of raw materials and the export of the finished products. Finally, the rapid rivers—notably the Merrimack in Massachusetts—provided abundant water power to turn the cogs of the machines. By 1860, more than 400 million pounds (182,000 metric tons) of Southern cotton poured annually into the gaping maws of over 1,000 mills, mostly in New England.
APPENDIX C
MULTIPLE CHOICE TEST OF PRIOR KNOWLEDGE

QUIZ

1. The Industrial Revolution was called that because
   a. it was a sudden, revolutionary change in manufacturing methods.
   b. it was a gradual, but revolutionary change in manufacturing methods.
   c. the change was slow, but awareness of change was instant.
   d. England's place as foremost manufacturer in the world was overthrown quite suddenly.

2. Plan to spend the following study time for each hour you're in class:
   a. 1 hour
   b. 2 hours
   c. 3 hours
   d. none of the above

3. If we study hard or boring subjects first,
   a. we get them out of the way.
   b. we study them when we're fresh.
   c. we feel better about our other studies.
   d. all of the above.

4. Alchemists paved the way for modern chemistry
   a. by developing a system of symbols.
   b. through their experiments.
   c. through their development of the alphabet.
   d. all of the above.

5. The "Father of the Factory System" in America was
   a. Moses Brown
   b. Eli Whitney
   c. Alexander Hamilton
   d. Samuel Slater

6. The industry to launch the Industrial Revolution was
   a. the coal industry.
   b. the textile industry.
   c. the furniture industry.
   d. the shoe industry.

7. The symbols for elements are written as
   a. a single letter.
   b. two letters.
   c. three letters.
   d. all of the above.

8. When you're scheduling study sessions, it's best to schedule
   a. very long blocks of time--8 to 9 hours.
   b. very short blocks of time--30-40 minutes.
   c. moderate blocks of time--2-3 hours.
   d. Don't bother scheduling; just study when you can.
9. Because of his invention of the cotton gin, Eli Whitney can be said to have been
   a. responsible for the industrialization of the South.
   b. responsible for the growth of slavery.
   c. an incredibly wealthy individual.
   d. only mildly influential.

10. Which of the following is not a correctly written symbol of a single element?
    a. F
    b. Ra
    c. NE
    d. C

11. Eliminating oxygen from the earth’s atmosphere would
    a. destroy human life.
    b. mess up chemistry texts worldwide.
    c. make breathing difficult.
    d. not be noticed in LA.

12. When you’re studying several subjects, it’s best to arrange your time this way:
    a. Study all similar subjects close together.
    b. Study dissimilar subjects close together.
    c. Study similar subjects at one time, but take a break between them.
    d. Study only those things you like close together.

13. Which of the following is least likely to be a good study area?
    a. the library
    b. your bedroom
    c. an empty classroom
    d. a dorm study room

14. Britain’s attitude toward the textile industry could be said to be
    a. monopolistic—Britain wanted no foreign competition.
    b. developmental—Britain wanted to spread textile industries around the world.
    c. backward—Britain wanted to prevent factory development altogether.
    d. ambivalent—Britain wanted only limited factory development.

15. Emerson’s statement that “the progress of invention is a threat... to monarchy means that
    a. inventions promote economic independence which results in political independence.
    b. inventors are usually political agitators.
    c. monarchs cannot exist in a modern technological state.
    d. inventions are prohibited by monarchies.
16. SQ3R stands for
   a. survey, question, read, read, read.
   b. survey, question, review, recite, rehearse.
   c. survey, question, react, remember, refer.
   d. survey, question, read, recite, review.

17. About 99% of the earth's crust, seawater, and atmosphere is made up of how many elements?
   a. 5
   b. 22
   c. 108
   d. 10

18. Which of the following is not helpful with good notetaking?
   a. Review previous class notes before class.
   b. Sit near the front.
   c. Let go of judgments.
   d. Wait till after class to do assigned reading.

19. What did the United States lack that slowed its industrial revolution?
   a. labor, consumers, capital
   b. labor, capital, natural resources
   c. labor, natural resources, consumers
   d. capital, consumers, and natural resources

20. The element oxygen is responsible for about ______ of the weight of the earth's crust, seawater, and atmosphere.
   a. 25%
   b. 5%
   c. 99%
   d. 50%

21. "You create it all" means that
   a. whatever goes wrong, you're responsible.
   b. you're too involved to have good judgment.
   c. you create your own failures.
   d. you create your experience of everything in your world.

22. Because of the growth of the textile industry,
   a. the economies of both the North and the South flourished.
   b. the economy of the South grew faster because it produced the cotton.
   c. the economy of the North grew faster because it had the industry.
   d. both economies were slow for some time.

23. Which of the following is not listed as a source of the names of various elements?
   a. properties of the elements
   b. locations of the elements' discovery
   c. commemoration of famous scientists
   d. relative frequency of occurrence
24. One of these is not a way to deal with test anxiety:
   a. visualize success
   b. yell stop!
   c. consider the worst
   d. punish yourself if you fail

25. What element would you expect to do the following: when heated, it changes from a solid to a violet-colored vapor.
   a. iodine
   b. oxygen
   c. hydrogen
   d. fluorine

26. Most substances can be decomposed into
   a. two or more elements
   b. two or more complex substances
   c. two or more atoms of an element
   d. oxygen and chlorine

27. The development of the American cotton industry was a chief cause in
   a. the French and Indian War
   b. the American Revolution
   c. the American Civil War
   d. the French Revolution

28. Elements are numbered
   a. in order of increasing complexity.
   b. in order of discovery—hydrogen being the first to be discovered.
   c. in order of their relationship to one another.
   d. in order of decreasing complexity.

29. The usual result of "you" messages is
   a. understanding
   b. defensiveness
   c. compromise
   d. agreement

30. In the 1780's, goods from British factories
   a. were superior to American goods.
   b. were the equal of American goods.
   c. were inferior to American goods.
   d. were not available in America.
APPENDIX D

STUDENT INFORMATION QUESTIONNAIRE

QUESTIONNAIRE

1. Name ______________________________

2. Date ______________________________

3. Year and semester in school (Second semester freshman, first semester sophomore, etc.) ______________________________

4. Major ______________________________

5. GPA ______________________ (If you aren't sure, estimate)

6. SAT/ACT scores: verbal ______ quantitative ______ Total ______

7. Reason for taking FCR 194 ______________________________

8. Areas of interest: Please check any of the following areas in which you are particularly interested or in which you plan to take (or have taken) coursework:

   - history
   - government
   - English
   - humanities
   - art
   - music
   - media studies
   - foreign language
   - science
   - chemistry
   - physics
   - biology
   - math
   - engineering
   - other

9. Would you classify yourself as primarily science oriented, liberal arts oriented, or fine arts oriented in your choice of subject area interests? ______________________________

10. To this point in your college studies, in which courses have you had the most success? In which have you had the least success? ______________________________

11. Ethnic group

   - Afro-American
   - Asian-American
   - Hispanic
   - Native American
   - Caucasian
   - Other

12. What is your enrollment status?

   - Full time
   - Part-time

13. I consider myself a(n) ______ (excellent, good, fair, poor) reader.
14. I consider myself a(n) ________(excellent, good, fair, poor) writer.

15. How would you define good study skills?

16. Do you feel you have/use these skills?

17. If you are having difficulty learning material, what do you do?

18. If you knew that someone else was having difficulty learning, how would you help that person?
APPENDIX E

METACOGNITION QUESTIONNAIRE

Name________________________
Date________________________
Class________________________

Please answer the following questions about the reading you have just completed. You may not know some of the answers, but try to answer all the questions. This exercise will not count for your grade in this course.

1. Please comment about how you felt about reading this selection. Was it easy or difficult for you to read? Why do you believe it was easy or difficult?

2. How did you choose the main ideas for this selection?

3. When you read this text, how did you go about learning and remembering the information?
Oral prompt for reading passages, to be used prior to both readings for the annotation group:
I am going to give you a selection from a text to read and annotate. I want you to read and annotate this selection with the idea of remembering as much information from it as you can. When you are finished reading, you will be asked to write about what you have read. I am interested in your thoughts about what you have read and how you comprehended what you read. When you have completed the reading and annotation, please bring the reading selection up to my desk and exchange it for this questionnaire.

Oral prompt for reading passages, to be used prior to both readings for the underlining group:
I am going to give you a selection from a text to read and underline. I want you to read and underline this selection with the idea of remembering as much information from it as you can. When you are finished reading, you will be asked to write about what you have read. I am interested in your thoughts about what you have read and how you comprehended what you read. When you have completed the reading and underlining, please bring the reading selection up to my desk and exchange it for this questionnaire.
Oral prompt for reading passages, to be used prior to both readings for the recall group:
I am going to give you a selection from a text to read. I want you to read this selection with the idea of remembering as much information from it as you can. You may mark or process it in any way you like. When you are finished reading, you will be asked to write about what you have read. I am interested in your thoughts about what you have read and how you comprehended what you read. When you have completed the reading, please bring the reading selection up to my desk and exchange it for this questionnaire.

Oral prompt for reading passages, to be used prior to both readings for the reading only group.
I am going to give you a selection from a text to read. I want you to read this selection with the idea of remembering as much information from it as you can. You may mark or process it in any way you like. When you are finished reading, you will be asked to answer some questions about what you have read. I am interested in your thoughts about what you read and how you comprehended what you read. When you have completed the reading, please bring the reading selection up to my desk and exchange it for this questionnaire.
Oral prompt for all groups, for delayed retelling.

A few weeks ago, I asked you to read two selections, one from a history text and one from a science text. I would like for you to take a few minutes and write everything you remember from those texts. You may write about them in any order, but label them history and science and keep the sections separate on your paper.
APPENDIX G

RETELLING PROFILE

RETELLING PROFILE*

Directions: Indicate with a check ( ) the degree to which the reader's retelling reflects the reader's comprehension in terms of the following criteria:

<table>
<thead>
<tr>
<th></th>
<th>none</th>
<th>low degree</th>
<th>moderate degree</th>
<th>high degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Retelling includes information directly stated in text.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Retelling includes information inferred directly or indirectly from text.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Retelling includes what is important to remember from the text.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Retelling provides relevant content, concepts, and context.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Retelling indicates reader's attempts to connect background knowledge with text information.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Retelling indicates reader's attempts to make summary statements or generalizations based on the text and apply them to the real world.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Retelling indicates reader's highly individualistic and creative impressions of or reactions to the text.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Retelling indicates reader's affective involvement with the text.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Retelling demonstrates reader's language fluency (use of vocabulary, sentence structure, language conventions, etc.).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Retelling indicates reader's organization or composition abilities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Retelling demonstrates the reader's sense of audience or purpose.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Retelling indicates reader's control of the mechanics of speaking or writing.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interpretation: Items 1-4 indicate reader's text-based comprehension information; Items 5-8 indicate reader's response and reactions to text; Items 9-12 indicate reader's language use.

APPENDIX H

MULTIPLE CHOICE POSTTEST

Quiz

1. The Industrial Revolution was called that because
   a. it was a sudden, revolutionary change in manufacturing methods.
   b. it was a gradual, but revolutionary change in manufacturing methods.
   c. the change was slow, but awareness of change was instant.
   d. England's place as foremost manufacturer in the world was overthrown quite suddenly.

2. The "Father of the Factory System" in America was
   a. Moses Brown
   b. Eli Whitney
   c. Alexander Hamilton
   d. Samuel Slater

3. The industry to launch the Industrial Revolution was
   a. the coal industry.
   b. the textile industry.
   c. the furniture industry.
   d. the shoe industry.

4. In the 1780's, goods from British factories
   a. were superior to American goods.
   b. were the equal of American goods.
   c. were inferior to American goods.
   d. were not available in America.

5. Because of his invention of the cotton gin, Eli Whitney can be said to have been
   a. responsible for the industrialization of the South.
   b. responsible for the growth of slavery.
   c. an incredibly wealthy individual.
   d. only mildly influential.

6. Britain's attitude toward the textile industry could be said to be
   a. monopolistic--Britain wanted no foreign competition.
   b. developmental--Britain wanted to spread textile industries around the world.
   c. backward--Britain wanted to prevent factory development altogether.
   d. ambivalent--Britain wanted only limited factory development.

7. The development of the American cotton industry was a chief cause in
   a. the French and Indian War.
   b. the American Revolution.
   c. the American Civil War.
   d. the French Revolution.
8. What did the United States lack that slowed its industrial revolution?
   a. labor, consumers, capital
   b. labor, capital, natural resources
   c. labor, natural resources, consumers
   d. capital, consumers, and natural resources

9. Because of the growth of the textile industry,
   a. the economies of both the North and South flourished.
   b. the economy of the South grew faster because it produced the cotton.
   c. the economy of the North grew faster because it had the industry.
   d. both economies were slow for some time.

10. Emerson's statement that "the progress of invention is a threat to monarchy..." was chosen to introduce this chapter because
   a. inventions promote economic independence which results in political independence.
   b. inventors are usually political agitators.
   c. monarchs cannot exist in a modern technological state.
   d. inventions are prohibited by monarchies.

11. The symbols for elements are written as
   a. a single letter
   b. two letters
   c. three letters
   d. all of the above

12. Which of the following is not a correctly written symbol of a single element?
   1. F
   2. Ra
   3. NE
   4. C

13. About 99% of the earth's crust, seawater, and atmosphere is made up of how many elements?
   a. 5
   b. 22
   c. 108
   d. 10

14. Which of the following is not listed as a source of the names of various elements?
   a. properties of the elements
   b. locations of the elements' discovery
   c. commemoration of famous scientists
   d. relative frequency of occurrence
15. What element would you expect to do the following: when heated, it changes from a solid to a violet-colored vapor.
   a. iodine
   b. oxygen
   c. hydrogen
   d. flourine

16. Most substances can be decomposed into
   a. two or more elements
   b. two or more complex substances
   c. two or more atoms of an element
   d. oxygen and chlorine

17. Elements are numbered
   a. in order of increasing complexity
   b. in order of discovery—hydrogen being the first to be discovered
   c. in order of their relationship to one another
   d. in order of decreasing complexity

18. The element oxygen is responsible for about _____ of the weight of the earth's crust, seawater, and atmosphere.
   a. 25%
   b. 5%
   c. 99%
   d. 50%

19. Alchemists paved the way for modern chemistry
   a. by developing a system of symbols
   b. through their experiments
   c. through their development of the alphabet
   d. all of the above

20. Eliminating oxygen from the earth's atmosphere would
   a. destroy human life
   b. mess up chemistry texts worldwide
   c. make breathing difficult
   d. not be noticed in LA
Inefficient readers open their textbooks to their assigned chapters and begin reading the very first sentence. They are like swimmers who never check the depth of the pool before diving in. Efficient readers look over their reading task before they begin. This is called previewing.

Why Is Previewing Beneficial?
1. Previewing written material before you read will improve your concentration.
2. Previewing written material will aid your understanding and remembering.
3. Previewing will increase your reading rate.

STEPS TO PREVIEWING
1. Read the Chapter Title
   The title announces the topic or subject. When you preview, you should call to mind what you already know about the topic from past experience.

2. Read the Introduction or First Paragraph
   The introduction, or first paragraph if there is no introduction, serves as a lead-in to the material. The introduction will often itemize what the chapter will cover. If the introduction or first paragraph is extremely long, read only the first five or six lines.

3. Read the Closing Paragraph or Chapter Summary
   These sections are often used to draw conclusions based on the facts that have been presented or to restate key ideas. Reading the first and last paragraphs will help you know what the author feels is important.

4. Read Questions or Vocabulary at the End of the Chapter
   The author lists questions and/or vocabulary at the end of chapters to test your knowledge of the material presented. Reading them beforehand alerts you to what is most important within the chapter.

5. Read Each Boldface (Dark Print) Heading
   Headings separate chapters into main divisions and indicate important concepts. By looking over a chapter's boldface headings, you can detect the organization of the chapter and the general approach the author is going to adopt.

6. Look at Any Pictures, Graphs, or Charts
   Pictures, illustrations, or captions may help you clarify ideas and give direction to your thinking.

7. Then Answer These Questions:
   a) This chapter is about . . .
   b) Important terms I should be able to define are . . .
   c) This chapter is organized in this way . . .
The Annotation/Underlining System of Text Marking

Textbook annotation is a part of a system of textbook marking that involves the reader in:
1. Writing brief summaries in the textbook's margins.
2. Enumerating multiple ideas (i.e. causes, effects, reasons, characteristics).
3. Sketching pictures or charts to explain difficult processes/concepts.
4. Writing possible test questions.
5. Noting puzzling or confusing ideas that need clarification by the professor.
6. Underlining key ideas.

Text annotation has several important advantages for the reader. It will:
1. improve your concentration so you will not become distracted and have to reread.
2. provide an immediate self-check for your understanding of the textbook's key ideas.
3. help you remember more.
4. assist you in test preparation.
5. negate the need to spend time rereading the chapters.
6. help you state ideas in your own words.

Annotation—What and How

<table>
<thead>
<tr>
<th>What?</th>
<th>How?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Definitions</td>
<td>Def., *, ( )</td>
</tr>
<tr>
<td>2. Lists, features, causes,</td>
<td>1) within text or in margin</td>
</tr>
<tr>
<td>effects, reasons,</td>
<td></td>
</tr>
<tr>
<td>characteristics</td>
<td></td>
</tr>
<tr>
<td>3. Names, dates, events that</td>
<td>Underline or circle</td>
</tr>
<tr>
<td>are important</td>
<td></td>
</tr>
<tr>
<td>4. Examples of main idea</td>
<td>ex. in margin</td>
</tr>
<tr>
<td>5. Good summaries</td>
<td>* ss</td>
</tr>
<tr>
<td>6. Good test questions</td>
<td>T.Q.</td>
</tr>
<tr>
<td>7. Something you do not</td>
<td>?</td>
</tr>
<tr>
<td>understand</td>
<td></td>
</tr>
</tbody>
</table>
Steps in Applying Annotation/Underlining to Textbooks

1. Look through the chapter. Note the length and organization of the chapter.

2. Read one or more paragraphs. Then stop. (The amount will vary, so judge according to your text's difficulty and organization.)

3. Think about the key ideas.

4. Briefly write the key ideas in the margin. Look for:
   a. definitions
   b. examples
   c. lists
   d. causes/effects
   e. characteristics
   f. likenesses/differences
   g. names/dates

5. Check your annotations to be sure that they make sense.

6. Go on to the next paragraph or section. Remember, not every paragraph will have a key concept that should be annotated, but every page or section usually does.

7. After annotating, go back and underline. If you have no annotating, you should have no underlining.

Steps for Test Preparation using the Annotation/Underlining System

1. Cover text.

2. Read your annotations. Ask yourself the following questions: "Do my annotations make sense? Do I understand?"

3. If not, uncover the text and reread only the underlined material. Do not read the entire paragraph.

4. In essence, you want to talk yourself through the entire chapter and actively learn the material.
Exercise for Marking a Textbook:

Memory

Psychologists have identified at least three different methods of measuring remembering: The evidence for retention may be from recall tasks, in which the subject must demonstrate memory without the aid of significant stimuli; recognition tasks, in which the subject is required to demonstrate familiarity with stimuli which are present; and relearning tasks, in which the subject is expected to show savings of time and effort in relearning previously acquired skills.

There is some evidence that ideas, stories, scenes, and even isolated facts which are remembered undergo predictable changes with the passage of time.

In simplification, parts of the original story or drawing did not appear in the reproduction. In elaboration, certain details are emphasized, presumably at the expense of those which are omitted. In conventionalization, unfamiliar features are invariably changed in the direction of increased familiarity.
Sociology example

The term "groups" has long been a pivotal concept of sociology; stated tersely, a group is any number of human beings in reciprocal communication. It may be well to emphasize certain aspects and implications of this short definition which beginning students, as well as some sociologists themselves, frequently overlook or do not appreciate fully. First, a group refers only to persons in communication. Mere physical closeness, if there is not communication, does not make a group. The communication creates the group, not the mere fact of spatial proximity or physical contact. Second, a group may be of any size from two persons to, theoretically and potentially, the entire population of the world. Third, communication need not be face-to-face or by "word of mouth;" it may be indirect through writing or at long-range through such instruments as the telegraph.
Inefficient readers open their textbooks to their assigned chapters and begin reading the very first sentence. They are like swimmers who never check the depth of the pool before diving in. Efficient readers look over their reading task before they begin. This is called previewing.

Why Is Previewing Beneficial?
1. Previewing written material before you read will improve your concentration.
2. Previewing written material will aid your understanding and remembering.
3. Previewing will increase your reading rate.

Steps to Previewing

1. Read the Chapter Title
   The title announces the topic or subject. When you preview, you should call to mind what you already know about the topic from past experience.

2. Read the Introduction or First Paragraph
   The introduction, or first paragraph if there is no introduction, serves as a lead-in to the material. The introduction will often itemize what the chapter will cover. If the introduction or first paragraph is extremely long, read only the first five or six lines.

3. Read the Closing Paragraph or Chapter Summary
   These sections are often used to draw conclusions based on the facts that have been presented or to restate key ideas. Reading the first and last paragraphs will help you know what the author feels is important.

4. Read Questions or Vocabulary at the End of the Chapter
   The author lists questions and/or vocabulary at the end of chapters to test your knowledge of the material presented. Reading them beforehand alerts you to what is most important within the chapter.

5. Read Each Boldface (Dark Print) Heading
   Headings separate chapters into main divisions and indicate important concepts. By looking over a chapter's boldface headings, you can detect the organization of the chapter and the general approach the author is going to adopt.

6. Look at Any Pictures, Graphs, or Charts
   Pictures, illustrations, or captions may help you clarify ideas and give direction to your thinking.

7. Then Answer These Questions:
   a) This chapter is about . . .
   b) Important terms I should be able to define are . . .
   c) This chapter is organized in this way . . .
Steps in Applying Highlighting/Underlining to Textbooks

1. Look through the chapter. Note the length and organization of the chapter.

2. Apply the previewing process.

3. Begin reading. Read one or more paragraphs, then stop. (The amount read will vary, so judge according to your text's difficulty and organization.

4. Select the main idea or ideas.

5. Underline/highlight the main ideas.

6. Be careful to choose only main ideas; highlighting/underlining too much is ineffective.

7. Go on to the next paragraph. It may be that not every paragraph has a concept worth remembering, so don't be alarmed if you have some paragraphs with no highlights.

Test Preparation Based on Highlighting/Underlining

1. Read only the highlighted material, not the entire paragraph.

2. Try to talk yourself through the chapter. Ask yourself, "What does this idea mean, and what do I know about it?"
Exercise for Marking a Textbook:

Memory

Psychologists have identified at least three different methods of measuring remembering: The evidence for retention may be from recall tasks, in which the subject must demonstrate memory without the aid of significant stimuli; recognition tasks, in which the subject is required to demonstrate familiarity with stimuli which are present; and relearning tasks, in which the subject is expected to show savings of time and effort in relearning previously acquired skills.

There is some evidence that ideas, stories, scenes, and even isolated facts which are remembered undergo predictable changes with the passage of time.

In simplification, parts of the original story or drawing did not appear in the reproduction. In elaboration, certain details are emphasized, presumably at the expense of those which are omitted. In conventionalization, unfamiliar features are invariably changed in the direction of increased familiarity.
Sociology example

The term "groups" has long been a pivotal concept of sociology; stated tersely, a group is any number of human beings in reciprocal communication. It may be well to emphasize certain aspects and implications of this short definition which beginning students, as well as some sociologists themselves, frequently overlook or do not appreciate fully. First, a group refers only to persons in communication. Mere physical closeness, if there is not communication, does not make a group. The communication creates the group, not the mere fact of spatial proximity or physical contact. Second, a group may be of any size from two persons to, theoretically and potentially, the entire population of the world. Third, communication need not be face-to-face or by "word of mouth;" it may be indirect through writing or at long-range through such instruments as the telegraph.
REFERENCES


