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**Learning and remembering text: The effect of training a
combination of summarization skills and mnemonic devices**

Palmer, William L., Ph.D.

City University of New York, 1991

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Learning and Remembering Text: The Effect of
Training a Combination of Summarization Skills
and Mnemonic Devices

by
William L. Palmer

A dissertation submitted to the Graduate Faculty in
Educational Psychology in partial fulfillment for the
degree of Doctor of Philosophy, The City University of
New York.

1991

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This manuscript has been read and accepted for the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

4/29/91
Date

Shirley Feldmann
Prof. Shirley Feldmann
Chair of Examining
Committee

4/29/91
Date

Carol Tittle
Prof. Carol Tittle
Executive Officer

Prof. Marian Fish

Prof. Philip Saigh

Supervisory Committee

The City University of New York

Abstract

Learning and Remembering Text: The Effect of Training a Combination of Summarization Skills and Mnemonic Devices

by

William L. Palmer

Advisor: Professor Shirley Feldmann

This study explored an instructional method for enhancing a reader's skills in summarizing and remembering text book passages. Instruction included either training in summarizing passages, memorizing one's summary, or a combination of the two.

Three eighth-grade classes (90 students) served as subjects. Each class received one of the training interventions, either a variant of Brown and Day's (1983) and Kintsch and van Dijk's (1978) steps for summarizing texts, instruction in forming acronyms (as a mnemonic device), or the two interventions combined. Two novel instructional techniques were employed in the study. One, developed by Guido and Colwell (1987) provided a step-by-step approach for instructing subjects in constructing passage summaries. The technique, up

to this point, had never been subjected to formal analysis. The second, a technique for instructing subjects to create acronyms from their summaries, was developed solely for the purposes of this study. The summarization procedure developed by Guido and Colwell (1987) received partial support in that it was only significantly effective in raising students' summarization scores when combined with the mnemonic instruction. The mnemonic instruction phase of the study did not receive significant support in this study.

Dependent variables assessed were: (1) scores for including passage main ideas on a summarization task, (2) scores for including passage supporting details on a summarization task, (3) scores for including passage main ideas on a delayed recall measure (a free recall essay test), (4) scores for including passage supporting details on the delayed recall measure, and (5) scores on a test preparedness scale. A pre-treatment standardized reading comprehension score was recorded for all subjects and later served as a covariate variable.

Over a period of two-weeks, subjects were provided with text book passages, taught summarization and mnemonic techniques, and then

tested on a delayed recall examination. A series of one-way and 2 X 3 ANOVAS, ANCOVAS, and linear regression analyses were calculated to analyze the data. Results of the study supported that training subjects in using the Guido and Colwell (1987) summarization approach together with a mnemonic approach is an effective means for teaching them how to summarize text book passages.

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Chapter I

Introduction

From the onset of reading, students must learn to determine independently what is important to learn and remember in texts. As students reach the junior high school level, they are increasingly asked to demonstrate their knowledge of text book learning via their performance on essay-type examinations.

Although educational research has looked at some aspects of text learning, particularly a readers' ability to summarize and comprehend story-like prose, a void exists in the examination of instructional strategies that are designed to facilitate the retrieval of previously read technical prose. This dearth of research becomes even more apparent when the research paradigms involve the inclusion of lengthy delays between the time of encoding and that of retrieval. Few researchers have provided a systematic instructional technique that is specifically tailored to this pursuit. Consequently, the given recommendations for learning are often anecdotal and stated in terms such as "Look out for important

text passages." "Underline them." "Review your notes." Such advice is seldom based upon empirical evidence nor is it transformed into manageable processing/instructional steps.

The main purpose of this study is to examine the effectiveness of an instructional method, based on Kintsch and van Dijk's (1978) model, for facilitating the long-term recall of previously read expository prose. In pursuit of this goal, several other models and techniques will also receive additional empirical support.

Specifically, the findings will be useful in determining if it is possible to teach students a combined comprehension-memory strategy that is aimed at facilitating both text encoding and the retention/retrieval of prose passages. Recent research in text learning has stressed the value of analyzing the procedures/rules that are involved in the process of summarization in conjunction with memory techniques that are intended to enhance retrieval. It is possible that if readers are taught to apply a specific combination of summarization skills together with a novel mnemonic device, they could improve their ability to identify the most important elements in a passage,

and retain and retrieve them for later use.

These two procedures can be addressed within a prose analysis theoretical framework and a mnemonic prose-learning strategy. Readers' ability to summarize a passage can be taught and measured by examining how they transform passages to arrive at their core information. Readers' ability to remember that information for extended time intervals can be taught through the use of mnemonic strategies that have been devised for remembering the contents of prose passages.

Through an investigation of these two procedures, it could be possible to identify a practical learning program for facilitating the retrieval of expository (technical) prose and thereby provide concrete instructional information for the use of educators, parents, and readers themselves. These results should be of value to both teachers and students in that they provide empirically derived results that will assist them in their future text book learning endeavors.

The findings of this study will be useful in supporting the text processing research that is offered by Kintsch and van Dijk (1978) and van Dijk and Kintsch (1983). These investigators propose

that retrieval is a natural-spontaneous process that occurs as the reader progresses through a text. Briefly, it is assumed that the reader constructs an ordered hierarchy of propositions with the theme at the highest level and argument(s) supporting propositions descending from it. As the reader advances through the text, he/she is thought to retain these constructed meaning(s) in short-term memory as a nucleus (superordinate) for which to assimilate or reject incoming text propositions. In terms of retrieval, text elements are said to become retrieved with probabilities that are proportionate to the probability of storage, that is, the longer the superordinates are retained, the greater the likelihood that they will later be recalled. Finally, it is assumed that if a superordinate is recalled, it is believed to act as a retrieval cue for material that is organized below it.

The present study is designed to operationalize and extend the van Dijk and Kintsch (1983) and Kintsch and van Dijk (1978) model. By requiring the readers to form summaries by extracting the passage's main and supporting details, the operations specified in the model are

concretized. Moreover, by having these same readers integrate these passage elements into a mnemonic device that is composed of a passage's main idea, the speculation, offered by Kintsch and van Dijk, that superordinate propositions, if recalled, will act as retrieval cues will be examined.

The design of this study also fits within a contemporary cognitive framework for memory performance. For example, theorists such as Tulving and Thompson (1973) have argued that forgetting results not from a permanent loss of information but from temporary inaccessibility. In this framework, the retrieval process is thought to involve the contact of a cue with event information in memory; to retrieve, it is asserted that these cues must be present at retrieval, at least to some extent. More recently, Tulving (1983; 1985) and Rabinowitz and Craik (1986) have extended their views stating that retrieval cues have their greatest effect when the operations required at retrieval matches those required at encoding. The findings of this study should also provide additional information as to these proposed retrieval mechanisms in two ways. First the design of this study ensures that the operations required

at encoding (generating superordinates and their corresponding subordinates) do indeed match those required at retrieval, namely, reconstructing those text elements from memory. Second, if cues do indeed facilitate retrieval (accessibility), the treatment group should outperform the control group (a condition where no mnemonic training is provided) on a measure of recall performance.

Chapter II

A Review of the Literature

The Research Problem

In recent years, studies of educational success and failure have increasingly emphasized the importance of learning from text and remembering salient aspects of it. Such studies have indicated that reading is a purposeful activity that requires the coordination of several cognitive skills to decode, understand, and remember text. Although the literature has provided a large number of detailed instructional models and interventions in the areas of decoding and understanding, the same is not true for remembering text material. Yet, the recall of information is often demanded in schools, both verbatim recall as in vocabulary tests and gist recall as when the student is required to reconstruct the essential meaning of a text (e.g., Brown, 1981; Stevens, 1988).

As students advance in school they are increasingly expected to study and retain information that is presented in text. As Stevens

(1988) notes, learning from text requires that students extract the main idea, or gist, of what they have read, and retain that and related information for future use. One problem, suggested by Yaniv and Meyer (1987) is that people often seem to have retained bits of information that at times cannot be accessed from long-term memory (LTM). Similarly, students often report that when studying for tests that they have learned the text material, i.e., that they "know" the material, and can assess how well they know the target information, if asked, despite being unable to recall it at the time of recall testing. Furthermore, these same students report that this problem becomes most apparent when they are asked to prepare for several exams simultaneously that are administered at a lengthy time delay between encoding and retrieval. Thus, it appears that what is stored (or available) in memory is not always accessible to the reader when required.

As Moely et al. (1986) note, there is little information concerning the manner in which students are instructed in memory strategies in their day-to-day activities. In particular, the extant literature is lacking in describing how the

retrieval process (i.e., accessing previously read information) should be viewed and instructed in the classroom. For example, Dunkin and Biddle (1974) and Thomas and Rohwer (1986) found that teachers do instruct students in the use of learning or memory strategies, but such teaching activities were observed to occur with low frequency and they rarely observed the teaching of high complexity memory strategies. The literature is even more restricted if one is seeking instructional methods that deal with the relationship between memory and text material. For example, as Kintsch (1982) notes, memory research has been concerned with lists of items (words, nonsense syllables, and even sentences), but not with texts. Thus, he adds, "we know quite well how people remember a list of words in the laboratory, but very little about how they learn physics in school from listening to a lecture, reading a text book, or doing problems" (p.186). It appears that memory instruction remains ill-defined with respect to the long-term storage and retrieval of complex prose material.

Theoretical Background

To facilitate the process of retrieving previously read material, it is essential to

delineate how information that is read is encoded, stored, and readied for later retrieval. Varied approaches have been used to study these processes. One approach, however, text processing via propositional analysis, has received extensive attention in the field of educational research in that it provides a comprehensive and objective method for evaluating and characterizing text material. The two major contributors to this line of research, Kintsch and van Dijk (1978) and Meyer (1975) will be discussed below.

Text Processing and Summarization:

Recently, many researchers of prose comprehension and memory have used propositional analysis to represent the content of prose materials. This method of text representation is often used as a characterization and description of the material, and has served as the basis for evaluating and analyzing a reader's performance in comprehension experiments (Bovair & Kieras, 1985; Alba & Hasher, 1983). Perhaps the most widely quoted approaches of this sort are those of Kintsch and van Dijk (1978), and Meyer (1975). These researchers focus on a text's structure of

discourse (e.g., the organization and interconnections of the text's propositions) and its relationship to a reader's comprehension and recall performance.

Kintsch & van Dijk (1978) and, more recently, van Dijk and Kintsch (1983) have proposed that when a text is presented, the reader forms a generalized inference or gist while forming guesses or hypotheses about main points as he/she progresses through the text. Such guesses are considered possible through the activation of a reader's prior knowledge base that provides a schema or knowledge frame containing slots or place holders to be filled with text relevant propositions located within the text. Thus, the reader is thought to retrieve from his/her knowledge base a knowledge structure that corresponds to the semantic unit that is being processed and to use that knowledge structure to organize the forthcoming semantic units. The schema determines which propositions are relevant and, thus, which parts of the text will form its gist. Thus, the schema is assumed to classify all propositions of a text as either relevant or irrelevant. For those propositions deemed relevant, the reader is thought to construct

an ordered hierarchy of them with the theme at the highest level and argument supporting propositions descending from it. These propositions are thought to be ordered by various semantic relationships among the propositions that link adjacent and hierarchically positioned propositions.

The semantic structure of a discourse is characterized at two levels, namely at the levels of "microstructure and macrostructure". Micropropositions, in this model, are thought to include a predicate or relational concept (i.e., verbs, adjectives, adverbs, sentence connectives) and one or more arguments whose semantic functions include the agent, object, and goal (Kintsch & van Dijk, 1978, p.367). Macrostructure, on the other hand, is conceived of as the reader's interpretation of the author's overall gist. The theory operates on the assumption that propositions are processed according to their appearance in the text and that readers do this in chunks (several propositions at a time) because one cannot process the whole text at once. Thus, text chunks or cycles are posited when selected propositions are carried over from one paragraph to the next in the reader's short-term memory. As readers progress through the

text, they begin to develop a meaning, and then assimilate propositions where relations exist into that stored meaning. Thus, readers are thought to construct a network of coherent propositions by retaining some propositions in their short-term memory.

Similar suggestions have been made by Brown (1975) who contends that when faced with the task of comprehending and remembering passages, readers integrate the meaning and relationships perceived in the individual sentences into holistic situational descriptions. Thus, the comprehension of passages is thought to entail a process of semantic integration that involves the construction and integration of semantic relationships.

In the Kintsch and van Dijk model, propositions are selected for retention when they are considered to be important in terms of their relevance to the reader's schema or their relation to the reader's gist construction and/or saliency. If retained, such propositions may participate in more than one processing cycle and therefore experience repeated chances of being stored in memory. In terms of retrieval of such information, text elements are retrieved with probabilities

proportional to the probability of storage. Consequently, the differences between well recalled and poorly recalled propositions results from the degree of reprocessing in later cycles, according to the number of times these propositions were held over in the reader's short-term memory. However, as van Dijk and Kintsch (1983, p.356) note, the 1978 model does not include an explicit account of the retrieval processes and concerns the mechanisms for storage only. Moreover, retrieval processes in general have received relatively little attention by reseachers of text memory (Kintsch, 1982).

The 1983 model, however, has addressed the issue of retrieval mechanisms and the larger issue of text memory a bit more thoroughly. The model makes the assumption that memory for text is not only memory for all the detail in the text, but also for its gist. The van Dijk and Kintsch (1983) proposal suggests that if readers have a well developed repertoire of comprehension strategies that these same strategies will also serve as mnemonic devices that will facilitate memory. Specifically, the authors propose that a macrostructure (gist) is formed while

encoding and that it is hierarchical in structure. This macrostructure is considered to be crucial to the retrieval system in that by hierarchically subordinating the text propositions under various levels of macropropositions (i.e., hypotheses about main points), an efficient retrieval structure is formed.

Thus, certain propositions are selected as important and carried along in memory as superordinates for propositions that are encountered later. These latter propositions are organized under the important ones and, the longer a proposition is carried along in short-term memory, the more likely it will be recalled later. If a superordinate is recalled, it is believed to act as a retrieval cue for material that is organized below it, that is, the subordinate propositions. Thus, according to this model, the retrieval of a proposition depends on the strength (with strength defined as the degree of processing) of the connections that link adjacent and hierarchically positioned propositions; these can themselves act as retrieval cues in determining how many and what particular ideas are recalled. Similar support for this reasoning can be found

with Palmere et al. (1983) and Craik and Tulving (1973), who found that memory for prose is enhanced as the number of subordinate ideas supporting a superordinate idea is increased.

In sum, van Dijk and Kintsch (1983) believe that the forementioned comprehension process "quite naturally functions as an efficient retrieval system so that just reading or listening to a text assumes a respectable level of recall" (p.364). However, they add the following afterthought, namely: "this does not mean that it would be impossible to achieve even better recall for discourse as a result of special memory encoding procedures such as mnemonic tricks."

Meyer (1975) has also stated that the identification of a text's structure is a necessary requirement for examining the processes of text comprehension and memory. Meyer (1975) defines a text's structure as the organization that binds it together, giving it its overall organization. Meyer has described different text structure categories that characterize prose passages and that appear to be similar across many models, namely: Comparison/contrast, collection or enumeration,

sequence, and problem solution. These structures are thought to display how some ideas are of central importance to the author's message, while other ideas are shown to be more trivial. In expository text, the text structure specifies the logical connections among ideas as well as the subordination of some ideas to others.

According to Richgels, McGee, Lomax, and Sheard (1987), text structures, described above, vary in their saliency to readers, indicating possible facilitative effects when readers engage in encoding, retrieving, and generating textual information. Thus, the facilitative effects for different text structures can not be assumed for different tasks, presentation modes, or response modes. Mayer (1985) adds that many researchers hypothesize that the representation of a text in memory is parallel to their analysis of the text structure. Following this line of reasoning, several researchers have found that instruction in reading or comprehension may indirectly affect recall. For example, investigators such as Taylor and Beach (1984) and Spurlin et al., (1988) have taught specific strategies for identifying the organization of text by focusing on the subordinate

and superordinate ideas in that text.

In the Taylor and Beach study (1984), the investigators focused on a reader's comprehension and memory for content area text book material. In their experimental group, seventh-grade students received instruction on a text's structure, defined as the organization of super- and subordinate ideas in the text. The subjects were instructed in how to produce a hierarchichal summary of the text starting with a key point, as indicated by the heading of the paragraph, and any supporting details offered. Next, the subjects engaged in a teacher-led discussion of their work and were then instructed to study their summaries for a free recall-short answer examination to be given on the following day. The researchers found that students who received the instruction recalled more information and number of propositions, over the conventional group, that read and reread the text, but performed no differently on the short answer items. Hence, the researchers concluded that reading instruction that focused on text structure had direct effects on their recall for text material.

Similarly, Stevens (1988) taught specific strategies for identifying the topic and main idea of passages. In this study, the topic was defined as the subject that was most frequently referred to in the paragraph. Once the subjects learned to identify the main ideas in individual sentences, they learned to identify the main ideas in the whole paragraph. Stevens found that sixth through eleventh-grade remedial readers were able to identify the main ideas of expository passages on a test administered on the following day more effectively. Similar findings on the efficacy of training readers on their sensitivity to text structures have been found by Meyer, Brandt, and Bluth (1980) and Palincsar and Brown (1984).

In summary, these models and studies have been developed within the reading comprehension research domain. In spite of the fact that models such as Kintsch and van Dijk's (1978) and Meyer (1975) have increased the level of knowledge with regard to text comprehension, and perhaps, as a by product short-term memory, little is known about the mechanisms that exist or can be applied to the material by the reader, so that it can become more memorable to him or her when required at a later date.

SUMMARIZATION SKILLS:

One important finding arising from the forementioned inquiry on text processing is the facilitating effect of training readers to better identify the passage's main theme and supporting details on recall and comprehension measures (e.g., Taylor and Beach, 1984). Summary writing has received extensive attention and is often considered to be an important study skill involving both comprehension of and attention to importance at the expense of trivia (Brown & Day, 1981).

Guido and Colwell (1987) have claimed that summary writing is consistent with the percepts of memory theory and information-processing in that it provides the reader with the opportunity to interact with the ideas of the author and to synthesize and restructure those ideas. Similarly, Kintsch (1989) has stated that summarization depends on the meaning representation of a text that is constructed during reading. In this description, the act of summarization demands that the reader not only develop inferences as to the author's intended meaning, as is ordinarily done while reading, but that one additionally construct explicit and coherent verbal statements

for that conceptual representation. Thus, Kintsch believes that more conscious attention is directed to selecting the appropriate information to include, and ideally, a greater effort is made to generalize the information in order to make a concise summary. In sum, although the models and studies described in the sections of text processing and summarization have been formulated for slightly different purposes (i.e., comprehension or memory), the similarity among them is striking with regard to their assumptions and prescriptions for enhancing text comprehension and memory. For example, in the Kintsch (1989) and the Kintsch and van Dijk's (1978) model, an assumption is made that when a reader comes to the task of reading, he/she does so with an understanding that to summarize an article is to reduce it to its gist as well as to identify those ideas to be included as well as deleted.

Similarly, in Mayer's investigations of the influence of text structure (i.e., Mayer, 1985) on comprehension and memory, more proficient readers were found to select higher-order propositions and engage in more of their own gist or meaning formulations while reading. Although text

processing and summarization techniques have contributed greatly toward an understanding of how readers come to represent and temporarily store an author's message, issues regarding the long-term retrieval of prose and how it can be instructed and therefore facilitated has been neglected and ill-defined.

COGNITIVE THEORIES

Cognitive theories constitute yet another avenue of exploration in finding a means to help readers improve their ability to comprehend, store, and retrieve prose material. In terms of retention and retrieval, many cognitive theories have suggested that forgetting results not from the permanent loss of information but from temporary inaccessibility (e.g., Underwood, 1969; Tulving & Pearlstone, 1966; Tulving, 1983; 1985). According to these theorists, the retrieval process involves the contact of a cue with event information in memory. Thus, the encoded material, some set of attributes such as text elements, is "specific" to a particular context or situation with a memory trace to represent that specific feature set.

In order to retrieve the stored information from memory, some attribute or aspect of that information must be reinstated at retrieval, at least to some extent. Thus, the retrieval context must be compatible with the encoding context in the sense that the elements sampled in the process of retrieval overlap with those sampled at encoding. To obtain this compatibility, a cue is often used at retrieval that represents the encoding context. The memory of an event ("engram"), as Tulving (1983) notes, is determined by the encoding context and consequently it is reasoned that the best cue is one that represents that context. Thus, contextual cues play an important role in recall and in the retrieval of stored information. A retrieval failure, is assumed to be due to the presence of too few cues and/or inadequate cues (i.e., a poor match between the cue and trace information) to recall, and future encounters with more adequate cues are predicted to yield successful retrieval despite the prior failure.

The overall effectiveness of providing retrieval cues in the service of facilitating recall performance is well supported in the extant literature (see, e.g., Britton et al., 1980). Given

the importance of cues in relation to retrieval, a number of techniques have been explored as a means of providing readers with a mechanism for producing cues. These cues may be provided by the environment (e.g., context, sensory cues), or they may be provided by the recallers themselves for example, as the result of successfully probing his or her memory. One approach with documented benefits is the application of mnemonic techniques (Pressley, Levin, & Delaney, 1982).

Bellezza (1981) has defined a mnemonic device as a strategy that creates and uses a cognitive cuing structure in order to organize and/or encode information for the sole purpose of making it more memorable. A similar definition has also been offered by Brown (1975) who adds that via such transformations of the material, a more efficient use of a limited capacity memory system is ensured. Further limits as to the definition of mnemonics are provided by McCormick and Levin (1987), who rule out a number of prose-learning strategies such as notetaking, question asking, paraphrasing, and, summarizing. As will be discussed later, McCormick and Levin concur with Bellezza (1981) in that "true" mnemonic strategies must include

elaborations and transformations of the to-be-encoded material, a condition that is not met with the forementioned strategies.

That mnemonics have been useful in aiding readers interface with text material is well supported by the extant literature (e.g., Pressley, 1982; Mastropieri et al., 1985; Peter & Levin, 1986). This conclusion is drawn from many studies of tasks typically involving the learning and recall of lists of discrete items of information. Using mnemonic instructions, such as an adaptation of the keyword method (e.g., Atkinson, 1975), these items are better remembered than when other techniques, such as experimenter-directed rehearsal are employed. For example, Shriberg et al., (1985) and McCormick & Pressley, (1982) have demonstrated the efficacy of keyword-type mnemonics, (i.e., recoding unfamiliar terms into familiar more picturable ones), when applied to relatively concrete and simply structured passages; they simultaneously caution, however, that such mnemonic devices will not likely generalize to more complex and abstract material. Although the techniques appear to be beneficial, their educational significance is not directly observable since

students are not generally asked to process and remember word lists per se.

Snowman (1987) and Levin (1982) have introduced several other variables to be considered when researching text processing and memory. For example, they cite that most prose passages differ from those used in typical paired associate learning tasks in several ways. First, in prose material, relevant prior knowledge is more likely to be used in understanding new information. Second, prose contains an organizational structure designed to deliver a message, so that in comparison to details, main points are usually stated at higher level of abstraction. Third, in comparison to details, main points are likely to be associated with a greater number of interpropositional connections. Finally, learning principles that often operate when word lists are used (e.g., serial position effect) are not always found with prose. The third issue, the number of propositional connections, is seen by Levin (1982) as particularly troublesome. Specifically, he doubts that one or more mnemonic system(s) can be combined to represent both passage content and structure.

COMBINING BOTH MEMORY AND SUMMARIZATION SKILLS

Levin (1982, 1986) has argued that certain prose-learning strategies are better suited for enhancing students' comprehension of what they are reading while other strategies are better suited to enhancing students' memory for what they have previously read (i.e., remembering). Specifically, he has suggested that nonmnemonic systems that identify the various types of ideas in a passage (e.g., general topic, topic areas, facts, details) and the ways in which those ideas relate to one another (e.g., A causes B, A is an example of B), may be more effective in aiding comprehension of a passage content and structure. In contrast, other strategies, such as mnemonic techniques, may prove to be more efficacious for improving a reader's memory for text that has been processed.

Although Levin (1982; 1986) has argued for these two processes to be viewed as distinct, he does not claim that comprehension and memory-directed activities are mutually exclusive. Despite this qualification, he does consider the distinction, separating comprehension strategies from memory strategies, to be a worthy effort when classifying and researching prose strategies. In

making his point, Levin has provided two examples of these different strategies in an attempt to illustrate their differences. One example of a strategy for rendering unfamiliar prose concepts more familiar is the use of paraphrasing, which is viewed primarily as a comprehension-directed strategy, whereas the strategy of underlining is viewed primarily as a memory-directed strategy. This argument can be graphically delineated as in Figure 1. In sum, Levin considers comprehension-directed strategies to be those intended to facilitate a reader's conceptual understanding of a text's propositions whereas, memory-directed strategies are considered to be those that are intended to enhance a reader's later retrieval of text information that has initially been adequately understood.

Consistent with Levin's position, Tulving (1983) has argued that any attempt to describe a memory phenomena in terms of either encoding factors or retrieval factors is incomplete at best in that both are involved together in the memorization of information. Similarly, a number of investigators have urged that the processes of comprehension and retention not be regarded as

Strategies

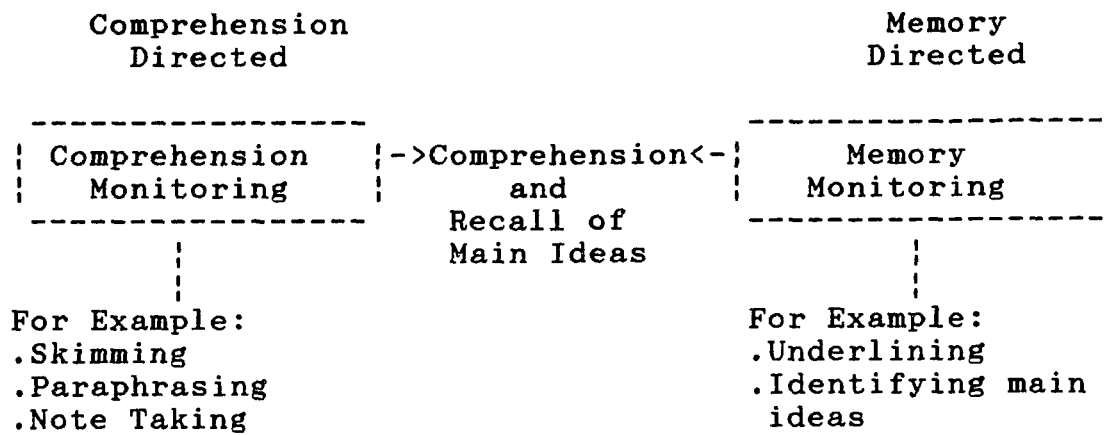


Figure 1
Prose-Learning Strategies According to Primary
Cognitive Function Served

Adapted from Levin (1982).

synonymous. For example, Brown (1975, p.107) has argued that "separation of these processes will be made only in terms of the temporal constraints on memory, for it is clear that we forget what we once understood". Finally, van Dijk and Kintsch (1983, p.364) have stressed that "comprehension and recall are correlated only up to a point: Beyond that, memory improvement can still occur without affecting comprehension".

In view of the preceding arguments, it appears that in order to delineate those skills and processes surrounding text processing, comprehension and retention should be conceptualized as separate components. Moreover, as Levin (1982; 1986) has argued, a more effective strategy for learning and remembering prose material may then be a combination of a mnemonic technique with a strategy designed to enhance comprehension. A combination of a comprehension-fostering technique that identifies important content and relations and a memory technique that will aid in the retention and retrieval of that information may provide a reader with an integrated instructional program for processing and retrieving prose material.

Several investigators have demonstrated the efficacy of such an approach. Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, and Evans (1979) have argued that an effective interaction with academic materials requires that the student engage in a complex system of interrelated activities. In their study, experimental subjects were taught an executive or primary strategy that was designed to assist the readers in reorganizing, integrating, and retrieving text book information. The strategy included the following six steps: 1) setting the mood, 2) understanding the requirements of the task, 3) recalling main ideas, 4) detailing the main ideas, 5) expanding the information into an outline, and 6) reviewing the efficacy of the plan. In addition, the readers were taught several "support strategies" such as goal setting-time scheduling, concentration management, and monitoring the adequacy of their attempts.

When combined, the forementioned skills are considered to be an "overall strategy" that is intended to facilitate one's performance in both the comprehension and retention of textbook material. In addition, the investigators explored three more "substrategies" in order to further address the issue of retrieval. Although all of the

experimental subjects (n=36) received the overall strategy, once instructed, the group was then divided into three separate groups to test the merit of the following retrieval strategies: 1) paraphrasing/imagery, 2) networking, and 3) key ideas. In the first strategy, paraphrasing/imagery, subjects were instructed to either describe the passage in their own words or create mental pictures of the concepts depending on the material. In the networking condition, subjects were instructed to convert the passage into diagrams/networks using a set of experimenter-provided links that contained paraphrases and images of key ideas that specified the relationships between them. Finally, in the key idea condition, the subjects were taught to identify concepts, develop definitions and elaborations, and form relationships among them. Each subject was aided by worksheets that specified categories of definitions and comparisons.

All subjects, control and experimental, received three different 3,000 word passages to read and each was followed by an examination that included both short-answer and multiple choice questions. The first passage and examination was

administered prior to the provision of any experimental condition and therefore served as a pretest measure. The second examination was given after the subjects received the overall strategy treatment and finally, the last exam was given after the divided experimental group received the retrieval strategies.

The results of this study indicate that the overall strategy subjects did outperform the controls on the short-answer and multiple choice questions. There were, however, no significant differences between the three Substrategy groups and the pre- and post tests indicated that these subjects performed approximately the same before and after receiving treatment. However, as a whole, they outperformed the controls and, it was the networking group that accounted for the majority of the variance. The paraphrasing/imaging group actually performed worse than the controls from the midterm test to the final exam; this was an unexpected finding, in that their earlier works (e.g., Dansereau et al., 1975) had demonstrated the technique to be positive. In attempting to reconcile the findings, the investigators claim that evaluators of the paraphrasing/imagery

technique have typically used shorter passages of 1,000 words or less. In this study, the passage was approximately 3,000 words in length and was considered to be too long for the imagery technique in that it did not emphasize the organization of the passage content.

Although the study appears to have been somewhat effective in improving the comprehension and retention of textbook material, the intervention is lacking in terms of its feasibility (i.e., cost-time effectiveness) and attention to the retrieval process. The investigators themselves have stated that "in order to examine and capitalize on the strategies, subjects must be taught large portions of the method." They also say that "unfortunately, the time and a subject's motivation required for training precludes exploring the system in its entirety and therefore, the components were put together to form a one-semester course." Because the system combines the components into interrelated strategies, a problem of assessing the significance of each individual component becomes apparent. A second problem with the method is that it is quite complex and it requires an undue amount of time, on the part of

both subjects and investigators, for its completion. A third problem with the study concerns the samples utilized. The subjects for the study consisted of psychology majors who received credit for their participation in a learning skills course. Therefore, these subjects may not be representative of the population at large in that these students may have sensed some learning problems of their own leading to their participation in the study. Also, the sample sizes employed in the study are questionable. The total sample was 36 with 8 students per substrategy experimental conditions. Finally, although the study explored three techniques which were intended to increase the students' retrieval performance, it did not specify the mechanisms or steps involved in designing and executing the techniques. Consequently, questions remain as to why the techniques were not very effective and as to how one might go about trying to increase their effectiveness.

Several other comprehension-memory studies have been conducted using mnemonic devices in a prose-learning context. The impetus for applying such devices to the study of higher-order prose,

according to McCormick and Levin (1987), comes from a retrospective study of mnemonic techniques by Grunberg (1973). In this study, graduate students were asked to report their spontaneous use of study strategies when preparing for their exams. Over 30% of the respondents reported using mnemonic techniques at least "sometimes", typically employing the "first-letter" mnemonic. In a later study, Gruneberg and Monks (1974), reported that over 50% of the graduates surveyed at a medical school also reported the use of mnemonic devices.

More recently, Snowman and his colleagues (Krebs, Snowman, & Smith, 1978; Snowman, Krebs, & Kelly, 1980; Snowman, Krebs, & Lockhart, 1980) investigated the possibility of teaching mnemonic prose-learning strategies to college students. These studies were reported to be "demonstrations", owing to restrictions in randomization and experimental control that resulted from administering treatments within the context of an offered college class in memory improvement skills. In the Krebs et al. study, undergraduates were taught how to analyze prose passages in terms of their superordinate "central ideas" and subordinate

"information units." They were also instructed to generate corresponding visual images from both types of information, and to incorporate these images into mnemonic loci (also called the "place method" because "loci" means "places"). The method includes the visualization and commitment to memory of a series of places that are well known to the learner. The next step is to generate visual images of the things to be remembered and then to place these images at particular points within each locus (place). Finally, at the time of retrieval, the learner is instructed to walk mentally through the locations, retrieving and decoding the information that was deposited there previously (see Snowman, 1987, for a complete account). Results of the study showed that both immediate and four-week delayed recall of passages read after mnemonic training increased substantially over recall exhibited on a similar passage studied using "typical study methods" prior to mnemonic training.

Unfortunately, it is difficult to draw general conclusions from these results in light of the very small sample (seven students) employed.

The two later studies of Snowman et al. (1980a, 1980b) utilized more substantial sample

sizes of students. In the first study, the subjects were "high risk" college freshman enrolled in a 14-week course designed to improve reading comprehension. Experimental subjects were taught how to combine the mnemonic method of loci with an organizational text analysis strategy. Control subjects practiced using traditional reading comprehension strategies, including note taking, and main idea identification. After 10-weeks of training, experimental subjects recalled more than twice as much posttest passage information than the controls.

The second study (Snowman et al., 1980b) was initiated in an attempt to separate mnemonic and text analysis strategy effects. The investigators compared the two types of strategy instructions as well as a combined approach in the context of another study skills course. The findings indicated that relative to their pretreatment performance, subjects displayed substantial prose recall gains following combined mnemonic/text analysis instruction. Interestingly, however, the benefits of mnemonic instruction alone were minimal, the single most important component being the prose

analysis training. With regard to the mnemonic instruction only condition, the investigators found the poor results to be a consequence of the prose passages used in their studies which they termed not "typical"; they were found to contain some abstract terms as well as complex internal structures. These results imply that the loci technique, as applied to students' free recall of text, may not be a very effective strategy (McCormick & Levin, 1987).

Consequently, Shriberg et al., (1982) have proposed alternative mnemonic approaches for facilitating prose learning and remembering. The Shriberg study is of interest because it was the first to adapt a mnemonic keyword method to a prose-learning situation. It compared two different mnemonic-instructional variations and a non-strategy control. In each of the experimental conditions subjects were read a series of short (3-sentence) passages. In the first condition the subjects were provided with interactive mnemonic illustrations (drawings depicting the story condition, the subjects were instructed to generate their own images. Although subjects in both conditions recalled more of the target material

(name-accomplishments) than did no-strategy subjects, mnemonic subjects who were provided with actual illustrations benefited more (by about 40%) than did those who generated their own images.

Despite its efficacy, as McCormick and Levin (1987, p.34) note, "from a cost efficiency perspective, it may not always be feasible to produce mnemonic illustrations for subjects' use". Moreover, although the facilitative effect of mnemonic prose-learning illustrations has been documented (e.g., Levin et al., 1986), other studies such as Morrison and Levin (1986) offer doubt as to the efficacy of providing instructions to subjects for generating mnemonic imagery. In the Morrison and Levin study, in which eighth-grade subjects read a relatively complex science lesson on their own, experimenter-provided mnemonic illustrations were facilitative relative to a control (no-strategy) condition, whereas subject-generated mnemonic imagery instructions were not.

McCormick and Levin (1987) have previously explored whether or not mnemonic strategy instruction would similarly facilitate a reader's recall of thematically connected prose information. Specifically, they argue that a legitimate

criticism of the extant literature is that most of the materials constructed for these studies may be characterized as essentially a set of unconnected facts embedded in prose passages. In the McCormick et al., (1986) study, college subjects were assigned to one of four experimental conditions and were asked to read fictitious biographical passages. The conditions were as follows: 1. control, in which subjects were left to their own devices to remember the passage content; 2. mnemonics, in which subjects were provided a mnemonic strategy in order to integrate the characters' names with biographical information; i.e., an integrated scene to imagine while studying the passage; 3. thematic, where the coherence of the passage was enhanced by providing subjects with an explicit theme and associated text signals, (*italicized*) print; and finally 4. mnemonic and thematic, where the two strategies described above were combined.

Contrary to their predictions, subjects in the three experimental conditions were able to recall more information than the control subjects. The investigators speculated that subjects who read the thematic paragraphs were somehow able to associate biographical information with the correct

names even without the benefit of mnemonic strategy instruction. Several explanations for this result were posed, namely, that the amount of the information was small and therefore easy to "keep straight", and also, that the performance measure used in the study (filling in a name by topic information grid) would be expected to diminish name-information confusions relative to other possible measures, such as randomly ordered cued-recall questions.

In sum, the preceding investigations support the efficacy of a combined mnemonic-nonmnemonic approach towards facilitating comprehension and memorization of material. There are several limitations of the various approaches and their interactions with specific tasks. First, the efficacy of the loci method for facilitating complex prose retention remains equivocal, as does the generation of one's own visual images. Similarly, providing illustrations for readers does not appear to be cost effective nor does it provide the reader with a technique that he/she could carry around with them. In addition, often only short-term memory is being measured since these studies typically asked readers to recall material or

answer questions immediately after reading. This last point is quite crucial when considering the work of Corkhill (1988) who found that retrieval events occurring too soon after the initial encoding context may not be demonstrated to be effective in increasing retrieval performance, as the original learning context may not have been forgotten. Consequently, any attempt to apply a mnemonic device at that time would only be redundant, masking any of the facilitative effects offered by that device. Corkhill recommends that a lengthy delay be imposed between encoding and retrieval in order for the initial context to be "lost."

Given that comprehension and memory training do appear to be valuable, but have not been studied fully with complex (technical) prose, this author is proposing a combined approach that will include both a comprehension strategy and a memory technique that will address the issue of prose retrieval without relying on visual imaging or experimenter-provided worksheets. The strategies decided upon will combine a mnemonic-acronym technique (to be described) and an instructional scheme for identifying and transforming prose into main ideas and supporting details.

A Combined Memory-Comprehension Learning Scheme

Researchers have stressed that when investigating a memory task, both factors of retrieval and encoding should be considered in that they are correlated and become separated only when such factors as temporal constraints or memory facilitating devices are introduced. Thus, at least with regard to short-term memory, the two factors are not completely independent. However, once these factors are introduced into the learning paradigm, the possibility that comprehension and memory can become independent is likely. This is because at some point instructional activities that are aimed at increasing comprehension will no longer affect memory if the performance measure is demanded after encoding and at some delayed point in time. Therefore, under these circumstances, memory facilitating techniques that are aimed at "jarring one's memory" would be quite useful to the reader who is faced with an exam that is scheduled to take place at some later time after processing.

Given these assumptions, the first step in investigating methods for facilitating memory must be to ascertain that the text was initially

processed and stored by the reader. An appropriate method should provide a means for identifying ideas in a passage and their relationships to one another when processing in the text and later in a reader's recall of that text. Once these conditions are met, it then becomes possible to determine to what extent the reader has comprehended, stored, and recalled the material.

Methods for Representing Prose

In pursuit of a suitable model for representing prose passages, some researchers such as Snowman et al. (1978) have considered Meyer's (1975) text organization as a possible model. Her method required the reader to identify the main idea in a paragraph and then to note other ideas that provide additional, more specific information. These ideas are arranged in outline form from top to bottom and left to right. General or superordinate ideas are located toward the top and left of the outline, and the specific or subordinate ideas are placed toward the right and bottom. The result is a hierarchical structure of the ideas in the passage. In addition, a total of 27 labels, divided between role relationships and

rhetorical predicates, are provided in order to classify the relationships among the ideas. Despite its apparent suitability, Snowman rejected the technique because of the extensive amount of time required for readers to organize prose materials in this manner (p.379).

Consequently, Snowman et al. formulated their own scheme for parsing prose into main ideas and supporting details. This model entailed the construction of a four-level hierarchical outline composed of a topic, area, characteristic, and example. The topic was defined as the subject or main idea of the passage under study and could be identified as a chapter heading, subheading, or lead sentence in a paragraph as long as it related to who or what was being discussed. The area was defined as a representation of the scope, range, or extent of coverage of the topic, that is, the passage's major or key points. The characteristic was defined as a distinguishing feature, quality, or trait of an area. Finally, the example was defined as an illustration of a characteristic with a typical instance that reflects the passage's more specific and concrete idea. In their study, students first received an hour-long lecture on the

organization of a text followed by practice in scanning the passages for the central topic and supporting details. In the following hour, the students were introduced to the method of loci (see above for description) by a lecture that explained its use and summarized supporting research. Students were required to construct their own list of loci.

Snowmen's et al. (1980) method, however, was deemed unsuitable for the purposes of the present study for several reasons. The first problem concerns using the method of loci as a mnemonic device. The effectiveness of the loci method is questionable. The Snowman et al., (1986) study, showed the benefits of the loci method alone to be minimal, leading some, such as McCormick and Levin (1987) to suggest that the "loci mnemonic as applied to students' free recall of text may not be a very effective strategy" (pp.393). In addition, if the loci method were shown to be effective in facilitating recall, its utility is still tempered by its cost efficiency limitations. Finally, as Morrison and Levin (1986) have indicated previously, subject-generated mnemonic imagery instructions were not found to be useful in

facilitating recall for eighth-graders.

A similar propositional analysis to that of Meyer (1975) is the method developed by Kintsch and van Dijk (1978) and van Dijk and Kintsch (1983). Their model, as indicated earlier, poses that when a reader progresses through a text, he/she reduces and organizes its details into a gist through the application of a series of transformations ("macrorules") and thereby arrives at an internal representation of the author's message. However, as Boviar and Kieras (1985) note, this model, like Meyer's model (1975), is difficult and time consuming to apply. These investigators formulated a simpler procedure for a propositional analysis technique and, although based on the Kintsch and van Dijk model, it is designed to be more oriented for use in experimental studies. Bovair and Kieras argue that in the Kintsch and van Dijk model, the propositional analysis approach tended to focus on theoretical issues of semantics, and emphasized literary texts. This emphasis, in their experience, has little relevance in the scoring of responses made in their experiments on memory and summarization of technical prose.

In their procedures, Bovair and Kieras have posited that "technical" prose is a subtype of expository prose in that it is concerned with presenting information of a technical nature (e.g., biochemistry books) with specific characteristics of its own. They maintain that technical prose presents densely packed complex information that is usually quite novel to the reader. Specifically, technical prose is posited to differ from narrative prose in several ways. First, technical prose is mostly comprised of novel concepts or terms that appear to require additional processing to understand. Second, narrative prose is thought to feature "distinctive referential forms" (e.g., use of determiners such as "a" and "the") whereas technical prose is thought to follow some different but complicated, rules in the use of determiners.

In technical prose, Kieras suggests that the classification of given and new information needs to be expanded to include the distinction between whether a referent was given or not with regard to not just the prior text, but the reader's knowledge as well. More specifically, technical prose is thought to contain many general concepts that are

usually referred to with plural nouns with no determiners, such as in the sentence, "the corona is the outer atmosphere of the sun." "Corona" is completely new to most readers, and so is the concept of the "outer atmosphere of the sun," although it can be assembled from the concepts of the "atmosphere" and the "sun" which is a unique concept that can be presumed to be known to everybody, and so the definite determiner is appropriate. But the same determiner is used in "the corona" and "the outer atmosphere of the sun", which are both not known.

Kieras adds that it is possible that the definite determiner on a knowledge-new item, which is not known in the reader's own knowledge base, signals that the reader should attempt to learn it in that it is not previously known and now being referred to in the text. In contrast, concepts that are found in text such as "a superheated gas" that are, for argument's sake, textually new, not yet presented in the text, and are knowledge-new, are often found to have "normal" indefinite

determiners. Thus, it may not be clear to the reader as to if a referent is given or new with regard to not just the prior text but the reader's own knowledge base as well. Furthermore, other terms can be found in texts that lack determiners completely, and are textually new and probably knowledge-given. Thus, according to Kieras (1985), technical prose follows some definite, but complicated, rules in terms of referents and how they are signaled syntactically.

To summarize, first, Kieras suggests that technical prose contains many general concepts that are usually referred to with plural nouns with no determiners. Second, indefinite noun phrases are relatively infrequent, and usually signal referents that are both textually new and knowledge-new. Third, definite noun phrases may mean any of the following: a) textually-new knowledge-given items, such as "the sun"; b) textually-new knowledge-new vocabulary terms that are important, such as the "the corona"; c) a textually new and knowledge-new pairing of concepts that are important, such as "the outer atmosphere of the sun"; d) an ordinary reference to a textually given item, such as "the corona" when repeated in later sentences (pp. 91-

92). Thus, Kieras emphasizes that in narrative prose, there is a consistent use of determiners making referential processing of noun phrases relatively simple. In contrast, the multiple use of definite determiners in technical prose makes it difficult to devise simple parsing and reference rules for handling noun phrases. In conclusion, Kieras notes that the coherence and referential requirements of understanding technical prose are substantially more difficult than those of narrative prose.

Another distinction between simple and technical prose concerns the role and influence of schemas in terms of aiding the understanding of technical prose. Anderson et al., (1982), among others have proposed that a major task facing a reader is to find an overall framework, or schema, within which to understand a text. The schema is thought to allow the reader to place the major themes, secondary themes, and supporting details in proper relation to one another, providing a framework to which new information can be assimilated. Kieras argues, however, that a major feature of technical or textbook prose is that it usually contains content that is mostly novel to

the reader and so the reader cannot apply content schemas routinely. Consequently, the comprehension of technical prose is not so much a matter of matching the content to a previously developed knowledge base, but rather involves dealing with the passage content at the level of individual propositions conveying the content. Once the reader has encoded the material, he or she may then assimilate additional propositions. Thus, according to Kieras, the schema notion would appear to have very little applicability to the comprehension of technical prose. He recommends that a model that operates at the level of processing individual content facts, such as the propositional analysis model offered by Kintsch and van Dijk (1978), be used to explore prose processing and recall.

A Method for Instructing Readers in Prose Processing

The model offered by Kieras and Boviar provides as a suitable prose parsing method for representing a text and a reader's written recall of that text. The question remains, in terms of instructional strategies, as to how best to

instruct readers in identifying ideas and their relationships in the passages. One model that appears to meet this challenge has been proposed by Guido and Colwell (1987). These investigators claim that summary writing is consistent with the precepts of memory and information-processing theories in that it provides the reader with the opportunity to interact with the ideas of the ideas for one's self. They have proposed a specific summary writing technique that combines the works of Kintsch and van Dijk (1978), and Brown and Day (1983) who have worked extensively on detailing the processes which occur in text processing and summarization. From the Kintsch and van Dijk (1978) studies, they have borrowed a series of processes called "macrorules" which are thought to occur in text processing and summary writing. The first rules, called "generalization" rules, involve the deletion of unnecessary and redundant material while the more advanced or sophisticated "integration" and "construction" rules involve the selection of a topic sentence or, if one does not exist, the invention of one's own topic sentence. From the Brown and Day model, Guido and Colwell employed the description of the six basic rules for

summarizing text in order to provide a more detailed and thorough description of the summarization process. Briefly, the first two rules in this model require the deletion of: 1) trivia and 2) redundancies. Next are two rules for substituting a superordinate statement for list of 3) items or 4) actions. The fifth rule is to select a topic sentence; but, if one does not exist, rule six calls for the reader to invent one.

Since Guido and Colwell's model is derived from the precepts of the Kintsch and van Dijk model, as is the parsing scheme developed by Bovair and Kieras, and it provides a direct, step-by-step instructional method for providing hands-on instruction, it may become possible, by combining the summarization steps provided by Guido and Colwell (1987) with the prose parsing scheme developed by Bovair and Kieras (1985), to represent the important content in a passage and to instruct readers in identifying and summarizing that information. Both procedures have been described in detail and can be found in the procedure section below. Since the Guido and Colwell model has been untested, an effort will be made to validate it in the present study.

A Method for Enhancing Recall of Previously Read Material

Now that a scheme has been identified for representing and summarizing the content of a passage, and its recall by a reader, it can now become possible to address the enhancement of a reader's memory for that material. As was discussed above, comprehension and recall were said to be related up to a point and beyond such, separate with respect to temporal constraints and memory facilitating techniques. In accordance with these findings which indicated that mnemonic devices are useful in enhancing a reader's recall performance, it appears reasonable to assume that memory for previously stored information could be enhanced and that such enhancement would be most beneficial with tasks requiring long-term retention.

Because of the dearth of mnemonic devices that are appropriate for processing technical prose material, as argued previously, it seemed necessary to create a novel mnemonic technique. The technique used in this study was devised with reference to three sets of criteria, namely, 1) compatibility with the encoding operations as posited by the Kintsch and van Dijk (1978) model, 2) the basic

elements of a mnemonic device as defined by Belleza (1987), and 3) the current literature on memory research. In the Kintsch and van Dijk model, it is proposed that the reader construct a gist of the author's message that is composed of a list of main propositions which are selected in short-term memory as superordinates for subpropositions that are encountered later. In terms of retrieval, of key importance is their belief that if a superordinate is recalled, it can then serve as a retrieval cue for information subordinate to it. Thus, if a main idea term can be constructed and retrieved by the reader, his or her recall of the major and minor points of a previously read text will be enhanced.

In terms of the second criteria, Belleza (1987) has argued for two main types of mnemonics. The first, are "encoding mnemonics" that ensure that a mental symbol exists, i.e., a word, for the items of information being memorized, for example, if a word is created for an abstract concept. The second, called "organizational mnemonics" organize and interrelate these represented symbols in memory and when later recalled they act as mental cues for the items to be recalled. He contends that if the reader initially processes the material and

constructs symbols to represent that information and then develops a plan for remembering those symbols, his or her memory for the text should be enhanced.

Recent research has indicated a need to consider the similarity of events and operations that are in existence during processing-comprehension with those occurring during retrieval when attempting to study memory facilitating techniques. According to these findings from the memory literature, information that is stored can be better retrieved if the reader attempts to match the processes and content of what he or she has read with those of what he or she is doing to remember that information when preparing for a recall test. For example, Tulving and Pearlstone (1966) hypothesized that forgetting results not from permanent loss of information but from temporary inaccessibility. According to them, contextual cues play an important role in recall, and they significantly modulate the retrieval of stored information. Thus a retrieval failure could be due to the presence of inadequate cues to recall, and future encounters with more adequate cues could yield successful retrieval despite the

prior failure. Rabinowitz and Craik (1986) found that retrieval cues had the greatest effect when the operations required at retrieval matched those required at encoding. Similarly, Tulving and Thompson (1973) suggested that good recall will result when self-generated retrieval cues provide a compatible description of the encoded information. More recently, Tulving (1983, p.181) describes his "Encoding Specificity" hypothesis which emphasizes the match between the stored information and the retrieval information in determining the recollective experience of the rememberer. Specifically, the hypothesis states that the "Engram" (the product of encoding-information stored e.g., propositions) of an event stored in the system, and the retrieval cue, must be compatible for remembering to occur (p.224). Of particular interest to this paper is Tulving's assessment of Kintsch's (1974) model, that states "in the Kintsch model, the retrieval information complements the stored information at the time of retrieval".

Based upon the forementioned findings, it is proposed that if the reader is taught to formulate passage superordinates and he or she can retain

them for extended periods, passage recall on delayed measures will be enhanced in that those superordinates will access additionally stored material by acting as retrieval cues. It is reasoned, by this writer, that when the reader has formulated his or her "text base" (passage gist) and identified the superordinate propositions, that a substitute word (that is more memorable to the reader) can be created for that information, thus meeting Belleza's first type of mnemonic. With regard to Belleza's second mnemonic, the organizational, a technique is needed to organize these represented symbols in memory and ensure that the substitute words will be available when needed, as in response to a free recall test where no retrieval cues are externally provided.

The technique that is proposed for this study a semantic acronym type of mnemonic, will include both of Belleza's mnemonic definitions. The encoding requirement will be met by having the readers list their superordinate propositions or main ideas (as identified via the nonmnemonic method) and their supporting details and formulate one or two-word headings. The organizational mnemonic will be met by having the reader generate two sets of related acronyms. The first will

symbolize-represent the superordinate(s) (i.e., the main idea) while the second will symbolize specific details of each superordinate (i.e., specific details). Once completed, the reader will write out these symbols and rehearse them until they are well memorized.

The semantic acronym technique proposed here incorporates the fundamental propositions proposed by the forementioned criteria. Following the Kintsch and van Dijk (1978) model, students learning this technique will construct super- and subpropositions from the reading passages. One of the premises of the Kintsch and van Dijk model is that if a reader can remember the superordinates of a passage, they will serve as retrieval cues for the passage's content and facilitate recall. Further, Belleza (1981) contends that if a reader can reduce a text's gist to symbols and develop a plan for remembering these symbols, recall will be enhanced. Therefore, if the reader is additionally taught to symbolize the superordinates and devise a plan for remembering them, recall will be enhanced. Finally, the proposed technique incorporates some of the findings from the memory literature (e.g., Tulving, 1983) that recommends using reader-generated cues and the matching of processing

events and operations with retrieving events and operations. This last condition is met by asking the student to interface with the same text content during processing and retrieval. During reading, the student is processing the material by forming the passage's main idea and subordinate details.

When learning the mnemonic technique, the student is again reviewing the main ideas and supporting details but now is additionally required to formulate more compact symbols for the material together with a plan for remembering these symbols. Therefore, if the reader is additionally taught to symbolize the superordinates and devise a plan for remembering them, recall will be enhanced. Finally, the proposed technique incorporates the conclusions found in the memory literature (e.g., Tulving, 1983) that recommends using reader-generated cues and the matching of processing events and operations with retrieving events and operations. This last condition is met by asking the student to interface with the same text content during processing and retrieval. During reading, the student is processing the material by forming the passage's main idea and subordinate details. When

learning the mnemonic technique, the student is again reviewing the main ideas and supporting details but now is additionally required to formulate more compact symbols for the material together with a plan for remembering these symbols.

Self-confidence Issues

A number of studies have demonstrated that when students are made aware of the utility or effectiveness of reading strategies, the strategies are used more and consequently their performance becomes enhanced (e.g., Borkowski, Weyhing, and Carr, 1988; Cross and Paris, (1988)). In view of these of findings, this study hopes to demonstrate that by providing students with an explicit awareness of the utility of this study's instructional methods for processing and retrieving text, that their specific self-attributions, their confidence in being well prepared to take an essay examination, will improve. As the reader will recall, a large number of students have stated that they had studied well for a test only to find that when taking it that they could not remember all of the material considered to be in their possession. With the interventions that are offered in this

study, it is hoped that students will perceive a greater sense of personal ability and causality in preparing for a test and that this will be reflected on a self-confidence measure.

Borkowski et al. (1987) suggests that an often overlooked aspect of instructional interventions is the student's internalized motivational system (Weiner, 1985). Researchers investigating this issue, commonly referred to as "attribution theorists" have been interested in people's perceptions of why things happen and the way they occur. For example, one reader may attribute his/her luck as being the cause for passing a test while another may consider his/her ability to be the responsible factor. According to Borkowski et al. (1987), each student brings to the classroom a long-standing belief system about personal causality and task-specific self-attributions. While long-standing beliefs are believed to be formed from years of experience in dealing with all sorts of problems, specific self-attributions are more narrowly defined and are based on one's beliefs formed from experiences with specific areas and tasks.

In the realm of reading and test taking, attribution theory has been heavily researched by those investigating the phenomenon of "metacognition." According to Cross and Paris (1988), "metacognition is the knowledge and control students have over their own thinking and learning activities, including reading". One's knowledge of his/her own thinking includes an understanding of what factors influence reading, how these learning activities operate or are applied, and why particular strategies are required and how they affect reading. Of particular importance here is that the self-appraisal of one's knowledge, abilities, and thinking are often charged with affect and motivation. For example, a student's understanding of summarizing while reading interacts with a knowledge of effective summarization activities, comprehending of the effort required, of personal expectations for success, of the task goal, and so forth. As a result, metacognition includes informed, affective, and motivated self-appraisals.

One surprising finding is that there is very little evidence of monitoring in some situations in which it would be expected to occur, such as when

competent readers are processing texts (e.g., Glenberg, Sanochi, Epstein, & Morris, 1987). Only when students take a test over prose content do they seem to become aware of how much and what parts of text were learned (Pressley, Snyder, Levin, Murray, & Ghatala, 1987).

Summary

The constructs of comprehension and remembering textual information deal with classes of responses that are proposed to be reflective of thought processes. The studies offered by Kintsch and van Dijk (1978) and van Dijk and Kintsch (1983) have attempted to define the basic operations involved in comprehending and remembering prose. Their model was selected as part of the conceptual framework for this study since they attempt to show how individual propositions in text are transformed and condensed into a gist. The analysis of propositions and their relations has served as the basis for evaluating and analyzing a reader's performance in comprehending and remembering text (see, for example, Bovair & Kieras, 1985). As mentioned previously, Bovair and Kieras have developed a technique for subjecting prose text to

a propositional analysis. The conceptual framework underlying their method is based on the Kintsch model of text processing which makes it particularly applicable to this investigation. Bovair and Kieras have attempted to quantify and qualify these propositions and their relations; this method will be employed in this study.

Further, material that was stored must also be available to the reader when needed. In attempting to facilitate memory, Tulving (1983) has reminded researchers that, "all retrieval is cued" (p.171). Thus a cuing system was deemed necessary. However, a void was found to exist with regard to training studies that employ an appropriate cuing system for instructing the retrieval of complex (technical) prose. This situation is particularly evident if the examination is administered at a delayed time interval from the initial encoding. Consequently, a memory device was constructed. The theoretical premise for the construction of this device rests with the Kintsch and van Dijk model of text processing and recall. The model accounts for recall by positing a hierarchical structure whereby superordinate concepts are semantically tied with subordinates in a linear fashion.

Using these concepts, this author has attempted to operationalize the processes of parsing prose into its main and sub-propositions and to include (explicitly) instruction in applying these propositions in the formation of a semantic device that will simulate the text processing hierarchy espoused by Kintsch and van Dijk. Thus, by instructing subjects in the formation of propositional hierarchies, subjects can condense the total passage into a more manageable (in terms of cognitive capacity) amount of information. Further, once these main ideas are identified, if retained by the reader, it is reasonable to assume that if the superordinates were available to the reader, that their memory for subordinate material would be more likely to become activated in memory. Thus, it follows that readers' memory for the passage content should be enhanced.

The Acronym method is an attempt to achieve this end by providing readers with a memory technique that is aimed at keeping the superordinates (and several supporting statements) alive in short-term memory so that they may serve, when needed, as effective cues for dredging-up latent stored material.

A review of the present literature has revealed that much has been offered to help readers transform prose passages (e.g., form a gist) but little exists in the way of instruction for facilitating the retrieval of long-term stored information. McCormick and Levin (1987, p.391) have argued that from a "theoretical standpoint, one can strive to account for the mechanisms associated with the operation of mnemonic strategies, which in turn will permit precise specifications of the conditions related to their effectiveness. From an applied educational standpoint, one can strive to design and prescribe different varieties of mnemonic strategies for different varieties of classroom curricula." This study uses a systematic and integrated program for helping students read technical text by providing instruction in forming a gist (i.e., identifying main ideas and their supporting arguments) as well as steps toward organizing this information into an effective retrieval system so that material can be accessed when later needed.

Chapter III

Methodology

The purpose of this study was threefold. The first was to demonstrate that the process of training readers in a summarization technique would enhance their ability to summarize a text book passage by extracting its main ideas and supporting details. Second, the study sought to examine if it is possible to enhance a student's ability to remember more of a summary by teaching him or her a memory facilitating mnemonic device. Finally, the study sought to examine if the student's self-rating of test-recall confidence would vary as a result of his or her receiving either one or both of the the instructional conditions.

In addition, this study extended the work of Kintsch and van Dijk to account for the retrieval processes associated with text processing. In attempting to do so, several other models received empirical attention including the conceptual framework proposed by Snowman and Levin which differentiates between strategies that are aimed at

facilitating comprehension and those that are aimed at retention.

Design

The present training study is an attempt to look at the effect of three independent variables upon five dependent variables. The procedure, described in full below, included the following variables. For the independent variables, two instructional techniques were employed. The first, a summarization technique, taught subjects how to condense a text passage into its main ideas and supporting details. The second variable taught subjects how to construct a mnemonic device, formed from the subjects' own text summaries. Three separate training groups were employed to examine the effectiveness of these instructional techniques. The first group, labeled "Summarization-Only," received only the summarization training. The second group, labeled "Mnemonic-Only," received only the memorization training. The third group, labeled, "Combined" (Summarization and Mnemonic) received the two instructional interventions together.

One pre-treatment variable, reading comprehension level, was included in the study as a covariate in that it was assumed that student's reading comprehension skills may be associated with the effectiveness of the training variables.

For the dependent variables, the first dependent variable was the number of main ideas scored for each subject's reading passage summary. The second dependent variable was the number of main idea supporting details scored for each subject's reading passage summary. The third dependent variable was the number of main ideas scored for each subject's essay test. The fourth dependent variable was the number of main idea supporting details scored for each subject's essay test. Finally, the last dependent variable was a subject's score on a measure of test preparedness.

The first two dependent variables examined the effect of teaching an instructional technique that is designed to improve a subject's ability to form a summary, i.e., a passage's main ideas and supporting details. The third and fourth dependent measures examined the effect of teaching a memory facilitating technique on enhancing a subject's memory for their summaries. Finally, the last

measure was employed to examine a student's sense of being well-prepared to take an essay examination, that is, that he or she was able to remember (recall) the summarized material.

As the reader may recall, Kintsch & van Dijk (1978) proposed that when a reader is presented with a text, he or she begins to perform a number of mental operations in order to process, store, and retrieve the material (see page 9 for a review). The present study was designed to help operationalize these underlying mechanisms and to adapt them to instructional interventions. Summarization, like reading for comprehension, requires both the identification of the gist of the text and its support by related arguments. Thus, the reader, while engaged in summarizing a passage, is consciously performing many of the operations proposed by Kintsch and van Dijk. The summaries of an expository text that were written by the students were examined to gauge to what extent the meaning was grasped at the macrolevel or gist level. The subjects' summaries were then used as part of an instructional method to facilitate their long-term memory of that material. In the production of their summaries, subjects had been taught to identify the main idea, to construct

superordinate terms that represent those concepts; they were then taught to use these constructions as part of a mnemonic device that was then used as a memory facilitating technique.

Upon completion of the training sessions, the subjects were then asked to employ the mnemonic device as an aide to their preparation for a future examination. All the subjects in the experimental conditions were given a prose passage (used as a dependent variable) to take home and study to prepare for an essay examination administered one-week later.

Hypotheses

The three major questions and related hypotheses addressed in this study are as follows:

A. Quality of subject-generated summaries

Does summarization training enhance a subject's ability to read a textual passage and construct a well written summary of that material? Subjects who participated in the summarization condition received training in how to construct a well-defined summary.

Hypothesis: I. Subjects who receive the summarization training (the Summarization-Only

group) will exhibit significantly higher main idea scores on a passage summarization task than subjects in the Mnemonic-Only group.

Hypothesis: II. Subjects who receive the summarization training will exhibit significantly higher supporting detail scores on a passage summarization task than subjects who do not (the Mnemonic-Only group).

B. Quality of essay-recall examinations

Does training in the formation and use of a mnemonic device enhance a subject's ability to remember more of the material that was included in his/her summaries and, consequently, more of the passage's content as a whole? In this analysis, the ability to remember more of the passage is defined as the inclusion of the main idea(s) and supporting details of a passage. Subjects who participated in the mnemonic training condition received training in how to better remember the products of their own summarization protocols.

Hypothesis: III. Subjects who receive the mnemonic training (the Mnemonic-Only group) will

achieve significantly higher main idea scores on a recall task (essay-test) than the Summarization-Only group.

Hypothesis: IV. Subjects who receive the mnemonic training will achieve significantly higher supporting detail scores on a recall task than the Summarization-Only group.

Hypothesis: V. Subjects who receive the Summarization and Mnemonic training (combined) will achieve higher scores on all dependent measures than either the Mnemonic-Only or Summarization-Only groups. This expectation is based upon the assumption that subjects who receive both instruction in identifying what is important to remember coupled with instruction in how to better remember that information, will be more likely to retrieve a greater amount of pertinent information, hence, a combination of the two treatments (Combined) will produce a greater effect than either the Mnemonic-Only or Summarization-Only conditions.

C. Self-ratings

Does training subjects in summarization and mnemonic instruction influence their feelings of being well-prepared for taking an essay examination? After receiving the instruction, will the students feel more confident in their ability to recall the studied material when called upon to do so?

Hypothesis: VI. Subjects in the Summarization plus Mnemonic condition will rate themselves higher on a test preparedness measure than either of the other two groups in terms of their estimates of being well-prepared for taking the essay test.

Treatment groups

There are three treatment groups, the Mnemonic-Only, the Summarization-Only, and the combined group as seen in Table 1, and detailed below. There were six training sessions. In the first three sessions, subjects in the Summarization and Mnemonic and Summarization-Only conditions received training in summary production; the subjects in the Mnemonic-Only condition did not receive this training and had to rely on their own

Table 1

Experimental Design and Training-Testing Procedures

Sessions 1-3		Sessions 4-5	Session 6
Orientation		Training	Data Collection

Group: Summarization + Mnemonic			
Ss receive an overall plan of the 6 sessions to include a briefing on summarization and mnemonic instruction.	Ss receive training in transforming a passage into main ideas & their supporting details.	Training in constructing a mnemonic device. Ss are given a (Dep. Var.) passage to summarize, & to hand in at the next session.	Essay test (Dep. Var.) and test prep. scale given one-week following session 5; written summaries collected.

Group: Summarization Only Condition			
Ss receive an overall plan of the 6 sessions to include a briefing on summarization training and remembering, with no mention of strategies.	Ss receive training in transforming a passage into main ideas & supporting details.	Ss will rely on their own previously learned ways to remember a text. Ss given a passage to summarize, & to hand in next session.	Essay test given one-week following session 5; written summaries are collected.

Group: Mnemonic Only Condition			
Ss receive an overall plan of the 6 sessions to include briefing on remembering through the use of mnemonic devices.	Ss receive no explicit summary training, relying on previously learned ways.	Mnemonic training, Same as above. Ss given a passage to summarize, and to hand in next session.	Essay test to be given one week following session 5; written summaries are collected.

previously developed means for summarizing a text. Next, subjects in all three of the conditions were asked to summarize a new passage. It was expected that the subjects in the two conditions that received the summary training would outperform those in the Mnemonic Only-condition in their ability to summarize the material. The Mnemonic-Only condition served as a control to test the efficacy of the summarization training. During the next phase of the training, sessions 4-5, subjects in the Summarization and Mnemonic and the Mnemonic-Only conditions received an instructional treatment designed to facilitate their memory for the summaries that the subjects had previously developed. The Summarization-Only condition, however, did not receive this treatment and this group served as a control for the efficacy of the mnemonic training procedure.

Subjects

Four classes of children (120 subjects) from the eighth-grade of a lower-to-middle class urban junior-high school served as subjects. Thirty students participated in the pilot study, and the remaining 90 were used in this study. Due to

attrition, the final sample size was 68 and approximately equal in terms of gender. The four classes differed with respect to the subjects' academic functioning (i.e., faster versus slower tracks). For the purposes of this study, the school's principal randomly mixed the classes, thereby eliminating this confound. Parents of students selected were contacted, permission was solicited for their children's participation in a doctoral dissertation that seeks to learn more about the ways teachers can assist students in learning and remembering text book information (see Appendix A).

The thirty eighth-grade students in the pilot study received the entire procedure for summarization and memory as described in the procedure section. The pilot study assisted the examiner in ensuring that the instructional method proposed by Guido and Colwell (1987) and the novel mnemonic procedure developed for this study were clear to the subjects, that is, they understood the instructions, performed the tasks, and benefited from the technique.

Materials

Training Materials

Three expository paragraphs were selected as the focus of this study because they are typical of those found in the eighth-grade. Students in all treatment groups were given the same pool of passages on topics in earth science and life-science. The materials were selected for use in this study keeping in mind two major concerns. The first concern is for text structures and the possible confounding effects of employing passages that contain particular structures. According to Richgels, McGee, Lomax, and Sheard (1987), text structures vary in their saliency to readers, indicating possible facilitative effects when readers engage in encoding, retrieving, and generating textual information and that the facilitative effects for different text structures cannot be assumed for different tasks, presentation modes, or response modes. Therefore, a variety of text structures have been identified, according to the work presented by Meyer, Brandt, and Bluth (1980) and included in the passages, namely, descriptive, comparative, sequential and causal.

Varying the structure of a passage is assumed to remove any potential confounding due to these variables by balancing out any of the possible effects of a particular structure; therefore, the training passages have been selected so as to include a variety of structures such as comparative (the Natural Resources passage), descriptive (the AIDS passage), and sequential (The Dinosaur passage).

The second concern is that each passage contain similar topics so as not to raise a question of comprehension differences resulting from differences either in a subject's familiarity with a topic or the degree of reading comprehension proficiency required to process that topic. For example, it is possible that it is easier to process a passage in the area of English, or non-technical prose, versus science which is technical. Based upon these considerations, the passages have been selected from the eighth-grade science curriculum. The first summary training topic concerns the earth's "Natural Resources", the second training topic includes a passage on "Dinosaurs", and the posttest passage includes a topic on "AIDS" (see Appendices J-L for the respective passages in their entirety).

Furthermore, all passages were selected in accordance with Kintsch and van Dijk's (1978) criterion for selecting a suitable text for investigating text processing. This criterion stipulates that the passages are approximately 800-1500 words in length, well-structured, in terms of their having an easily identifiable structure (e.g., compare/contrast) and, understandable without technical knowledge.

The text passages that were used in this study were selected through the assistance of two sources. The first source of assistance was from a Nassau County public librarian who used the Junior High School Library Catalog (fifth ed., 1985) in the selection process. According to this catalog, the text selected is appropriate for an eighth-grade reading population. Although the texts are appropriate for the sample, parts were slightly rewritten as a means to facilitate the propositional scoring analysis that is described below. The second source of assistance was from a curriculum coordinator who is employed by a New York City parochial school who selected the two training passages from a pool of commonly used passages employed in her school's science classes. Although

differences in general knowledge may well be a factor across this sample, this cannot be completely controlled. Rather, neutral content domains were chosen, based on the assumption that most students have only a vague knowledge about the topics.

Material for the summarization training consisted of the two expository prose passages mentioned above, namely, the passages on the earth's resources and dinosaurs (see Appendices J-K). The subjects read these passages and received the summary instruction through the aide of an overhead projector. Both of the training passages have been summarized according to the method listed in the procedure section (as described below) and placed on a transparency for presentation and instructional purposes (see Appendixes B-D).

Three transparencies were developed in accordance with the three main principles of summary instruction developed by Kintsch and van Dijk (1978). As will be described in detail below, these are: deletion, substitution of a superordinate, and integration. The first transparency identifies the first principle of

excluding unnecessary details and provides examples of such. The second transparency identifies the second principle of using a general term or proposition for a list of specific items or propositions. Finally, the third transparency represents the last principle of using a general term to integrate and condense the subject matter in its entirety. The transparencies include only the first two paragraphs of each passage.

Since the study involved the reading of text book passages and the formation of summaries, skills associated with reading comprehension (i.e., decoding skills and forming inferences), were assumed to possibly influence the relationship between the independent and the dependent variables employed in this study. Therefore, the subjects' reading comprehension levels were statistically controlled (as a covariate). Reading scores for the analysis were taken from the Comprehensive Tests of Basic Skills (Fourth Ed.).

Pilot Test Materials

A fourth expository passage, used for the pilot study, was selected using the selection criteria described above. The pilot passage was

selected from the earth science literature and concerned the topic of "Space Rockets" (see Appendix P). The subjects read this passage and received the summary and memory instruction using transparencies described above.

SCORING

Individual Propositional Analysis For Summary Training Protocols

The scoring method described by Boviar and Kieras (1985) in their Guide to Propositional Analysis for Research on Technical Prose was employed in this study. The method involves preparing a relatively formal representation of the semantic content of the material as expressed in the form of a list of propositions. This can be found in the appendix (see Appendices F-H). The scoring methods involve "all-or-none" scoring; a proposition is counted either as recalled, or as not recalled, and no partial credit is given. Consistency in scoring is the most important aspect of scoring. Hence, Bovair and Kieras note that the scoring of the summaries demands that criteria be

strict, allowing only close reproductions of propositions, meaning the proposition must be reproduced in the protocol exactly or by a close synonym.

A strict scoring procedure is easier to perform and results in more consistency than liberal scoring which allows for more generalizations. Credit for closely reproduced responses in the protocol will be given because subjects rarely produce protocols that are word for word exactly the same as the original text; thus some degree of latitude in interpretation is necessary.

Following the Bovair and Kieras method, each of the subject's summary protocols was subjected to a propositional analysis and then compared to the propositional analysis of the original passage that is listed in the appendix section. Propositions, either exact or close in meaning, appearing in the subject's protocol and matching the appendix' received a score of 1. The total possible score for each passage is the total number of text propositions as listed in the appendices. An example of the scoring protocol can be viewed in Table 2. As can be viewed, each text proposition is

Table 2

Example of a Scoring Protocol

<u>Proposition</u>	<u>Subject</u>	<u>Score</u>
<u>0</u>		<u>1</u>
P1.	(WHAT P2)	
P2.	(ISA AIDS DISEASE)	
P3.	(DESTROY AIDS SYSTEM)	
P4.	(MOD SYSTEM IMMUNE)	
P5.	(ISA SYSTEM DEFENSE)	
P6.	(MOD DEFENSE CELLS)	
P7.	(KILL AIDS PEOPLE)	

listed along with the subject's possible score.

Summary protocols for the pilot study sample were also collected and subjected to the same propositional analysis technique that is described above. Two examiners scored each of the protocols according to the procedures described above. Using the pilot study protocols, comparisons were made between the two examiner's scores in an effort to achieve conformity in scoring. Where large discrepancies occurred (greater than five points), the two examiners met to resolve the conflict.

Individual Propositional Analysis for Recall Protocols

All students, regardless of the experimental condition to which they were assigned, were required to first read a passage and later take a free-recall essay examination. Each of the subjects' essay tests, i.e., recall protocols, were scored in exactly the same manner as listed above.

Main Idea Analysis for Training Summary and Recall Protocols

Main idea propositions have been developed, according to the forementioned criteria, for each

paragraph of the three experimental passages (see Appendices M-O). These propositions served as a scoring template to ascertain the number of main ideas that the subjects recalled. Similar to the individual proposition analysis, the method consists of "propositionalizing" the subjects responses according to the original version and comparing the two resulting sets of response propositions. Thus, the analysis examined how the content of these responses compared to the templates listed in appendices M-O. Scores of 1 or 0 were given depending upon the presence of propositional matches.

As indicated earlier, a free-recall, essay test was administered to all of the students one-week after the presentation of the third text passage. Each of the essays were propositionalized according to the previously described method. Comparisons were made between the main idea statements (listed in appendices M-O) and the subject's essays (free-recall protocols). Again exact or close reproductions, e.g., synonyms, were given a score of 1, if no such comparisons could be given, a score of 0 resulted.

Procedure

Pilot Study Sample Summary Instruction

A pilot test with 30 eighth-grade subjects was undertaken prior to the initiation of this experiment. The subjects were selected by the school's principal. The class was not composed of any specific track or mastery level. The purpose of the pilot testing was to assess the measurement instruments, and refine any methodological problems inherent in the model. As previously indicated, the Guido and Colwell (1987) procedure had not received an adequate validation analysis; hence, the need for a pilot study to fill this void. Moreover, the memory enhancement strategy, the teaching of a mnemonic device, was developed for this study and had not been validated.

All pilot subjects received the summary instructions described below, i.e., sessions 1-4, and the same orientation and instruction as the Summarization plus Mnemonic group that is described below.

The subject group was then asked to discuss their customary methods for studying and preparing

reading passage outlines. The subjects were then introduced to the summarization instructions in which the method developed by Guido and Colwell (1987) was employed. Subjects were first provided with an expository passage to read on the topic of "Space Ships" (see Appendix P). Then, the examiner introduced the tasks of summarizing each paragraph according to the methods described below. For the second passage the subjects were provided with a passage entitled "What causes pollution" (see Appendix Q). The subjects' protocols were collected and analyzed for their propositional content as a means for ensuring that the steps did, in fact, lead the subjects towards preparing a "summarized" protocol.

Pilot Study Results

The thirty subjects' summarization and essay-test recall protocols were examined to ensure that eighth-grade students were able to understand the tasks and directions. A review of the protocols indicated that the subjects, indeed, were quite able to comprehend the nature of the tasks. Specifically, the subjects were able to produce the desired summarization protocols and mnemonic

devices, and employ those devices in their essay tests, in the form mandated by the instruction. Of the thirty subjects, 24 were able to summarize the second passage according to the instructional procedure. The remaining subjects required additional instructions in order to complete the assignment. Twenty-one of the subjects were able to independently develop a mnemonic device, with the remaining subjects requiring further instruction.

As a result of the pilot study, a brief discussion was added to the initial orientation that reviewed the definitions of a sentence, a paragraph, an essay, a main idea and its supporting details, and as well as defined some of the differences between a text book presentation and other types of written material (e.g., text books contain sections and headings). Also included in the initial orientation was a brief discussion of general study skills which included the concepts of memory and summarization skills, and how they can be of value to them. A full description of the orientation directions can be found below.

Training Procedures

Sessions 1-3: Orientation and Summary Instruction

Orientation. All students received a general orientation. The experimenter greeted each of the three classes and explained the purpose of the study in the following way:

"Hello, I want to thank all of you who will participate in my learning and memory program and explain what we will be doing over the next several days. The tasks that I will ask of you are not difficult, they are probably similar to the kinds of work that you are use to doing. I will explain all of the details as we go along but, just to give you a general idea, we will review some ways to study for essay tests."

"I would like to teach you a way to read through text books and then better summarize what you have read, meaning to form and identify the major ideas of text book paragraphs. By the way, what is a paragraph? It is a group of sentences that are organized around one main idea that work together to explain, describe, or discuss that idea. What

is a main idea? It tells you what the paragraph is about and is based on "unity;" that all the ideas and information in that paragraph are directly related to one main point. What is a summary? It's a way to organize the paragraph and your ideas about it."

"Next, we will discuss ways to better remember what you have summarized. What is memory? There are basically two types of memory. One is short-term, when you are trying to keep something in your head for a short time, like a phone number. The other, long-term memory, is when you are trying to remember something that you have learned like a reading assignment for a test."

At this juncture, the orientation was specific to each of the three training conditions (as described below).

Summarization and Mnemonic Condition

For the Summarization Strategies Plus Mnemonic condition, the examiner added the

following to the orientation:

"First you will be taught a way to summarize, meaning to form and identify the major ideas of textbook paragraphs. The ability to read a passage and summarize its content is probably the most important study skill that you can learn. The ability to summarize a passage effectively will help you in all of your classes because it allows you to create a list of main ideas and details. My goal for you is to learn a way of summarizing that is easy and works well. You will learn a way to help you remember what you have summarized."

"I will teach you a type of memory trick that is called a "Mnemonic Technique." We will learn to make "Acronyms" that are words made by taking the first letter from each word that you want to remember and making a new word from all of those letters. For example, "SCUBA" stands for self-contained under water breathing apparatus. You will eventually see that in making a word such as this, you can remember a great deal of the passage at a later time if you can remember the word.

Finally, I will ask each of you, on your own, to demonstrate what you have learned by reading a passage, forming a summary and mnemonic technique, and by taking an essay test."

Summarization-Only Condition

For the Summarization-Only training condition, the examiner discussed the above orientation as it relates to summarizing a passage only. Then, the class, as a group, discussed ways to remember-study the summaries that were made. Finally, the subjects were told that they were expected to individually read a passage, form a summary, and take an essay test.

Mnemonic-Only Condition

For the Mnemonic-Only condition, The subjects received the part of the orientation described above that relates to memory instruction. Following this, the class as a whole, discussed ways to summarize a passage, meaning, to form and identify the major ideas

presented in the passage. Finally, the subjects were told that each of them were expected to individually read a passage, form a summary, apply the memory technique learned, and to take an essay exam.

Instructional Steps

Deletion. Session 1 in the Summarization plus Mnemonic training and the Summarization-Only training conditions consisted of specific summarization instructions in which the method developed by Guido and Colwell (1987) was employed. Subjects were first provided with an expository passage to read on the topic of "Natural Resources." Then the examiner introduced the task of summarizing each paragraph. The definition centered around the capturing of main ideas presented by the author in as few words as possible. The examiner stressed that the main idea of the passage should be a short summary of what the paragraph told about the topic. Next, the subjects were taught specific strategies for creating summaries.

The subjects were informed that their instruction would include three separate phases, with the first being a strategy of deletion. Using an overhead projector, the subjects were presented

with Guido and Colwell's first principle of summarization, namely, "do not include unnecessary details, even if they are interesting to you" (see Appendix B). The subjects were provided with a copy of the passage and shown the transparency depicting the first principle while the examiner reiterated that "deletion" consists of trimming away information that is either unimportant and/or repetitive. The transparency shows the examiner's application of this principle for the first paragraph of the "natural resources" passage. The examiner explained, using a sentence-by-sentence procedure, just what and why certain material was deleted. Again, they were reminded that repetitions and trivia should be deleted.

Next, the subjects were asked to make deletions (on their own) in the second paragraph, on the handout. Once the subjects completed the paragraph in this fashion, the examiner performed a sentence-by-sentence analysis of the paragraph while engaging the subject's participation. For each sentence, the examiner asked the class, as a whole, to indicate what information should be included or deleted and why. The class was then instructed to complete the remainder of this

passage as well as the passage on "Dinosaurs" in this fashion. Questions were then accepted while the examiner offered assistance where needed for the remainder of the period.

Session 2: Substitution. Session 2 began with a review of the previous session. In session 2 the subjects received instruction in forming superordinate terms for a list of more specific items, actions, or propositions included in the original paragraph. Using the overhead projector, the subjects viewed a transparency (see Appendix C) depicting the second principle of summarization, namely, "Use a general word for a list of specific items or action." The examiner reiterated that the purpose of this training was to teach a way of replacing a series or several "points" in the passage with a general term. Thus, during this training, the subjects were taught to substitute a series of propositions consisting of a single general concept with a general proposition. The subjects again viewed the transparency that was developed in session 1 (see Appendix B) that presented the "deleted" version of the first paragraph.

As shown on this transparency, a second version of the paragraph was uncovered that illustrated the product of substitution. The examiner then demonstrated how the general terms were formed from the original sentences. For example, the term "Renewable Resources" can replace the subordinate terms of water, air and soil." The subjects were then instructed to take each remaining paragraph in the passage and perform the same substitution techniques on them. Once completed, the examiner presented a transparency illustrating the technique for the second example paragraph (See Appendix C-lower half). The examiner then reviewed the determinants of each superordinate and entertained any questions that the subjects presented. The subjects were then instructed to practice the strategy on the second topic labeled "Dinosours."

Session 3: Integration. In this last phase of the summarization training, the subjects received instruction on the integration of superordinates into an overall main theme or topic sentence. Using an overhead projector, with transparency D displayed, the students were presented with the

third principle of summarization, namely, "Generating a summary of the paragraph as a whole." This session focused on selecting a "topic sentence" if one exists or, inventing one if there is no topic sentence available. The subjects then viewed the transparency that was previously presented in session 2 (see Appendix C). The subjects were reminded that the topic, the main idea of the paragraph, can be identified as the subject that was most frequently referred to in the paragraph. The subjects were also taught that there may be various referents for a particular subject. For example, a paragraph about Natural Resources might refer to them as "they" or "them." Next, the examiner modeled the process of constructing a topic sentence, if none existed, by examining the main idea terms with reference to their common theme. For example, the main idea terms of "conservation," "recycling," and "energy sources" all refer to the topic of "natural resources." The subjects were then provided with a summary sheet (see Appendix S) for constructing topic sentences, and asked to complete the task in the fashion described on the sheet, for the remaining paragraphs.

Training in the other conditions. Subjects in the Mnemonic-Only condition read the same passages used in the Summarization Plus Mnemonic and Summarization-Only training conditions in sessions 2-3, except that no direct teaching of summarization strategies were provided. Subjects in this condition were asked, as a group, to read the passages and to summarize them, by attempting to identify the paragraph's main ideas along with their supporting details. The examiner introduced the task of summarizing as the "capturing of the author's main ideas in as few words as possible."

This procedure differed from the experimental procedure in that it lacked the explicit instruction for each level of summarizing, that is, instruction in condensing, substituting, and integrating the passages. It was necessary to direct the subjects in this group to identify the main ideas along with their supporting details so that all of the subjects in the study received similar standardized procedures and therefore were working towards the same goals. The subjects were then asked to read the first passage on natural resources in its entirety. Next, the examiner asked the class, as whole, to review the first and second

paragraphs and describe their usual methods for studying text book passages.

Session 4: Mnemonic Instruction. Session 4 in the Summarization Strategies Plus Mnemonic and Mnemonic-Only conditions consisted of specific memory instructions in which the method of applying first-letter mnemonic techniques were taught. As discussed below, Mnemonic instruction varied as to whether or not the group received the summarization training.

Subjects who received the Summarization Strategies Plus Mnemonic condition (the Combined group) were asked to take-out their summarie sheets, developed in the summarization training procedures, for use in this session (see Appendix S). The goal of this training was for subjects to develop a memorization scheme like the one that is presented in appendix T. A four-step strategy for memorization of their summaries was introduced. First, the examiner presented Appendix T on an overhead projector. The examiner then reminded the subjects about the definition of the term "Mnemonics" as discussed in the "orientation" section. The subjects were then instructed to examine their own summaries (Appendix S) and then,

on a separate sheet of paper, horizontally list the passage's main theme across the top. Next, the subjects were instructed to select the supporting details that they deemed important enough to remember. The next step involved the development of acronyms from the first letters of each main idea statement. The examiner modeled the following steps on the blackboard. This involved the listing of the first letter of each main idea on their papers and to form a memorable word. The examiner called the attention of the class to once again view the overhead projector and demonstrated his selection of main idea and supporting detail terms and how each letter was selected to form the acronym. Next, using these letters, the examiner demonstrated how a word can be invented that is made up from a combination of these key letters, for example, the word "Rancer" for the following main idea terms: renewable resources, nonrenewable resources, conservation, recycling, and energy sources.

Next, the examiner listed, vertically, under the corresponding main idea letter, the first letters of each of the detail terms for each main idea. Again, the examiner demonstrated that a word can be invented that is made up from a combination

of these letters, beginning with the first letter of the main idea terms. For example, under the main idea letter "R", for renewable resources, the following subordinate terms can be found: Air, water, and soil. The examiner placed the "R" on the board and list the first letters of "air," "water," and "soil" beneath it. Subsequent to this action, the word "RAWS" appeared on the board. The examiner demonstrated this procedure with the remaining terms. When completed, the finished product appeared as a series of main idea acronyms across their sheets and a series of supporting terms descending from each of its corresponding main idea statements (see Appendix T).

The Mnemonic-Only training group was also asked to bring their summaries to this session. Similar to the above procedure, the examiner presented Appendix T in sections. The subjects were informed that their main ideas and supporting details may not be like those of the examiner's, but that the procedure and principles for learning the mnemonic technique will work regardless. The subjects in this group were asked to transcribe their main idea(s) and supporting terms on to a separate sheet of paper (Appendix S). The examiner

then demonstrated the mnemonic steps in a similar manner to the previous group. Again, The examiner instructed the subjects to list the main idea statements across their papers and to place their supporting terms beneath their corresponding main idea terms. Next, the examiner demonstrated the procedure of listing the first letters of these terms separately and forming acronyms as detailed in the above section.

Session 5: Mnemonic Instruction. The Summarization Plus Mnemonic and the Mnemonic-Only groups were asked to review the passage on "Dinosaurs" and to complete a mnemonic worksheet, in class, like the one they did on "Natural Resources." The examiner walked around the room to ensure that all of the subjects were completing the work and their questions were answered by the examiner as to the construction of these worksheets.

Training in the other condition. The Summarization-Only group read paragraphs from the same pool of passages used in the previous treatments but did not receive direct teaching of memory techniques. Instead, the subjects were asked to review the

passages and participate in a class discussion on how to remember what you have read. No explicit instruction was provided.

All training groups were given a new passage to take home and read (see Appendix L). All subjects were asked to prepare a written summary of the passage (to fill out Appendix S), as they had done previously, and to bring it with them on the next meeting, to be held on the following week;

The Summarization Plus Mnemonic and the Mnemonic-Only groups were asked to also prepare their mnemonic worksheets (Appendix I) for the passage, and to bring this as well.

Session 6: The examiner collected the subject's summaries and mnemonic worksheets and distributed, to all of the subjects, the test preparedness scale (see Appendix E). All subjects were asked to rate their sense of being prepared for the examination on a 5-point Lickert scale that will range from "feeling poorly prepared" to "feeling very-very prepared." The rating scales were collected upon completion. Next, the examiner distributed an essay examination that was based upon the take-home passage on the topic of "AIDS." The examiner asked

the subjects to recall as much of the passage as possible while focusing on the passage's main ideas and their supporting details. All subjects had 15-minutes to complete the text (see Appendices V & W).

Chapter IV

RESULTS

The analyses assessed the group differences in the dependent variables of summarization skills and recall for both main idea and supporting detail tasks as well as differences among the groups on a perception of test-preparedness scale. In these analyses, group membership is the independent (categorical) variable; scores on the passage summarization and recall, for both main ideas and supporting details, are the dependent (continuous) variables. The reading comprehension scores for the subjects (obtained prior to the treatment) were used as a covariate to ascertain whether they might be linearly related to the other dependent measures.

The analyses were performed in five main parts: First, a series of analyses of covariance were performed to see if the treatment groups differed on the dependent measures, and controlling for possible differences between the groups on their reading comprehension scores. Second, a series of 2 x 3 analyses of variance were performed

to see if group performance was differentially affected by the subjects' reading comprehension level. Third, two analyses of variance were performed to evaluate whether or not the groups differed with regard to their reading comprehension and test-preparedness scores. Fourth, a linear regression procedure was used, as a more complete model, to test for differences in the relationship between the covariate and dependent variables across the groups. The analyses were conducted to determine if the covariate adjustments functioned in the same way for all groups (i.e., Parallel slope test). Finally, given that the slope test indicated a non-parallel relationship existed for one of the analyses, a full model (including the cross product terms representing the interactions), as well as terms for the group differences themselves, were included in the model.

Descriptive Statistics

Dependent measures studied in the model are (1) main idea summary scores, (2) supporting detail summary scores, (3) main idea recall scores, (4) supporting detail recall scores, and (5) subject self-rating scores on a test preparedness measure.

Table 3 presents both the observed means and, standard deviations for all variables, including reading comprehension (estimates that take into account the covariate). Means are given for the dependent measures.

As can be viewed in Table 3, the Summarization plus mnemonic (the Combined group) group achieved higher mean scores than the Mnemonic-Only and Summarization-Only groups on almost all of the dependent variables except the test-preparedness scale. Although the statistical significance of these findings are discussed below, the only significant group differences occurred between the Combined and Mnemonic-Only groups on the two summarization dependent variables. Although not significant, the groups varied in their performance. The Summarization-Only group achieved higher mean scores than the Mnemonic-Only group. The Mnemonic-Only achieved higher recall than the Summarization-Only group on both recall tasks. Thus, the Summarization training affected the subjects' scores on the summarization tasks in the expected direction. Similarly, the mnemonic training also affected the achieved scores for the recall tasks.

Table 3

Means and Standard Deviations of Summarization, Essay Test, and Test-Preparedness Scores by Group Participation

<u>Treatment Conditions</u>			
	Combined (n=22)	Summarization Only (n=23)	Mnemonic Only (n=23)
<u>Summaries-Main Ideas</u>			
Obs. M	4.82	3.52	2.0
SD	1.84	2.27	.95
Adj. M	4.72	3.55	2.06
<u>Summaries-Details</u>			
Obs. M	26.77	23.04	14.39
SD	11.48	19.76	8.91
Adj. M	25.29	23.54	15.31
<u>Recall-Main Ideas</u>			
Obs. M	4.27	3.04	3.22
SD	1.64	1.69	1.31
Adj. M*	4.12	3.09	3.31
<u>Recall-Details</u>			
Obs. M	23.50	16.83	17.87
SD	10.14	10.71	9.89
Adj. M*	22.60	17.13	18.82
<u>Reading Comprehension</u>			
Obs. M	80.3	71.9	70.1
SD	21.60	19.66	25.31
Adj. M*	-	-	-
<u>Test-Preparedness</u>			
Obs. M*	2.1	2.1	2.3
SD	.89	.87	.92
Adj. M*	-	-	-

*Note. Adj. M = Adjusted for the reading covariate (Subject's standardized reading comprehension score; range = 19-120, Comprehensive Tests of Basic Skills, Fourth Ed.) no standard deviations available for the adjustments).

As indicated previously, a subject's score on the reading comprehension measure was assumed to be related to his/her performance on the dependent variables that were studied in this research. Therefore, it may be of interest to present the correlations between the reading comprehension scores and the dependent measures. Table 4 presents the correlations between the reading comprehension scores and the dependent measures.

Hypotheses Testing

Hypothesis 1 posited that the two groups who received the summarization training group would exhibit significantly higher main idea scores on a passage summarization task than the Mnemonic-Only group. As indicated above, a relationship was assumed to exist between the dependent variables and a student's ability to comprehend written material, measured by the reading comprehension variable. Therefore, an ANCOVA was performed using the treatment condition for the independent variable, the subject's performance scores for the dependent variable, and their reading comprehension scores as the covariate, to control for possible differences between the groups on this variable.

Table 4

Correlations on All Dependent Variables Including Reading Comprehension

	Main Summ.	Detail Summ.	Main Essay	Detail Essay	Reading Comp.	Test Prep.
Main Summ.	1.00 p=.	.826 p=.00	.448 p=.00	.463 p=.00	.261 p=.016	.068 p=.291
Detail Summ.	.826 p=.00	1.00 p=.	.555 p=.00	.637 p=.00	.397 p=.00	.211 p=.042
Main Essay	.448 p=.00	.555 p=.00	1.00 p=.	.775 p=.00	.382 p=.001	.379 p=.001
Detail Essay	.463 p=.00	.637 p=.00	.775 p=.001	1.00 p=.002	.343 p=.	.322 p=.026
Reading Comp.	.261 p=.016	.398 p=.000	.382 p=.001	.343 p=.002	1.00 p=.	.238 p=.026
Test Prep.	.068 p=.291	.211 p=.042	.379 p=.001	.322 p=.004	.238 p=.026	1.00 p=.

Note. "." is printed if a coefficient could not be computed.

The result of this analysis (see Table 5) indicates that even when taking reading achievement into account, significant group differences still exist ($F, (1,67) = 12.58, p < .01$), thus supporting this hypothesis.

A linear regression procedure was employed to determine specific differences between the groups in the presence of the covariate as well as to test for differences in the relationship between the covariate and dependent variable across the groups. Specifically, the analysis was performed to see if the covariate adjustments functioned in the same way for all groups (i.e., the parallel slopes test). Given that the slope test indicated a nonparallel slopes relationship (F change statistic, $F = 13.67, p < .01$), a full model, including the cross products terms representing the interactions as well as terms for the groups differences themselves, was included in the analysis.

The analysis indicated that the difference between the Combined group and the Mnemonic-Only (indicated by the Beta weight for the difference in the regression model) group is significant ($F, 6.54, p < .05$). Thus, under a restricted ANCOVA

Table 5

ANCOVA for Creating Main Ideas in a Summarization Task by
Group Participation

Source	DF	SS	MS	F-Ratio	Prob.
Covariate- Reading-Comp.	1	20.14	20.14	6.54	.013**
Main Effects- Group	2	77.45	38.73	12.58	.000*
Explained	3	97.56	32.53	10.57	.000
Residual	64	197.04	3.08		
Total	67	294.63	4.39		

* $p < .01$

** $p < .05$

model (i.e., allowing for nonparallel relationships between the covariate and dependent variables across the groups), only the difference between the Combined group and the Mnemonic-Only group is significant. Thus, Hypothesis I was only partially supported in that only one of the two summarization groups significantly performed higher the Mnemonic-Only group.

It is of interest that the Pearson Correlation Coefficient between the covariate and the summarization scores, for main ideas, is $r = .26$, $p < .05$). Although this is small, it is significant. Furthermore, the one-way ANOVA examining group differences on the covariate (see Table 6) indicates that the groups do not differ on this variable (F , (2, 67) = 1.33 $p > .05$). Despite these findings, the covariate adjustment to the summarization task scores (for main ideas) shows an increase for the Summarization-Only group (adjusted mean = 3.6) and a decrease for the Summarization and Mnemonic group (adjusted mean = 4.7) resulting in a nonsignificant difference in the full ANCOVA (linear regression) model.

The forementioned findings indicate that a significant relationship exists between the

Table 6

Anova for Reading Comprehension by Group Membership

Source	DF	SS	MS	F-Ratio	F-Prob.
Between Groups	2	1322.734	661.367	1.33	.272
Within Groups	65	32403.207	498.511		
Total	67	33725.9412			

covariate and subjects' scores on the main idea summarization task.

Based on this finding, that the covariate is at a significant level in the ANCOVA, a separate analysis was performed to investigate the relationship between a subject's pre-treatment reading comprehension level and his/her scores on this main idea summarization task. Thus the question arose as to whether or not high or low reading scores influence the affect of the training outcomes. To answer this question, the subjects' reading comprehension scores were split along the median to form two groups; one high and the other low. The data was subjected to a 2 x 3 (training group x reading comprehension level) ANOVA on creating main ideas on a summarization task. The ANOVA (see Table 7) revealed that no significant differences exist between the three training groups on this dependent variable when the groups are split into high (72-120) and low (19-71) standardized reading comprehension scores. Therefore, since the groups did not significantly differ, the hypothesis remains partially supported.

Table 7

ANOVA for Creating Main ideas in a Summarization task by
Group Participation and Reading Comprehension Scores

Source	DF	SS	MS	F-Ratio	Prob.
Main Effects					
Group	2	78.46	39.23	12.13	0.0*
Reading Comprehension	1	2.98	2.98	0.92	0.3
2-Way Interactions					
Group Split	2	1.42	0.71	0.22	0.80
Explained	5	94.02	18.80	5.81	0.00
Residual	62	200.61	3.24		
Total	67	294.63	4.39		

*p < .05

Hypothesis II posited that the two groups who received the summarization training would exhibit significantly higher supporting details scores on a passage summarization task than the Mnemonic-Only group.

Table 8 presents the results of an ANCOVA that was performed to examine the performance of the three training groups, the relationship between this dependent variable and the covariate, i.e., reading comprehension scores, and to control for the possible differences between the groups on this variable. The result of this analysis indicates that even taking reading achievement into account, significant differences exist between the three training groups ($F, 1, 67 = 3.57$ $p < .05$). Therefore, Hypothesis II was partially confirmed in that only one of the two summarization groups significantly outperformed the Mnemonic-Only group.

A linear regression procedure, similar to the one used in the previous analysis was constructed. Tests of the parallel slope hypothesis indicated that no significant interactions were present (F change statistic, $F = 1.03$ $p > .05$). Thus, the relationship between the covariate and the dependent variable did not vary across the groups in this analysis. Therefore, the regression

Table 8

ANCOVA for Creating Details in a Summarization Task by
Group Participation

Source	DF	SS	MS	F Ratio	F Prob.
Covariate (Reading Comp.)	1	2363.63	2363.63	13.38	.001**
Main Effects Group	2	1262.66	631.33	3.57	.034*
Explained	3	3626.29	1208.76	6.84	.000
Residual	64	11302.59	176.60		
Total	67	14928.88	222.82		

*p < .05					
**p < .01					

model included only group difference terms. The results of this analysis indicated that the Combined group obtained a significantly higher mean score as indicated by the Beta weight associated with this difference) than the Mnemonic-Only group ($F = 6.12$, $p < .05$). The results of the ANCOVA reveals a significant relationship to exist between the dependent variable and the covariate.

Another analysis was done to examine the possible relationship between subjects' reading comprehension levels and their performance on this dependent variable. Once again, the subjects were divided into two groups (high & Low reading levels) and a 2 x 3 (training group x reading comprehension level) ANOVA was performed (see Table 9) to examine whether or not the reading comprehension variable differentially affected the performance of the three groups. The result indicates that no significant differences exist between the groups on the detail summarization variable when the samples are divided into the high and low reading comprehension groups.

Table 9A

Anova for Creating Supporting Details in a Summarization
Task by Group Participation and Reading Comprehension
Scores

Source	DF	SS	MS	F-Ratio	Prob.
Group	2	1470.16	735.08	3.67	0.03*
Reading	1	622.46	622.46	3.11	0.08
Comprehension					
2-way Grp X					
Read. Comp.					
Interactions					
Group Split	2	70.77	35.39	0.18	0.84
Residual	62	200.61	3.24		
Total	67	294.632	4.41		

*p < .05

Table 9B

Means and Standard Deviations of Recall and Summarization Scores by High Versus Low Reading Comprehension Level

		<u>Treatment Conditions</u>		
		Combined Group	Summarization-Only	Mnemonic-Only
<u>Reading</u>				
<u>Comp.</u>				
<u>level</u>				

		<u>Summaries-Details</u>		
Low	Mean	19.67	21.40	12.08
	SD	3.05	3.14	2.10
	n	6	15	13
High	Mean	29.44	26.13	17.40
	SD	2.78	4.49	2.70
	n	16	8	10
		<u>Summaries-Main Idea</u>		
Low	Mean	4.83	3.27	1.77
	SD	2.26	1.18	.88
	n	6	15	13
High	Mean	4.81	4.00	2.30
	SD	1.05	1.50	.79
	n	16	8	10
		<u>Recall-Details</u>		
Low	Mean	17.67	16.33	17.33
	SD	2.52	2.54	2.20
	n	6	15	13
High	Mean	25.69	17.75	18.50
	SD	2.82	3.18	2.90
	n	16	8	10
		<u>Recall-Main Ideas</u>		
Low	Mean	3.17	2.93	3.00
	SD	.90	1.07	.88
	n	6	15	13
High	Mean	4.69	3.25	3.50
	SD	1.15	1.17	1.10
	n	16	8	10

Hypothesis III Posited that the two groups who received the mnemonic training would exhibit significantly higher main idea scores on a recall task (essay-test) than the Summarization-Only group. Table 10 presents the results of an ANCOVA that was performed to examine group performances and to control for possible differences between the groups on the reading comprehension task. The result of this analysis indicates that no significant differences appear between the three groups ($F, 67) = 2.93$ $p > .05$). Therefore, Hypothesis III was not confirmed. However, as can be seen in Table 10, the F - probability level is $p = .06$, just missing statistical significance. Thus, even though the hypothesis is not substantiated, the .06 finding is suggestive of a possible treatment affect.

Since the ANCOVA indicated no significant differences between the groups, results of the linear regression analysis are not relevant.

The ANCOVA finding indicates that a significant relationship exists between the covariate and the main idea recall measure. Once again, the groups were split to investigate whether or not subjects having high or low reading

Table 10

ANCOVA for Recalling Main Ideas in an Essay Test-Recall
Task by Group Participation

Source	DF	SS	MS	F Ratio	F Prob.
Covariate- Reading- Comprehension	1	25.76	25.76	11.9	.001*
Main Effects- Group	2	12.67	6.33	2.93	.061
Residual	64	138.57	2.16		
Total	67	177.00	2.64		

*p < .01

comprehension scores affects the training outcome. An ANOVA procedure, that is similar to the one used in the previous analysis (2 x 3 training x reading comprehension), was performed for the main idea scores on the recall task. The ANOVA revealed (see Table 11) that no significant differences exist between the training groups. Thus, once again, the result of the preceeding analyses indicates that Hypothesis III is not supported.

Hypothesis IV posited that the groups who received the mnemonic training would exhibit higher supporting detail scores on a recall task (essay-test) than the Summarization-Only group. Table 12 presents the results of an ANCOVA that was performed to examine the group differences and to control for possible differences between the groups on this measure. The results of this analysis (see table 12) indicate that even when controlling for the covariate, no significant differences appear among the groups in terms of their scores for essay test details ($F(2, 67) = 1.84$ $p > .05$).

Once again, the forementioned findings indicate that a significant relationship exists between the covariate and the supporting detail recall measure. Therefore, the groups were divided

Table 11

ANOVA for Recalling Main Ideas on a Essay Test-Recall Task
by Group Participation and Reading Comprehension Scores

Source	DF	SS	MS	F Ratio	F Prob.
Group	2	10.88	5.44	2.32	0.012*
Reading	1	8.11	8.11	3.46	0.107
Comprehension					
2-Way Grp X Read. Comp. Interactions					
Group Split	2	3.92	1.96	0.84	0.438
Total	67	177.00	2.64		

*p < .05

Table 12

ANCOVA for Recalling Passage Details on an Essay Test-
Recall Task by Group Participation

Source	DF	SS	MS	F Ratio	F Prob.
Covariate- Reading- Comprehension	1	871.46	871.46	9.02	.004*
Main Effects Group	2	354.97	177.49	1.84	.167
Residual	64	6184.79	96.64		
Total	67	7411.22	110.62		

*p < .05

into high and low reading comprehension scores to investigate if these levels affected the training outcome. An ANOVA procedure (2 x 3 - Training group by Reading Comprehension) was performed for the detail scores on the recall task. The ANOVA revealed (see Table 13) that no significant differences exist between the training groups. Thus, hypothesis IV was not supported.

Hypothesis V tests the general assumption that posited that the Summarization and Mnemonic group (Combined) would score higher than the Summarization-Only and Mnemonic-Only groups on all measures of summarization and recall. As previously presented, the combined group achieved higher scores than the other groups on several tasks (see Table 3). In terms of creating summaries and including main ideas (Hypothesis I), the result of the linear regression analysis indicated that the Combined group achieved higher mean scores, than the Summarization-Only group and achieved significantly higher scores than the Mnemonic-Only group. In terms of performance on creating summaries and including details (Hypothesis II), the result of the linear regression analysis indicated that the Combined group achieved higher

Table 13

ANOVA for Recalling Supporting Details on an Essay Test-
Recall Task by Group Participation and Reading
Comprehension Scores

Source	DF	SS	MS	F-Ratio	Prob.
Group	2	350.28	175.14	1.66	0.19
Reading	1	155.66	155.66	1.47	0.23
Comprehension					
2-Way Grp X Read. Comp. Interactions	6	142.57	71.28	0.67	0.51
Residual	62	6537.18	105.44		
Total	67	7411.22	110.62		

scores than the Summarization-Only group and significantly higher scores than the Mnemonic-Only group. With regard to essay test performance and recalling main ideas, the Combined group performed higher than the Mnemonic-Only and the Summarization-Only groups, but not so significantly.

As Table 10 reveals, the significance was just missed with a $p = .06$ probability level. Finally, in terms of essay test performance and recalling details, the Combined group performed higher than both the Mnemonic-Only and Summarization-Only groups in terms of group means but, these differences were not significant. Thus, Hypothesis V was only partially supported. The Combined group scored significantly higher than the Summarization-Only and the Mnemonic-Only groups on the summarization measures only. In terms of the recall measures, the Combined group just missed statistical significance on the main idea recall measure and they did not achieve significance on the supporting detail recall measure as well.

Hypothesis VI posited that the Summarization and Mnemonic group would outperform the

Summarization-Only and Mnemonic-Only groups on a measure of test preparedness. Table 14 presents the results of an ANOVA for test preparedness scores by group participation. The ANOVA reveals that the groups did not significantly differ on this single item measure ($F(2, 67) = .278$ $p > .05$). Thus, Hypothesis VI was not supported.

A final analysis addressed the question as to whether or not the reading comprehension scores were different between those subjects who remained in the study and those who dropped-out. The means and standard deviations were computed for both groups and are as follows. For the group remaining, the score was: Mean reading comprehension = 74.029; standard deviation = 22.436. For the group that dropped-out, the score was: Mean reading comprehension = 69.673; standard deviation = 20.234. In view of these findings, it is unlikely that attrition influenced the results.

Table 14

ANOVA for Test Preparedness by Group Participation

Source	DF	SS	MS	F Ratio	F Prob.
Between Groups	2	.45	.22	.278	.758
Within Groups	65	52.69	.81		
Total	67	52.51			

Summary Statement

The present research was undertaken to examine the effectiveness of two instructional techniques on a students' ability to summarize and recall text book passages. A model was developed to explain the effects of the instructional technique on various dependent measures.

A series of one-way ANOVAS, ANCOVAS, and regression analyses were calculated to analyze the hypotheses. The analyses examined mean-group differences in summarization skills, recall performance, and the subjects' sense of feeling well-prepared to take an exam (test-preparedness). A pre-treatment variable, reading comprehension, was used as a covariate in that it was expected to exert an influence on the performance of the dependent variables.

Hypothesis I posited that the two groups who received the summarization training would exhibit significantly higher main idea scores on a passage summarization task than the Mnemonic-Only group. Hypothesis I was partially supported in that only one of the two summarization groups significantly outperformed the Mnemonic-Only group. The linear regression analysis revealed that only the

difference between the Combined and Mnemonic-Only groups was significant. Although not significant, the Summarization group did achieve a higher mean score than the Mnemonic-Only group favoring the expected prediction.

The results of the 2 x 3 ANOVA (training group by reading comprehension level) indicated that when the training groups were split according to high versus low reading comprehension scores, no significant differences among the groups occurred.

Hypothesis II posited that the two groups who received the summarization training would exhibit significantly higher supporting detail scores on the summarization task than did the Mnemonic-Only group. This hypothesis was partially supported in that the findings indicate that only one of the two summarization groups, the Combined group, achieved significantly higher scores than the Mnemonic-Only group. The result of the 2 x 3 ANOVA (training group by reading comprehension scores) indicated that the subjects' reading comprehension levels did not significantly, differentially, influence the effect of the summarization training.

Hypothesis III posited that the two groups who received mnemonic training would exhibit

significantly higher main idea scores on a recall task than the Summarization Only group. Hypothesis III was not supported. When the data were subjected to an ANCOVA, the result revealed that the differences were not significant. The result of the 2 x 3 ANOVA (training group by reading comprehension levels) indicated that the subjects' reading comprehension levels did not differentially influence the effect of the Mnemonic training. However, as indicated previously, the significance test was just missed ($p = .06$) suggesting that the training was somewhat effective in producing training group differences.

Hypothesis IV posited that the two groups who received the mnemonic training would exhibit higher supporting detail scores on a recall task than the Summarization-Only group. Hypothesis was not supported in that the groups did not differ significantly on the 2 x 3 ANOVA or the ANCOVA calculations. However, the groups' mean scores did differ, although not significantly, in the expected directions with the Mnemonic-Only group performing higher than the Summarization-Only group.

Hypothesis V posited that the Combined group would outperform both the Summarization-Only and

Mnemonic-Only groups on all measures. Hypothesis V was not supported. However, for all of the summarization and recall measures, the Combined group achieved the highest mean scores, although no significance resulted. In terms of creating summaries and including main ideas, the Combined group scored significantly higher than the Mnemonic-Only condition when the data was adjusted for the covariate. In terms of the subjects' performance on including passage details in their summaries, the ANCOVA revealed that the combined group performed significantly higher than the Mnemonic-Only condition.

In terms of including passage main ideas in their essays, the findings revealed that when the data were adjusted for the covariate, the groups did not significantly differ, although the means differed in the expected direction with the Mnemonic training groups achieving higher recall scores than the Summarization-Only group. In terms of the subjects' performance on including passage details, no significant results were found in the 2 x 3 ANOVA or ANCOVA. However, the groups performed in the expected direction with the Combined group obtaining the highest mean score followed by the

Mnemonic-Only group.

Hypothesis VI posited that the Combined group would obtain higher scores than the remaining groups on a measure tapping the subjects' sense of feeling well-prepared to study and take an essay exam. The results of an ANOVA reveals that the groups did not differ on this single-item measure. However, it should be noted that the measure was limited to a single item that had subjects select one of four choices that best described their feelings. Consequently, the variance was constricted on this measure and, this coupled with a small sample size, may account for this measure's poor showing.

Chapter V

Discussion

The main purpose of this study was to examine the effectiveness of an instructional method for enhancing a subjects' skills for summarizing and memorizing text book passages. In pursuit of this goal, several other models, theories, and techniques have also received additional empirical support. Specifically, this study sought to extend Kintch and van Dijk's (1978) and van Dijk and Kintch's (1983) model of text processing and comprehension and the cognitive theorists account of retrieval and accessibility (e.g., Tulving, 1983, 1985). In addition, two new instructional techniques were tried and evaluated in this study. As mentioned previously, Guido and Colwell (1987) have developed a novel approach for teaching text book summarization skills but, it has never been subjected to a formal data collection and analysis. The second technique, teaching subjects to form acronyms from their own summaries, was developed for this study and also lacked any formal empirical support.

It was assumed that study skills are learned abilities that help students to organize and direct

the effort they invest in learning. The use of these skills is thought to result in students becoming more effective and efficient in the process of acquiring knowledge and competence. Given these assumptions, it was hypothesized that a subject's skills in summarizing and memorizing text book material would improve as a result of his or her receiving explicit instruction in these two tasks. This study examined how students would perform on summarization and recall tasks after receiving training in either summarization, memorization, or summarization and memorization combined. In addition, it was hypothesized that those subjects who received the combined summarization and memorization training would gain a greater sense of feeling prepared to answer essay-tests than subjects who received only training in summarization or memorization individually.

The instructional technique that was employed in this study consisted of two phases, namely, the summarization training and memorization training. During the first phase of the study, two of the three training groups received the summarization training method that was proposed by Guido and

Colwell (1987). As the reader may recall, the Guido and Colwell procedure combined the instructional models of Kintsch and van Dijk (1978) and Brown and Day (1983) into a summary writing technique. The Guido and Colwell model presents a direct method for teaching summary writing and is particularly novel in that it calls for the instructor to construct instructional transparencies depicting the passage transformations. As indicated previously, it has not been empirically supported nor does their proposal provide extensive examples of how to actually apply the procedures, such as developing the transparencies.

The first phase of this study examined the effectiveness of applying the Guido and Colwell (1987) procedures to a junior-high school sample of students. The present findings suggest that for those groups receiving the summarization training, their summarization skill performance was positively influenced. The efficacy of the approach received partial support. Specifically, the results of this study indicate that the Combined group, which received both the summary and mnemonic instructions, achieved significantly higher mean scores on the main idea and supporting details

summarization tasks than the Mnemonic-Only group where no summarization training was offered. However, when comparing the performance of the Summarization-Only group with the Mnemonic-Only group, no significant differences resulted, although the former did achieve higher mean scores. Thus, these findings provide partial support for the efficacy of the Guido and Colwell (1987) approach to summarizing text book passages.

In the discussion of the pilot study that was presented previously, when the summarization approach was administered, the subjects were easily able to follow the presented directives and tasks. Moreover, based upon the results of the analyses, it can now be suggested that the procedure, when combined with the mnemonic instruction, appears to be a useful means for teaching students a fast and simple summarizing procedure.

The second phase of the study included the mnemonic instruction training. As the reader may recall, the students who received this training learned how to form acronyms from the summaries which had been developed during the summarization phase. As discussed in the presentation of the pilot study, the subjects were able to meet the

demands of the mnemonic training. After only a short period of instruction, the subjects were able to independently use their passage summaries as a basis for the construction of acronyms.

The present findings reveal that the mnemonic training was not significantly effective in improving the subjects' recall scores. However, the results do suggest that the mnemonic training may have influenced the recall scores to some degree in the main idea recall analysis, where statistical significance was nearly obtained. The Summarization and Mnemonic and Mnemonic-Only groups did perform in the expected direction by achieving higher mean recall scores than the Summarization-Only group where no such training was received. Of course no direct conclusions can be made since these results may have occurred by chance alone.

As the reader may recall, when reviewing the results of the ANCOVAs, the covariate (reading comprehension scores) is always at a significant level. Therefore, the question as to whether or not the subjects' reading comprehension level interacted with the effects of the training was addressed. In response to this issue, the entire sample was split according to (the Median) high and

low reading scores. Four separate 2 X 3 ANOVAS (reading score by training condition) were then calculated and, all four ANOVAS were found to be non-significant, indicating that a subjects' reading score does not significantly interact with the treatment affects. However, a number of interesting trends were found. For example, When looking at the results of the main idea summarization training, for those subjects comprising the Combined group, reading comprehension scores do not affect the benefit derived from the instructional intervention, whereas in the Summarization and Mnemonic-Only groups, higher reading scores do appear to boost performance (see Table 9B).

When examining the results for the supporting detail summarization scores, for the Combined group, their performance differed appreciably on this performance measure. However, for the Summarization-Only and Mnemonic-Only groups, higher scores on the reading comprehension measure appears to positively affect the benefit derived from the instructional interventions.

Thus, one interesting finding is that the reading comprehension split did not appreciably

affect the Combined group on the main idea task whereas on this task, a very large (but non-significant) difference occurred. For the second phase of the study, the results also revealed that some (non-significant) training group by reading comprehension level interactions occurred. For the main idea recall measure, when the Combined group was split for low versus high reading comprehension scores, their performance differed appreciably on the performance measure. In contrast, for the Summarization-Only group, higher scores on the reading comprehension measure appears to affect the benefit derived from the instructional interventions to a much lesser degree.

For the supporting detail recall task, an analysis of the group means reveals that when the Combined group was split for low versus high reading comprehension scores, their performance differed appreciably on the performance measure. In contrast, for the Summarization-Only group, higher scores on the reading comprehension measure do appear to affect the benefit derived from the instructional interventions to a much lesser degree. In sum, for the Combined group subjects, reading comprehension scores did not appear to

influence the affect of the summarization training, whereas for the remaining groups, reading comprehension was a factor. In contrast, for the recall tasks, reading comprehension level was a factor for the Combined group while for the remaining groups it did not appear influential. These findings are perplexing and no clear explanation can be offered at this time.

Kintsch and van Dijk (1978) proposed that the reader forms a gist, composed of propositions, of the text while encoding and that it is hierarchical in structure. As the reader may recall, this process is considered to be crucial to the retrieval system in that by hierarchically subordinating the text propositions under various levels of possible main ideas, an efficient retrieval structure is formed. Kintsch and van Dijk reasoned that the longer a proposition is carried along in one's short-term memory, the more likely that it will be recalled. If a main idea is recalled, it is believed to act as a retrieval cue for material that is organized below it.

The findings of this study do not provide significant support for these hypotheses. Although the two groups that received the mnemonic training

did score higher mean recall scores than the Summarization-Only group, the findings were not significant. In learning the mnemonic technique, the subjects initially composed a list of main ideas, one per paragraph, and then constructed an acronym for each of the main ideas. This process demands from the subjects that they select a main idea along with its subordinate supporting details, hence they are hierarchically listing the text's propositions. Once this process is completed, the subject's then formed acronyms which were based on the selected propositions.

This process demanded from the subjects that they form the acronym, retain it in their short-term memories, and write-out in full what the acronyms stood for. Thus, in terms of the Kintsch and van Dijk hypothesis, the subjects identified the main ideas in the text passages and were keeping them in their short-term memories; ready for recall. Once again, the findings do not significantly support these assumptions although for the main idea recall analysis, statistical significance was nearly attained and both of the mnemonic training groups achieved higher mean recall scores for main ideas than the

Summarization-Only group.

As mentioned above, Kintsch and van Dijk (1978) also proposed that if a main idea is recalled it will act as a retrieval cue for the subordinate propositions. This study examined this proposal by having the subjects design their summaries with their main idea selections listed and the supporting details descending beneath them. The subjects were instructed to develop their acronyms in such a way as to include both the supporting and main idea details. It was assumed, in this study, that if the main idea was recalled, at least some of the associated supporting details would be retrieved as well. Although the present findings indicate that the training groups did not significantly differ in terms of their recall of supporting details an inspection of the group means suggests that the groups differed in the expected direction.

The findings of this study also provide some data concerning the issue of "forgetting" that is commonly investigated by cognitive theorists such as Tulving (1983, 1985). Typically, these theorists propose that forgetting results not from a permanent loss of information but from temporary

inaccessibility. The belief is that the retrieval process involves the contact of a cue with event information in memory. In order to retrieve the stored information from memory, some attribute or aspect of that information must be reinstated at retrieval; at least to some extent. Retrieval failures are believed to be due to too few cues and/or inadequate cues. This study was designed to ensure that the retrieval cues and the event information (text book passages) were nearly the same. Thus, it was assumed that if the acronyms (cues) were recalled, more event information would be retrieved from the subjects' memory. As discussed above, little support for this hypothesis was found but, the results do indicate that the groups differed in the expected directions, particularly when examining the result of the main idea recall analysis where near statistical significance was attained.

The present study also posited that the Combined group would outperform the Summarization-Only and the Mnemonic-Only groups on all of the dependent measures. This hypothesis received partial support from the findings. As can be seen in Table 3, the combined group achieved higher mean

scores on all measures. In terms of creating summaries and including main ideas, the Combined group performed higher, in mean scores, than the Summarization-Only group and significantly higher than the Mnemonic-Only group even when adjusting for the covariate variable. In terms of the subjects' performance on creating summaries and including details, the Combined group performed higher than the Summarization-Only group and significantly higher than the Mnemonic-Only group. With regard to the recall measures, when controlling for the covariate, the groups differed in the expected directions but they did not reach statistical significance.

The last part of the study posited that the Combined group would achieve higher scores on a test preparedness scale than either of the two remaining groups. The findings revealed virtually no differences occurred between the groups. One potential reason for this result is that the scale has a four-point range and that most subjects selected from only two or three of the four possible selections. This finding in conjunction with small sample sizes may account for the results.

Educational Implications and Future Research

Study skills involve specific, observable behaviors that can be described and measured. Study skills are processes for learning that help students to organize and direct the effort they invest in learning, and when used, they assist students in becoming more efficient and effective learners.

The main purpose of this study was to determine the possibility of teaching subjects a combined method for summarizing and recalling text book material. The use of text books is a major part of the junior and high school students learning experience. Despite this reliance on text book learning, most students receive little specific instruction in text book summarizing and recall. Effective summarization skills are perhaps the most useful study skills that students can learn. The ability to extract the most important elements of a text will prove very helpful not only in every academic setting but also in any area in which learners need to read a passage, identify its main ideas and details, and retain that information for some later purpose.

To summarize a passage effectively, students must have the skills to be able to identify main ideas and their supporting details within a written record. To teach these skills, this study employed a summarization technique that was developed by Guido and Colwell (1987).

As discussed previously, this method had not been subjected to formal data collection and analysis. As a result of the present study, the method presents as a useful means for teaching summarization skills when it is combined with mnemonic instruction. The approach is of use to educators in that it is relatively easy to administer and well-received by the students. Moreover, educators often view content and study skills as separate concerns and that each must be taught separately. The results of this study indicated that there is no need to segregate study skills instruction from the teaching of content areas. In fact, as can be gleaned from this study, the teaching of study skills within the context of the teacher's current curriculum is recommended. By incorporating the program into the students' classwork, the student is motivated to learn and develop the method and is thereby helped to see

both the immediate and long-term utility of its use.

The study also sought to provide students with a means to improve their memory of what they have read. Students are required to demonstrate their knowledge of many different kinds of material through the use of tests. Despite the central role that the examination holds, students rarely receive instruction that focuses on storing and retrieving the learned information. This study sought to teach the students several memory skills. The students learned about the concepts of short-term and long-term memory and were taught mnemonic techniques as a means of retrieving their stored information. Specifically the students learned how to form acronyms from their summaries as a means for remembering the text book passages that were read previously.

The results of this study have not provided support for the efficacy of this approach, although near significance was attained for the main idea analysis and training group differences occurred in the expected directions with the groups receiving the mnemonic instruction achieving higher observed mean scores.

Future Research

Two caveats regarding this study should be further researched in future investigations. The first concerns the possible diffusion of the treatments. The study was performed in a small school setting where the teachers and students were well-known to each other. Soon after the second training session, the teachers began to incorporate some of the procedures into their own instruction. Furthermore, many of these students study together and there may have been some inter-treatment diffusion by the students through these exchanges.

The second caveat concerns a possible experimenter effect on the study. Again, this study was conducted in a small school where the students receive most of their instruction from two or three teachers. The school's typical classes are highly structured and unvarying. It is possible that an experimenter effect may have occurred in that this study presented a very different mode of presentation. Because of its novelty, it may have produced some unexpected effect such as a greater pupil participation rate. In sum, any following research should take into account these considerations.

APPENDIX A
SCHOOL LETTERHEAD

Date

Dear Parents:

Our school is cooperating with the department of Educational Psychology of the CUNY Graduate Center in conducting a study of ways to improve a students' ability to learn and remember from textbooks. A number of our students will be asked to participate in this study. Bill Palmer, a School Psychologist, and Maralyn Mash, an Educational Evaluator, both from our school district, will be working with them during class. Students will be asked to spend approximately six periods, spanning over the time of two weeks, learning how to develop summaries of what they have read; then they will learn some techniques to help them better remember what they have studied. Finally, students will be asked to read a chapter (in a science textbook) and take an essay test (that will not "count in their grades").

We would like your permission to allow your child to be included in this study. All of the results will remain confidential. We would appreciate your completing the tear-off below and returning it to your child's teacher as soon as possible. If you have further questions about the project, please call Bill Palmer at 533-1440.

Sincerely yours,

Principal

I will permit my child to participate in the project.

I do not want my child to participate in the project.

Child's Name.-----

Teacher-----

Parent's signature-----

Appendix B

PRINCIPLE 1: DELETION

"DO NOT INCLUDE UNECESSARY OR REDUNDANT DETAILS-
EVEN IF ITS INTERESTING TO YOU"

Natural resources. we rely on the earth for the material needed for life. much of our food, clothes, and shelter comes from plants. The rocks in the ground supply us with metals to build machinery. The fuel to run machines and heat homes comes from the earth. These materials are natural resources.

Renewable resources. The water, air, soil, and forests are renewable resources. The water cycle allows us to use water again, forests can be replanted, fertilizers put chemicals back into the soil for crops to grow again. The air can also be reused.

The Brontosaurus was one of the largest. They grew to more than seventy feet. Much of the length consisted of a long neck and a longer muscular tail. It's hips, the highest part of its body, were fifteen feet above the ground and were raised by long, thick elephantlike legs capable of supporting the larger fraction of her thirty-ton body. It's forelimbs were short, heavy, and strong. It's shoulders were lower than the hips. It had tough, leathery skin with folds and wrinkles.

Both the forelimbs and the hindlimbs terminated in broad, somewhat rounded, padded feet, like the feet of an elephant, but was different too. The forefeet had a large inner claw, while the front probably had blunt nails. The hindfeet were longer, each a yard (or meter) in length and were eliptical and armed with three huge claws which slanted outward and dug into the ground when walking.

Appendix C

PRINCIPLE 2: SUBSTITUTION

"GENERAL TERMS CAN BE SUBSTITUTED
FOR A LIST OF SPECIFIC ITEMS AND
ACTIONS"

The Brontosaurus- one of the largest (70-ft) dinosaurs.
Body parts: long neck and longer tail, hips the highest
part (15-ft), elephantlike legs supported much of the
weight. Shorter forelimbs, shoulders lower than the hips.
Skin: ;eathery and wrinkled.

Limbs: rounded- padded feet, front: inner claw with blunt
nails.
Hind: longer (3-ft) with 3 claws which dig into earth when
walking.

Natural Resources: The earth is like a storehouse.
Plants: provides clothes, shelter, and food.
Rocks: provides metal for machines.
Fuel: to run machines.

Renewable Resources: can be replaced after use.
Water:recycled.
Air: recycled.
Soil: for growing crops again.
Forests: replaced.

Appendix D

PRINCIPLE 3: INTEGRATION

" A TOPIC CAN BE IDENTIFIED AS THE SUBJECT THAT
WAS MOST FREQUENTLY REFERRED TO IN THE
PARAGRAPH"

TOPIC: The Brontosaurus-description of body.

Referents to the Brontosaurus include:

Lines 1. the Brontosaurus, they.
2. they.
3. Brontosaurus.
4. it's.
6. her.
7. its.
8. its.
10. its.
12 its.

TOPIC: The Brontosaurus-Limbs.

Referents to the Brontosaurus includes: The reader had to infer a continuation of the Brontosaurus' body description from the previous paragraph. The last line in the paragraph provides the reader with the name "Brontosaurus" and so serves as "proof" that this is the subject of the paragraph".

Earth Provides Natural Resources.

Referents to the topic includes:

Line: 1. earth.
2. earth.
5. land, ground.
8. earth.

Renewable Resources Are:

Materials which can be reused.

Referents to the topic are:

Line: 2. renewable resources.
3. renewable resources, they.

Specific examples:

4. water.
5. forests.
6. soil.
7. air.

NAME _____

Appendix E

PLEASE READ AND CIRCLE THE STATEMENT THAT BEST DESCRIBES YOUR
FEELING OF BEING WELL-PREPARED - THAT YOU HAVE LEARNED THE
MOST IMPORTANT FACTS IN THE READING AND CAN ALSO REMEMBER
THEM- TO TAKE THIS ESSAY TEST.

I FEEL VERY VERY
PREPARED

I FEEL VERY
PREPARED

I FEEL THE WAY
I ALWAYS HAVE
BEFORE LEARNING
(Bill's) WAY

I FEEL POORLY
PREPARED

Appendix F

PROPOSITIONAL ANALYSIS FOR "WHAT ARE THE EARTH'S NATURAL RESOURCES?"

P001 (ISA EARTH STOREROOM)
P002 (MOD STOREROOM LARGE)
P003 (RELY PEOPLE EARTH)
P004 (FOR P3 MATERIALS)
P005 (COMES FOOD LAND)
P006 (COMES CLOTHES LAND)
P007 (COMES SHELTER LAND)
P008 (SUPPLY ROCKS MATERIALS)
P009 (FOR P8 BUILDING)
P010 (MOD BULIDING MACHINERY)
P011 (RUN FUEL MACHINES)
P012 (HEATS FUEL HOMES)
P013 (POSSESS EARTH FUELS)
P014 (ISA FUEL NATURAL RESOURCE)
P015 (IN-ORDER-TO P16 P17)
P016 (USE \$ NATURAL RESOURCES)
P017 (SURVIVE NATURAL RESOURCES)

P018 (ISA WATER NATURAL RESOURCE)
P019 (ISA AIR NATURAL RESOURCE)
P020 (ISA SOIL NATURAL RESOURCE)
P021 (ISA FOREST NATURAL RESOURCE)
P022 (ABLE-TO RESOURCES P23)
P023 (REUSED RESOURCES \$)
P024 (ABLE-TO REUSE P25)
P025 (REUSE PEOPLE FORESTS)
P026 (ABLE-TO REUSE P27)
P027 (REUSE PEOPLE SOIL)
P028 (FOR P27 REASON)
P029 (MOD REASON CROPS)
P030 (ABLE-TO REUSE P31)
P031 (PEOPLE REUSE AIR)

P032 (NUMBER-OF RESOURCES)
P033 (MOD RESOURCES NON-RENEWABLE)
P034 (ISA MINERAL RESOURCE)
P035 (MOD RESOURCE NON-RENEWABLE)
P036 (ISA OIL NONRENEWABLE)
P037 (ISA GAS NONRENEWABLE)
P038 (ISA COAL NONRENEWABLE)
P039 (USE PEOPLE RESOURCES)
P040 (MOD RESOURCES NONRENEWABLE)
P041 (DEGREE-OF P39 AMOUNTS)
P042 (MOD AMOUNTS LARGE)
P043 (WILL P44)
P044 (DEplete RESOURCES)

P045 (BECOME PEOPLE LARGER)
P046 (MOD LARGER NUMBER)
P047 (NEED PEOPLE LAND)
P048 (MOD NEED SURVIVE)
P049 (BECAUSE P50 P51)
P050 (NEEDED LAND)
P051 (MOD LAND MORE)
P052 (MEET RESOURCES NEED)
P053 (MOD RESOURCES MORE)
P054 (MOD P53 WATER)
P055 (MOD P53 AIR)
P056 (WILL P57)
P057 (EXIST RESOURCES)
P058 (MOD EXIST FUTURE)
P059 (LOOK PEOPLE P 60)
P060 (REPLACE THINGS MATERIALS)
P061 (MOD MATERIALS NONRENEWABLE)
P063 (USE \$ RESOURCES)
P064 (MOD USE CAREFULLY)
P065 (ABLE-TO \$ P66)
P066 (USE \$ CONSERVATION)
P067 (MOD USE CONSERVE)
P068 (IF P69 P70)
P070 (CONSERVE \$ RESOURCES)
P071 (MOD P70 PROPERLY)
P072 (MOD RESOURCES EXIST)
P073 (MOD P72 LONGER)
P074 (IF P75 P77)
P075 (CONSERVE \$ RESOURCES)
P076 (MOD P75 PROPERLY)
P077 (MOD RESOURCES LAST)
P078 (MOD LAST LONGER)

P079 (ISA P80)
P080 (DISPOSE EVERYTHING GARBAGE)
P081 (CAN P82)
P082 (DESPOSE ITEMS RECYCLED)
P083 (PAY COMPANIES METALS)
P084 (MOD COMPANY SOME)
P085 (MOD METALS PRODUCT)
P086 (ISA COPPER PRODUCT)
P087 (ISA LEAD PRODUCT)
P088 (ISA ALUMINIUM PRODUCT)
P089 (ISA PAPER PRODUCT)
P090 (ISA BOTTLES PRODUCT)
P091 (RECYCLED PRODUCTS P86-90)
P092 (MOD METALS USED)
P093 (RECYCLED \$ MATERIALS)
P084 (CONSERVE RECYCLING RESOURCES)
P085 (REDUCE RECYCLING GARBAGE)

P086 (ISA COAL FUEL)
P087 (ISA OIL FUEL)
P088 (ISA GAS FUEL)
P089 (MOD GAS NATURAL)
P090 (MOD FUEL FOSSIL)
P091 (MADE FUEL ORGANISMS)
P092 (MOD ORGANISMS PLANTS)
P093 (MOD ORGANISMS ANIMALS)
P094 (DURATION-OF P76 YEARS)
P095 (MOD YEARS - MILLIONS)
P096 (SUPPLY FUELS PEOPLE)
P097 (PROVIDE FUELS ENERGY)
P098 (MOD P97 MOST)
P099 (RUN FUELS MOTORS)
P100 (PROVIDE FUELS HEAT)
P101 (PROVIDE FUEL ELECTRICITY)
P102 (ISA FUEL RESOURCE)
P103 (MOD FUEL FOSSIL)
P104 (MOD RESOURCE NONRENEWABLE)
P105 (BECAUSE P106 P107)
P106 (REMOVE FUEL)
P107 (POSSESS EARTH FUEL)
P108 (MOD P107 LESS)
P109 (USE PEOPLE FUEL)
P110 (BECOME FUEL EXTINCT)

P111 (SERVE FUEL PEOPLE)
P112 (CAUSE FUEL PROBLEMS)
P113 (BECAUSE P114 P115)
P114 (BURN FUELS)
P115 (PRODUCE FUELS GASES)
P116 (MOD GASES HARMFUL)
P117 (POLLUTE GASES AIR)
P118 (MOD GASES HARMFUL)

P119 (POSSES WATER ENERGY)
P120 (MOD WATER RUNNING)
P121 (MOD ENERGY KINETIC)
P122 (REF. KINETIC MOTION)
P123 (POSSESS WATER ENERGY)
P124 (MOD ENERGY POTENTIAL)
P125 (MOD ENERGY STORED)
P126 (PRODUCE WATER ENERGY)
P127 (MOD P126 MOVING)
P128 (PRODUCE ENERGY ELECTRICITY)
P129 (MOD ENERGY KINETIC)
P130 (MOD P128 POSSIBLE)
P131 (TURN WATER TURBINE)
P132 (MOD WATER MOVING)
P133 (DRIVE TURBINES GENERATORS)
P134 (CALL PEOPLE HYDROELECTRIC-PLANT)
P135 (POLLUTE PLANTS AIR)

P136 (NEGATE P135)
P137 (MOD PLANTS HYDROELECTRIC)
P138 (ISA WATER RESOURCE)
P139 (MOD RESOURCE RENEWABLE)

P140 (ISA ENERGY RESOURCE)
P141 (MOD ENERGY WIND)
P142 (MOD RESOURCE RENEWABLE)
P143 (USE \$ WINDMILLS)
P144 (PUMP WINDMILLS WATER)
P145 (GRIND WINDMILLS GRAIN)
P146 (USE PEOPLE WINDMILLS)
P147 (MOD P146 MORE)
P148 (POLLUTE WINDMILLS AIR)
P149 (NEGATE P148)
P150 (POSSESS WINDMILLS PROBLEMS)
P151 (WHAT P152)
P152 (HOW P153)
P153 (USE WINDMILLS WIND)
P154 (CHARGE WINDMILLS BATTERIES)
P155 (MOD P154 POSSIBLE)

Appendix G

P1(ISA BRONTOSAURUS DINOSAUR)
 P2(MOD P1- ONE OF LARGEST)
 P3(GROW DINOSAUR LARGE)
 P4(MOD LONG- 70 FEET +)
 P5(CONSIST LENGTH TAIL)
 P6(MORE-LENGTH-THAN TAIL NECK)
 P7(RAISE HIPS HINDLIMBS)
 P8(MOD HIPS HIGHEST PART)
 P9(MOD P8 15-FT +)
 P10(MOD HINDLIMBS LONG)
 P11(MOD HINDLIMBS THICK)
 P12(SUPPORT P11 WEIGHT)
 P13(MOD WEIGHT - 30 TON)
 P14(CONTRAST-SHORTER THAN HINDLIMBS FORELIMBS)
 P15(MOD FORELIMBS HEAVY)
 P16(BECAUSE P14)
 P17(SLOPE DINOSAUR BACK)
 P18(CREASE DINOSAUR SKIN)
 P19(MOD SKIN LEATHERY)
 P20(TERMINATE \$ LIMBS)
 P21(MOD LIMBS ELEPHANTLIKE)
 P22(DIFERRENT- FROM DINOSAUR LIMBS ELEPHANT LIMBS)
 P23(MODIFY FOREFEET ROUNDED)
 P24(MODIFY FOREFEET LARGE CLAW)
 P25(LARGER THAN HINDFEET FOREFEET)
 P26(MOD P25 ELLIPTICAL)
 P27(MOD P25 YARD)
 P28(ARM FOREFEET CLAWS)
 P29(DIG CLAWS EARTH)
 P30(WALK HEAD SWINGS)
 P31(MOD NECK FIFTEEN FT.)
 P32(MOD P31 STRONG)
 P33(MOD HEAD LARGE)
 P34(SMALLER- THAN HEAD BODY)
 P35(STARE EYES DIRECTION)
 P36(COMPREHEND REPTILE ENVIRONMENT)
 P37(FLARE NOSTRILS OPEN)
 P38(OR P39 P40)
 P39(ISA NOSTRIL OPEN APERTURE)
 P40(ISA NOSTRIL CLOSED SLIT)
 P41(KEEPOUT SLIT WATER)
 P42(MODIFY P40 UNDERWATER)
 P43(MAKE JAW LINE)
 P44(MOD LINE HORIZANTAL)
 P45(POSSESS JAWS TEETH)
 P46(MOD TEETH PEGLIKE)
 P47(CROP DINOSAUR VEGETABLES)
 P48(MOD VEGETABLED UNDERWATER PLANTS)
 P49(DREDGE UNDERWATER PLANTS)

P50(WALK BRONTO GROUND)
P51(LEAVE TAIL TRAIL)
P52(MOD TAIL GROOVED)
P53(ENTER BRONTOSAURUS WATER)
P54(SINK FEET BOTTOM)
P55(LEAVE FEET IMPRESSIONS)
P56(MOD IMPRESSIONS LARGE)
P57(PRESS FEET MUD)
P58(WELLED-UP \$ MUD)
P59(MAKE CLAW MARKS)
P60(NUMBER- OF MARKS THREE)
P61(BECAUSE P62 P63)
P62(WADE BRONTOSAURUS WATER)
P63(PRESS WEIGHT FEET)
P64CAUSE PRESS FOOTPRINTS)
P65(BECAUSE P66 P67)
P66(FLOAT TAIL WATER)
P67(MARK TAIL TRAIL)
P68(NEGATE P67)
P69(RECORD JOURNEY LAND)
P70(COMPARE-TO LAND WATER)
P71(MAKE DINOSAUR PACE)
P72(MOD PACE UNHURRIED)
P73(PLANTED FOOT BOTTOM)
P74(HEAD DINOSAUR SHORE)
P75(SEE BRONTOSAURUS ALLOSAURUS)
P76(SHARE DINOSAURUS LOCATION)
P77(DIFFERENT-THAN BRONTOSAURUS ALLOSAURUS)
P78(CALL \$ DINOSAUR)
P79(LESS-LARGE-THAN ALLOSAURUS BRONTOSAURUS)
P80(APPEAR ALLOSAURUS MENACING)
P81(ISA ALLOSAURUS DINOSAUR)
P82(ISA ALLOSAURUS CARNOSAUR)
P83(PREY ALLOSAURUS REPTILES)
P84(INCLUDE CARNIVORES REPTILES)
P85(OVERCOME CARNIVORES REPTILES)
P86(STAND ALLOSAURUS LEGS)
P87(MOD LEGS HINDLIMBS)
P88(MOD HINDLIMBS BIRDLIKE)
P89(MOD HINDLIMBS UPPER)
P90(MOD HINDLIMBS MUSCULAR)
P91(COMPARE ANKLES HINDLIMBS)
P92(SUPPORT ANKLES WEIGHT)
P94(MOD ANKLES WEAK)
P95(AMOUNT-OF WEIGHT- THREE TONS)
P96(END HINDLIMBS CLAWS)
P97(MOD CLAWS THREE-TOED)
P98(SAME-AS ALLOSAURUS FEET-BIRDFEET)
P99(CROSS ALLOSAURUS GROUND)
P100(MOD CROSS QUICK)

P101(USE FORELIMBS LOCOMOTION)
P102(NEGATE P101)
P103(SAME AS- FORELIMBS HANDS)
P104(USE ARMS RESTRAIN)
P105(MOD P104 PREY)
P106(CAPTURE ALLOSAURUS PREY)
P107(FURNISH HAND CLAWS)
P108(NUMBER-OF CLAWS-THREE)
P109(MOD INNER CLAW)
P110(MOD P109 LARGEST)
P111(MAKE CLAWS HOOKS)
P112(BECAUSE P112 P113)
P113(BIPEDAL ALLOSAURUS REPTILE)
P114(PIVOT HIPS BODY)
P115(BECAUSE P116 P117)
P116(STAND ALLOSAURUS POSITION)
P117(MOD STAND UPRIGHT)
P118(SERVE TAIL COUNTERBALANCE)
P119(SAME-AS KANGAROO AND ALLOSAURUS TAIL)
P120(ISA ALLOSAURUS RUNNER)
P121(NEGATE P121)
P122(CARRY ALLOSAURUS HEAD)
P123(MOD CARRY FIFTEEN FT HIGH)
P124(LARGER THAN-HEAD NECK)
P125(APPEAR HEAD LARGE)
P126(PROVIDE HEAD JAWS)
P127(MOD JAWS STRONG)
P128(ARM JAWS TEETH)
P129(CUT TEETH FOOD)
P130(MOD TEETH SABERLIKE)
P131(DEMONSTRATE JAWS PREDATION)
P132(SAME-AS ALLOSAURUS SKIN BRONTOSAURUS)
P133(MOD SKIN LEATHERY)
P134(ISA ALLOSAURUS PREDATOR)
P135(PREY ALLOSAURUS BRONTOSAURUS)
P136(MOD P135 OCCASIONALLY)
P137(BECAUSE-OF P138 SIZE)
P138(ABLE BRONTOSAURUS P139)
P139(PROTECT BRONTOSAURUS ITSELF)
P140(BRINGDOWN ALLOSAURUS BRONTOSAURUS)
P141(MOD P140 DIFFICULT)
P142(NOTICE BRONTOSAURUS ALLOSAURUS)
P143(FLEE BRONTOSAURUS ALLOSAURUS)
P144(QUICKER-THAN ALLOSAURUS BRONTOSAURUS)
P145(ISA BRONTOSAURUS SAUROPOD)
P146(ENTER ALLOSAURUS WATER)
P147(MOD ENTER RELUCTANT)
P148(CAPABLE ALLOSAURUS WADER)
P149(NEGATE P148)

Appendix H

Propositional Analysis For "What Causes Aids?"

P001 (WHAT P2)
P002 (ISA AIDS DISEASE)
P003 (DESTROY AIDS SYSTEM)
P004 (MOD SYSTEM IMMUNE)
P005 (ISA SYSTEM DEFENSE)
P006 (MOD DEFENSE CELLS)
P007 (KILL AIDS PEOPLE)
P008 (NEGATE P7)
P009 (BECAUSE- OF 10 AIDS)
P010 (OPENS AIDS GATES)
P011 (GET PEOPLE CANCER)
P012 (GET PEOPLE INFECTIONS)
P013 (MOD PEOPLE HEALTHY)
P014 (MOD P13 SOMETIMES)

P015 (WHAT P16)
P016 (ISA AIDS ACQUIRED IMMUNODEFICIENCY SYNDROME)
P017 (ACQUIRE PEOPLE VIRUS)
P018 (DESTROY AIDS SYSTEM)
P019 (MOD SYSTEM IMMUNE)
P020 (POSSESS SYSTEM CELLS)
P021 (NUMBER-OF TRILLION)
P022 (MOD SYSTEM IMMUNE)
P023 (MOD SYSTEM HEALTHY)
P024 (MOD CELLS WHITE)
P025 (MOD CELLS TINY)
P026 (DESTROY CELLS INVADERS)
P027 (MOD INVADERS BACTERIA)
P028 (MOD INVADERS VIRUSES)
P029 (MOD INVADERS PROTOZOA)
P030 (MOD INVADERS FUNGI)
P031 (CAUSE INVADERS INFECTIONS)
P032 (PREVENT CELLS INFECTION)
P033 (POSSESS VICTIMS CELLS)
P034 (MOD VICTIMS AIDS)
P035 (MOD CELLS WHITE)
P036 (MOD CELLS FEW)
P037 (GROW INVADERS ARMIES)
P038 (MOD P37 POSSIBLE)
P039 (CAUSE INVADERS CANCER)
P040 (CAUSE INVADERS INFECTIONS)
P041 (MOD CANCER LUNGS)
P042 (MOD CANCER STOMACH)
P043 (MOD CANCER INTESTINES)
P044 (MOD INFECTIONS LUNGS)
P045 (MOD INFECTIONS STOMACH)
P046 (MOD INFECTIONS INTESTINES)
P047 (SUFFER VICTIMS LOSS)

P048 (MOD VICTIMS AIDS)
P049 (MOD LOSS WEIGHT)
P050 (MOD LOSS APPETITE)
P051 (MOD LOSS MEMORY)

P052 (WHEN P53)
P053 (DISCOVERED \$ AIDS)
P054 (MOD P53 1981)
P055 (HOW P56)
P056 (NOTICED DOCTORS CANCER)
P057 (MOD CANCER RARE)
P058 (AFFECTS CANCER PEOPLE)
P059 (MOD P58 USUALLY)
P060 (MOD PEOPLE OLDER)
P061 (AFFECTS AIDS PEOPLE)
P062 (RATE-OF P61 INCREASING)
P063 (MOD PEOPLE YOUNG)
P064 (EXISTS INFECTIONS PEOPLE)
P065 (MOD P64 UNEXPECTEDLY)
P066 (MOD INFECTIONS INFECTIONS RARE)
P067 (MOD INFECTIONS INFECTIONS LUNGS)
P068 (MOD INFECTIONS STOMACH)
P069 (APPEARED INFECTIONS PEOPLE)
P070 (MOD P64 PREVIOUSLY)
P071 (MOD PEOPLE SICK)
P072 (MOD SICK CANCER)
P073 (MOD PEOPLE DONORS)
P074 (MOD DONORS ORGAN)
P075 (POINT FACTS ILLNESS)
P076 (MOD FACTS UNEXPECTED)
P077 (MOD ILLNESS NEW)
P078 (CRIPPLE AIDS SYSTEM)
P079 (MOD SYSTEM CRIPPLES)

P080 (WHAT P81)
P081 (CAUSE HIV AIDS)
P082 (ENTERS VIRUS BLOODSTREAM)
P083 (INVADES VIRUS CELLS)
P084 (MOD CELLS WHITE)
P085 (STOP VIRUS CELLS)
P086 (MOD P85 FIGHTING)
P087 (MOD FIGHTING INFECTIONS)
P088 (BECAUSE-OF P90 HIV)
P089 (MOD HIV FACTORY)
P090 (ABLE VIRUS P91)
P091 (MULTIPLY VIRUS NUMBER)
P092 (NUMBER-OF-MILLIONS)
P093 (BECAUSE P94 P95)
P094 (KILLS HIV)
P095 (ABLE VIRUS P88)
P096 (INVADE CELLS)

P097 (HOW P98)
P098 (INFECT HIV BLOOD)
P099 (POSSESS VIRUS MOLECULES)
P100 (POSSESS MOLECULES FAT)
P101 (POSSESS MOLECULES PROTEINS)
P102 (PROTRUDE \$ FATS)
P103 (PROTRUDE \$ PROTEINS)
P104 (SAME-AS KEYS PROTRUDE)
P105 (FIT KEYS LOCKS)
P106 (SAME-AS LOCKS RECEPTORS)
P107 (POSSESS CELLS RECEPTORS)
P108 (MOD CELLS WHITE)
P109 (IN-ORDER-TO P110 P111)
P110 (USE \$ HIV)
P111 (OPEN CELL DOOR)
P112 (BECAUSE P115 P113)
P113 (INVADE HIV CELLS)
P114 (MOD CELLS IMMUNE)
P115 (POSSESS HIV DANGER)

P116 (BECAUSE P118 P117)
P117 (INJECTS HIV)
P118 (POSSESS CELL RULES)
P119 (MOD RULES NEW)
P120 (BECOME RULES PERMANENT)
P121 (MOD PERMANENT PARTS)
P122 (MOD PARTS CELL)

P123 (WHEN P124)
P124 (OCCURS SYMPTOMS)
P125 (ALTHOUGH P126 P128)
P126 (CONTROL VIRUS CELLS)
P127 (MOD CELLS WHITE)
P128 (MOD P127 SOME)
P129 (LIE CELLS DORMANT)
P130 (MOD CELLS WHITE)
P131 (DURATION-OF P130 YEARS)
P132 (ALTHOUGH P133 P134)
P133 (INFECT PEOPLE HIV)
P134 (SHOW PEOPLE SYMPTOMS)
P135 (NEGATE P134)
P136 (DURATION-OF P134 YEARS)
P137 (IF P138 140)
P138 (AWAKENS VIRUS)
P139 (MOD AWAKENS ACTIVATE)
P140 (MAKE HIV VIRUS)
P141 (MOD VIRUS NEW)
P142 (RATE-OF P140 EXPLOSIVE)
P143 (CAUSE P144 P148)
P144 (ATTACK VIRUS CELLS)

P145 (MOD VIRUS NEW)
P146 (MOD CELLS WHITE)
P147 (MOD CELLS OTHERS)
P148 (DIE BODY CELLS)
P149 (MOD CELLS DEFENSE)
P150 (BECAUSE P150 P152)
P151 (DIE CELLS)
P152 (MOD CELLS BODY)
P153 (WEAKENS SYSTEM)
P154 (BECAUSE P155 P156)
P155 (WEAKENS SYSTEMS)
P156 (BECOME VICTIMS VULNERABLE)
P157 (BECAUSE P158 P159)
P158 (VULNERABLE VICTIMS)
P159 (HOST VICTIMS INFECTIONS)
P160 (MOD INFECTIONS OPPORTUNISTIC)

P161 (BECAUSE P162 P163)
P162 (INVADE INFECTIONS BODY)
P163 (MOD BODY HIV-INFECTED)
P164 (CALL \$ INFECTION-OPPORTUNISTIC)
P165 (MOD INFECTIONS DEADLY)
P166 (DURATION-OF P130 3-YEARS)
P167 (MOD 3-YEARS WITHIN)
P168 (IS P169)
P169 (POSSESS AIDS CURE)
P170 (NEGATE P169)
P171 (HOWEVER P169 P170)
P172 (DEVELOP RESEARCH AIDS)
P173 (MOD DRUGS CURES)
P174 (MOD CURES POSSIBLE)
P175 (NUMBER-OF SEVERAL)
P176 (EXIST DRUGS)
P177 (TIME 176 TODAY)
P178 (PREVENT DRUGS REPRODUCTION)
P179 (MOD REPRODUCTION HIV)
P180 (REBUILD GRUGS SYSTEM)
P181 (MOD SYSTEM IMMUNE)
P182 (MOD P181 DANGER)
P183 (FIGHT DRUGS INFECTION)
P184 (PRODUCE DRUGS VACCINES)

P185 (ABLE AZT P186)
P186 (PROLONG LIVES PEOPLE)
P187 (MOD PEOPLE AIDS)
P188 (DELAY AZT AIDS)
P189 (MOD P188 POSSIBLE)
P190 (MOD AIDS ONSET)
P191 (MOD ONSET SIGNS)

P192 (NEGATE P191)
P193 (STUDY \$ GOVERNMENT)
P194 (MOD STUDY RECENT)
P195 (IN P193 STUDY)
P196 (LENGTHENED AZT TIME)
P197 (TIME P196 SYMPTOMOTOLOGY)
P198 (BECAUSE OF P199 NEWS)
P199 (MOD NEWS RESEARCH)
P200 (FAVORED GROUPS TESTING)
P201 (MOD 201 SOME)
P202 (WHY P203)
P203 (TESTING OCCUR)
P204 (POSSESS AMERICANS HIV)
P205 (MOD P203 POSSIBLE)
P206 (NUMBER-OF AMERICANS 1-1.5 MILLION)
P207 (POSSESS PEOPLE KNOWLEDGE)
P208 (MOD KNOWLEDGE INFECTIONS)
P209 (MOD INFECTIONS HIV)
P210 (MOD PEOPLE MOST)
P211 (NEGATE P207)

P212 (IF P213 P215)
P213 (FIND PEOPLE INFECTIONS)
P214 (MOD INFECTIONS HIV)
P215 (ABLE PEOPLE BENEFIT)
P216 (MOD PEOPLE HIV)
P217 (MOD P214 POSSIBLE)
P218 (MOD BENEFIT TESTING)
P219 (BECAUSE-OF P220 TESTING)
P220 (ABLE-TO PEOPLE P221 P222)
P221 (USE PEOPLE AZT)
P222 (PREVENT PEOPLE SPREAD)
P223 (MOD P222 POSSIBLE)
P224 (MOD SPREAD AIDS)

Appendix I

EXERCISE - MEMORY

Name _____
Grade _____

Directions: Write an acronym for the summary that you have made. Remember, an acronym is made by taking the first letter from each word that you want to remember and making a new word from all those letters.

The first letter

[illegible]

Appendix J

"Natural Resources"

Natural resources. The earth is like a large storeroom. We rely on the earth for the materials needed for life. Much of our food, clothes and shelter comes from plants grown on land. The rocks in the ground supply us with metals to "build machinery. The fuel to run machines and heat homes comes from the earth. These materials are natural resources. Without these natural resources we could not live.

Renewable resources. The water, soil, air, and forests are renewable resources. They can be replaced after we use them. The water cycle allows us to use water over and over again. Forests are replanted after they are cut down. Fertilizers put chemicals back into the soil. This soil can then be used to crops again. The air too is used over and over again.

Nonrenewable resources. Some materials cannot be replaced after they are used. A mineral is such a resource. A mineral removed from one place in the ground is gone. Another spot must be found for more of that mineral. Materials that cannot be replaced are called nonrenewable resources. Oil, gas, and coal are also nonrenewable minerals. We are using these nonrenewable resources in large amounts. Will we ever run out of them? If we do, what then?

Conservation. The number of people living on the earth is becoming larger. More people need more land to live on. More land is needed to grow greater amounts of food. Larger amounts of pure water and air are needed. With more people on earth, greater demands are made on all our resources. Will there enough resources for the future? We must look for new things to take the place of nonrenewable materials. Resources that are renewable must be used carefully. Conservation is a way to make our natural resources last longer. When we conserve things, we use as little of them as possible.

Recycling. Is everything that you throw away garbage? Can some of these materials be used again? Many items thrown out can be used. Some companies are paying for used metals. Copper, lead, and aluminum are some materials being reused. Paper and bottles too are

being saved and collected. These materials are being recycled. Recycling helps in two ways. It conserves are renewable and nonrenewable resources. It also reduces the amount of garbage that has to be taken care of.

Energy from fossil fuels. Recall that coal, oil, and natural gas are fossil fuels. It took many years for the fossil fuels to be made. They formed from plants and animals that lived millions of years ago. The fossil fuels supply us with most of the energy we use. They run cars, trucks, and machines. They heat buildings and make much of the electricity we use. But they are nonrenewable resources. As we remove them from the ground, a smaller amount of them left. We are beginning to run out of the fossil fuels.

While fossil fuels have served us well, they have also caused us problems. When burnt, they produce harmful gases. These gasses pollute the air.

Energy from falling water. Water running downhill has kinetic energy, the energy of motion. Water at the top of a water-fall or stored behind a dam has potential energy. When this water falls to a lower level, its potential energy changes to kinetic energy. The kinetic energy of moving water can be used to produce electricity, or electrical energy. The moving water turns the blades of a turbine, and the turbine drives and electric generator.

A place where moving water makes electricity is called a hydroelectric plant. Hydroelectric plants do not pollute the air. Their source of energy, moving water, is a renewable resource.

Energy from the wind. The energy from moving air is another renewable resource. Windmills have been used for years. Farmers use windmills to pump water and grind grain. Today more and more people are using windmills to make electricity.

Windmills do not pollute the air, but there is a major problem with them. What happens on a windless day? Some people use their windmill to charge up storage batteries on windy days. On days when the wind is weak, they use electricity in the batteries.

Appendix K "Dinosaur"

The Brontosaurus was one of the largest of the dinosaurs. They often grew to more than seventy feet, or more, in length. Much of the Brontosaurus' length consisted of a long curving neck and an even longer muscular tail. It's hips, the highest part of it's body, were fifteen feet above the ground and were raised by long, thick elephantlike legs capable of supporting the larger fraction of her thirty-ton body. In contrast, it's forelimbs were relatively short, even though they, too, were heavy and strong. Consequently, it's shoulders were lower than the hips, so that the line of the back sloped in a great curve forward from its high point down to the shoulders and on to the base of the neck, and backward down to the base of the tail and to its extremity. It's tough, leathery, skin was creased with many folds and wrinkles.

Both the forelimbs and the hindlimbs terminated in broad, somewhat rounded, padded feet, like the feet of an elephant, but different, too. The forefeet were rounded in front; there was a large inner claw on each foot, while the front border was probably decorated with blunt nails. In terms of the nails, scientists can not be sure. The hindfeet, much longer than the forefeet, each a yard (or meter) long, and elliptical, were armed with three huge claws, located on the first, second, and third toes. Those claws which slanted outward, dug into the earth as Brontosaurus walked along with ponderous strides.

As it walked it swung it's head from side to side in horizontal arcs, thus scanning the scene from different points of view. To say that it swunh it's head widely is no exaggeration, for it's neck was at least fifteen feet in length from the shoulders to the base of the skull. It was a strong and very useful neck.

At the end of the boomlike neck was the head: a fairly large, bony structure in humans terms, but a remarkably small head in relation to the bulk of its body. From the sides of the head it's large eyes stared to the right and the left and forward, comprehending the scene in reptilian terms that will be forever be unknown to us. Directly in front of the eyes and slightly higher in elevation were the large nostrils, which flared open in the form of round, muscle-rimmed apertures, or closed into slits. These slits would keep out the water when the head was lowered beneath the surface. Finally, making a horizontal line from the front to the back of the head,

were the jaws, in the forward portions of which were set a limited number of rather uneven, peglike teeth, all alike. They appear to have been teeth for cropping vegetation, perhaps leaves of trees and shrubs, perhaps underwater plants, dredged up from shallow rivers, lakes, and marshes.

As it walked along, it's heavy tail dragged on the ground, leaving a groovelike trail behind it. As it left the forest, crossed the beach, and entered the shallow water, it's huge feet, with each step, sank deep in the muddy bottom, leaving impressions as big as bathtubs. As each foot pressed down, bearing the great weight which it partially supported, the mud welled up around it, to form a raised rim bordering the depression that was left when the foot was lifted. Within the rims at the front of the hindfoot impressions were deep marks made by the claws, three for each of these tracks.

Because it waded through the water that was too shallow to reach its stomach, so that its full weight pressed down on its feet to leave telltale footprints marking its course, yet deep enough so that its tail floated. Consequently, there was no groovelike mark of the tail drag between the footprints, as there might have been if its journey had been recorded on dry land.

Its pace was unhurried, for there was no reason for it to make haste. Each foot was firmly planted into the muddy bottom; each foot was lifted out of the ooze with a sucking sound. It waded in a straight course through the shallow water, heading for the distant shore which she could see on the other side of the embayment.

A very different dinosaur from Brontosaurus shared the location. This dinosaur, called Allosaurus, was not as large, but decidedly menacing in appearance. Allosaurus was a carnosaur, one of the giant carnivores that preyed upon other large reptiles, including any dinosaurs that they might be able to overcome. The carnosaur stood high on its hindlimbs, which were remarkably birdlike in form. Indeed, the long hindlimbs of Allosaurus, although massive and muscular in their upper portion, were comparatively slender below the ankles, as slender as they might be for the support of a body weighing some three tons. The hindlimbs ended in sharp-clawed, three-toed feet, closely resembling in form the feet of a large bird. The feet of Allosaurus might well have resembled the feet of large

birds, for they functioned in almost exactly the same manner as the feet of some large birds. This dinosaur could cross the ground with considerable speed.

The forelimbs of Allosaurus were relatively small and quite useless for locomotion. They were, in effect, arms and hands, useful for restraining any unfortunate victim the carnivore might capture. Each hand was furnished with three large, sharp, curved claws, ending in the thumb and two fingers. The inner claw on the thumb was the largest; the other two were progressively smaller. Together they made a set of fearsome hooks of undoubted efficiency.

Because Allosaurus was a strictly bipedal reptile, it's body was pivoted at the hips; and because it did not stand in an upright position, as a person does, it had a long heavy tail that served, among other things, to counterbalance the weight of the body. We see something of the same arrangement today in a Kangaroo, although the Kangaroo is a hopping animal rather than a runner, as was this dinosaur.

A most striking feature of the gigantic creature was it's huge head, carried some fifteen above the ground and set upon a comparatively short, strong neck. The head was so large that it might have appeared to be almost out of proportion to the rest of the animal, but there was a reason for it's great size. It provided Allosaurus with a formidable set of strong jaws, which were armed with a dazzling array of sharp, saberlike teeth; the thin edges of each tooth were serrated for cutting it's food. The jaws and teeth demonstrate a pattern for predation on a large scale. Allosaurus, like Brontosaurus, was clothed with heavy, tough, leathery skin.

Allosaurus was a predator and would, at times, prey on a Brontosaurus in a bloody fury. Such attacks were largely ineffectual because Brontosaurus' size was it's protection: the Allosaurus could tear at it, but could not bring it down. Upon noticing an Allosaurus, the Brontosaurus would flee but the Allosaurus proved to be quicker. One refuge for the huge Sauropod were large swamps or marshes, for Allosaurus was reluctant to enter the deep water. The Allosaurus, despite it's strong birdlike limbs and sharply clawed feet, was ill-suited to maneuver in the water. It could run across the hard ground, and it could even splash through the shallow waters, but in the marsh it was at a total disadvantage.

Appendix L

"AIDS"

What Causes AIDS?

AIDS is a disease that breaks down the Immune system - your body's army of defense cells. AIDS by itself doesn't kill. But it opens the gate to deadly cancers and infections that rarely take hold in healthy people.

Acquired immunodeficiency syndrome. Victims acquire, or catch, a virus that makes their immune system deficient, or defective.

A healthy person's immune system is made up of about a trillion tiny "soldiers" called white blood cells. These soldiers seek out and destroy enemy invaders - bacteria, viruses, protozoa, and fungi - before they can cause infections.

AIDS victims, however, have very few healthy white blood cells to combat the enemy invaders. Single invaders can grow to to armies, causing severe skin cancer and infections of the lungs, stomach, and intestines. Before they die, AIDS victims also suffer from loss of appetite, weight, and memory.

AIDS was first discovered in 1981. Doctors noticed that a rare skin cancer, which usually affects older people, began showing up in younger people and at alarming rates. Rare and deadly infections of the lungs and stomach also began showing up unexpectedly around the same time. These infections had previously appeared only in people whose immune systems were broken down by cancer treatments or organ transplant drugs. These facts pointed to the cause of a new illness: crippling of the immune system.

AIDS is caused by human immunodeficiency virus (HIV). The virus enters the bloodstream and invades certain white blood cells. A single virus can order a white blood cell to stop fighting infections and become an HIV factory. Millions of new viruses then bud, or break off, from the cell's surface. The cell dies. The new viruses invade other white blood

cells. Now you can see how the immune system of AIDS victims is destroyed.

The virus has molecules on its surface that are made of fat and protein. They stick out like "keys." And these keys fit perfectly into the surface "locks," or receptors, of certain white blood cells. Like most viruses, HIV uses its keys to open the door to the cell. What makes HIV so deadly is that it invades cells of the immune system.

The virus then injects a new set of rules for the cell. These rules become a permanent part of the infected person's cells.

Though the virus has seized control of some white blood cells, it may lie dormant, or inactive, for months, even years. A person can be infected with HIV for as many as 10 years before showing signs of AIDS.

But when the virus awakens, it orders infected white blood cells to start churning out new viruses at an explosive rate. The new viruses attack more white blood cells and other cells of the body. As the body's army of defense cells fall prey, the immune system weakens. Victims are then vulnerable to a host of infections, called "opportunistic" infections, because they take the opportunity to attack the body of an HIV -infected person. These infections are fatal usually within three years.

Extensive research began early to develop possible drug products for HIV infection and AIDS. Several different types of products are undergoing research and/or clinical trials. These include drugs to prevent reproduction of HIV, drugs to help rebuild a damaged immune system, drugs to fight infections, and vaccines.

One antiviral drug, called AZT, has prolonged the lives of some people with AIDS. The drug may even help delay the onset of AIDS among people who carry the virus but who do not yet show signs of the disease. In a recent government study, AZT lengthened the time it took for people infected with HIV to develop symptoms.

Such news has caused some groups to favor early testing for HIV antibodies. Here's the reason:

There may be from 1 million to 1.5 million Americans infected with HIV, most of whom do not know they carry the virus. If they found out through testing, they might be able to benefit from early use of AZT and could also take steps to prevent the spread of HIV to others.

APPENDIX M
SUMMARY SCORING TEMPLATE

Paragraph

1) The earth is like a storeroom for natural resources
that contains materials needed for life.

2) Renewable resources can be reused.

3) Nonrenewable resources can not be replaced.

4) Conservation is a way to make our natural resources
last longer.

5) Recycling means that materials can be reused.

6) Fossil fuels produce the most energy but, they are
nonrenewable resources.

7) Moving water has Kinetic energy which is a
renewable resource.

8) Energy from the wind is a renewable resource.

Appendix N

Main Idea Propositions for Dinosaurs

MACROSTRUCTURE

Superordinate-main idea items.

Paragraph

-
- 1) Brontosaurus is a type of dinosaur.
-
- 2) Forelimbs & hindlimbs look like those of an elephant, but are different too, they are armed with claws.
-
- 3) When walking, it was aware of the surroundings. It has a strong and useful neck.
-
- 4) It has a small head in relation to its body and jaws for eating vegetation.
-
- 5) As it walked it left large impressions/tracks from its feet & tail.
-
- 6) As it waded in the water, it left foot impressions but no tail marks.
-
- 7) It walked in an "unhurried" pace; it walked on land & water.
-
- 8) The Brontosaurus shared the same place with Allosaurus. Allosaurus was different, it was a carnosaur.
-
- 9) Allosaurus used his hands for capturing prey.
-
- 10) Allosaurus was similar to a kangaroo.
-
- 11) Allosaurus was a predator, as indicated by its large head that housed cutting teeth.
-
- 12) Allosaurus' attacks on Brontosaurus were unsuccessful for several reasons.
-

APPENDIX O

SUMMARY SCORING TEMPLATE-AIDS

PARAGRAPH

-
- 1) Aids is a disease that affects the immune system.

 - 2) Aids victims catch a virus that makes their immune system defective.

 - 3) A healthy immune system destroys invaders.

 - 4) Aids victims have few white blood cells to combat infections.

 - 5) Aids was discovered to be responsible for the crippling of the immune system.

 - 6) Aids is caused by a virus that invades white blood cells

 - 7) HIV is deadly because it invades the immune system cells.

 - 8) HIV injects permanent rules into the invaded cells.

 - 9) Symptoms can first appear long after the virus has invaded the system.

 - 10) When the virus begins to take effect, it attacks the immune system allowing for opportunistic infections.

 - 11) Aids cannot be cured but many drugs are being tested.

 - 12) One drug, AZT, has prolonged the lives of HIV infected people.

 - 13) Because AZT has been effective, some favor early testing.

Appendix P

"Space Travel"

An old Chinese invention. You may have watched a space launch on television. Satallites are placed in orbit by rocket engines. Rockets were invented by the Chinese over 800 years ago. They were used by the Chinese to launch fireworks and weapons.

Where's the action. To understand how a rocket moves, we can look at some other examples of movement. Each time an action takes place, there is a reaction. The reaction is in the opposite direction to the action. It has the same force as action. Issac Newton stated the law of action and reaction. The law says that for every action, there is an equal reaction in the opposite direction. It is this law that explains how a rocket moves.

How does a rocket engine work? Fuel is burned inside the rocket. It may be solid or liquid fuel. As the fuel burns, hot gases begin to expand. They create pressure inside the rocket. The hot gases are forced out of the rear of the rocket. This is the action. The rocket speeds off in the opposite direction. This the reaction.

There is no air in outer space. Rockets need oxygen to burn fuel. There is no air in space to supply oxygen to a rocket. Rockets must carry their own oxygen. This oxygen enables the rocket to burn fuel in space.

Down to earth. Toss a coin into the air. The earth's gravity pulls it down again. Toss the coin harder. When you use more force, the coin moves faster. It moves higher. The greater the force of an object, the faster it moves, the higher it can go.

Getting away from it all. The force that pushes a rocket forward is called thrust. The greater the thrust, the faster and higher the rocket will go. A rocket can get started into space if it has a speed of about 40 250 kilometers per hour. Once a rocket is moving at this speed, it can escape the earth's gravity. The speed of 40 250 kilometers per hour is known as the escape velocity for a rocket on the earth.

The multistage rocket. A great deal of thrust is needed to reach escape velocity. This thrust can be produced only by large rockets with large amount of fuel. Such rockets are very heavy. A multistage rocket is a heavy rocket that becomes lighter as it goes along.

The multistage rocket is actually several rocket engines fitted one on top of another. The largest engine is at the bottom. It supplies most of the thrust. This engine is fired first to lift the rocket from the ground. When its fuel is used up, the engine drops away from the rocket ship. This makes the ship lighter. The second engine is fired until it also uses up its fuel and drops off. Each engine thrusts the rocket ship forward and then falls away. The rocket gets lighter as its fuel is used up.

Blast off! A rocket moves away from from earth. As it moves farther away, the pull of the earth's gravity on it becomes weaker. The rocket uses little fuel out in space. There is nothing in space to slow down its motion. The rocket keeps moving because of its inertia. Fuel is needed in space only to change the rocket's speed or direction.

PEOPLE IN SCIENCE

Robert H. Goddard (1882-1945)

Robert H. Goddard built and launched the first liquid-fuel rocket in 1926. He launched many more rockets after that. It was Goddard's idea to build a multistage rocket. This American is known to many as the father of modern rocketry. His ideas have been used in all of today's rockets.

People in space. Space can be explored by manned space ships. An example of manned exploration of space was the Apollo flights. Six of the Apollo flights landed safely on the moon. All of the astronauts on these flights returned safely to earth. Since Apollo, many unmanned space ships have been launched. These are called unmanned space probes, or just space probes. Many kinds of space explorations are best done with a space probe. The probes sent to Venus are examples. Some probes sent to Venus went down through its atmosphere. They were all destroyed by the high temperatures on the planet's surface. But they sent back important

information before their destruction. We are not yet able to keep an astronaut alive on the surface of Venus. Another reason for unmanned exploration is that no supplies for astronauts need to be carried. Probes can be made smaller than manned spaceships. Finally, space probes need only go on one-way trips. Manned space ships must be able to return to earth.

What is a space station? So far, almost all the ships used in space have been used only once. They have either remained in space, remained on other planets, or have burned on re-entering the earth's atmosphere. This is very wasteful and expensive. The space station Skylab was built to help solve this problem. Skylab was an artificial satellite about the size of a small house. It was placed into orbit around the earth in May, 1973. Skylab stayed in orbit while different teams of astronauts visited it. It was the first space station. Astronauts in Skylab were able to stay in space for long periods of time. In November, 1973, a team of three astronauts lived in Skylab for 85 days. They were able to perform many experiments. The Skylab missions showed that people could live and work in space for long times and remain healthy.

Appendix P

SUMMARY SCORING TEMPLATE

PARAGRAPH

- 1) CHINESE INVENTED ROCKET ENGINES USED TO LAUNCH
SATELLITES

- 2) NEWTON'S LAW IS EVERY ACTION HAS A REACTION-EXPLAINS
THRUST

- 3) ENGINE BURNS FUEL CREATING INSIDE PRESSURE FORCING
GAS OUT

- 4) ROCKETS MUST CARRY THEIR OWN OXYGEN

- 5) GRAVITY PULLS ROCKETS DOWN

- 6) ROCKETS MUST MOVE AT 40 250 KMS EQUALS ESCAPE
VELOCITY

- 7) MULTISTAGE ROCKETS FIRE FROM BOTTOM UP BECOMING
LIGHTER

- 8) AS ROCKETS ENTER SPACE GRAVITY PULLS LESS IT MOVES
BY INERTIA

- 9) R. GODDARD BUILT/LAUNCHED 1ST LIQUID ROCKET-1926-
FATHER ROCKETRY

- 10) MANNED ROCKETS-APOLLO- UNMANNED PROBES CHEAPER

- 11) 1ST SPACE STATION 5/73 PROVED MAN COULD LIVE IN
SPACE

Appendix Q

"What Causes Air Pollution?"

The air we breathe. Air is mainly nitrogen and oxygen. When we breathe in, we remove some oxygen from the air. When we breathe out, we add carbon dioxide to the air. Why don't we use up the oxygen in the air? Green plants change carbon dioxide back into oxygen. This is called the oxygen-carbon dioxide cycle.

The balance of oxygen and carbon dioxide in the air has changed very little over millions of years. But now we may be upsetting this balance. Fuels use oxygen to burn. When they burn, they release carbon dioxide into the air. Can the green plants on the earth change all that carbon dioxide back into oxygen? We are not sure they can.

Dirty air. Coal and oil are needed to run our factories. Fuel oil is used to heat our homes. Gasoline is burned to make our cars, trucks, and buses run. Fuels are burned to help produce electricity. When these fuels are burned, they release smoke and other chemicals into the air. The unwanted smoke and chemicals are pollutants. They make the air dirty. Some of these pollutants are harmful. They may cause sickness in humans. They sometimes make the air unfit to breathe. Smog is a mixture of smoke, fog, and chemicals. Smog can be harmful to people and other living things.

Carbon dioxide in the air. When fuels burn, they use oxygen from the air. They give off carbon dioxide. Scientists think that too much carbon dioxide in the air can cause changes in the earth's climate. They think it might cause another ice age.

Water, water, everywhere.....More than three-fourths of the earth's surface is covered with water. Most of this water is salt water. Salt water is unfit for drinking. Our supplies of fresh water are limited. Cities build huge reservoirs to collect and store fresh water. Reservoirs are human-made lakes. Wells drilled into the water table provide a supply of drinking water. Aqueducts carry water from the mountains to the cities. Even with all of this effort, there may not be enough fresh water to meet the world's needs in the future.

.....and not a drop to drink. Many of our lakes and rivers were important sources of fresh water. But people used them as dumping grounds for wastes and sewage. This has caused them to become polluted. The water is unfit for drinking. Many lakes and rivers are so polluted that fish cannot live in their waters. Once a lake becomes polluted, it takes many years for it to become pure again. Our Great Lakes are dying because of the many wastes that have been dumped into them.

Water pollution. Some pollutants are dissolved materials. Other pollutants are suspended particles. The dissolved pollutants can come from sewage emptied into the water. Suspended particles can come from factories emptying wastes into the waters. Boats and ships pollute the water with oil and gasoline.

The death of a lake. Some pollutants are chemicals that aid the growth of green plants. They act like fertilizers. These pollutants can cause the rapid growth of algae in a lake. Algae are simple plants. While they are alive, they produce oxygen. But when they die, they decay. This uses up the oxygen in the water. As a result, most of the other living things in the lake die. Many pesticides also end up in lakes. As they build up, they cause harm to fish and other forms of life.

Finding out more. There are other forms of pollution besides air and water pollution. Thermal pollution is caused by pouring large amount of heated water into the rivers. Power plants often cause thermal pollution this way. The warm water can cause the death of many fish. Loud noises can cause damage to the human ear. Unpleasant or dangerous sounds are called noise pollution. Cities are trying to reduce unnecessary sounds. Environmental pollution is the spoiling of our environment.

Are we in Trouble? Some people say that pollution can destroy all life on the earth. Is the problem of pollution that serious? Can we do anything about it? People have always had pollution problems. In the middle ages, cities were filthy places. People used to throw their garbage out the window. It

would rot in the streets. Now garbage is collected. Streets are cleaned regularly. Pollution of cities is much less than in those times. But much more can be done and needs to be done. Many governments have new laws to reduce pollution and to prevent it. These laws can work if everyone cooperates.

The world's largest garbage dump. Cities produce large amount of sewage. Most of these wastes have been going into rivers. The rivers then carried it into the ocean. The ocean is very large. The wastes seemed to disappear in it. But now we know this isn't so. Raw sewage is harmful to water life. Today, cities send their wastes through sewage treatment plants. The sewage is changed to harmless materials before it is dumped into rivers or oceans. Factories also produce harmful chemical wastes. Factories used to dump these wastes into the rivers and oceans. Now they, too, must find other ways of getting rid of wastes. Oil pollution of the ocean is another serious problem. Ways must be found to reduce spills and leakage of oil into the ocean. Quick ways to clean up oil spills must be also found.

Tuna on rye, hold the mercury. Mercury is a very dangerous poison. A few years ago, scientists found mercury in tuna fish. The mercury came from factory wastes dumped into the water. Chemical sprays that are used to kill insects and weeds are called pesticides. Pesticides contain chemicals that are poisonous to humans. Animals may take in these poisonous chemicals with their food and water. Some of these poisons may collect in the bodies of animals that we use as food. New laws bar the use of these chemicals in pesticides. The laws protect our food supplies against further pollution.

Preventing air pollution. Automobiles and factories cause most of our air pollution. Lead was added to gasoline to make car engines run smoother. New automobiles use only lead-free gasoline. This prevents dangerous lead from entering the air and polluting it. New cars have many anti-pollution devices built into them. Automobile exhaust systems remove many kinds of pollutants before they enter the air. Factory smokestacks use electrical devices to remove the soot. Some fuels used in factories

contained sulfur. When these fuels were burned, the sulfur polluted the air. These fuels are no longer allowed to be used.

REMEMBERING BETTER

WE ARE TRYING TO ORGANIZE OUR NOTES TO MAKE THEM EASIER TO REMEMBER. WE WANT TO REMEMBER A FEW KEY PIECES OF OUR NOTES THAT WILL REMIND US OF WHAT WE HAVE LEARNED. WE WILL USE THE TOPIC SENTENCES THAT WE MADE IN "PRINCIPLE 3" TO FORM ACRONYMS. PICK A KEY WORD OUT OF EACH SENTENCE AND WRITE IT DOWN, ADD ENOUGH OF THE SENTENCE TO MAKE SURE YOUR POINT IS MADE.

FOR EXAMPLE: CHINESE — INVENTED ROCKETS
NEWTON'S — ACTION/REACTION
ENGINES — BURNING FUEL CREATES PRESSURE
ESCAPE VELOCITY — 40 250 THRUST
R.H. GODDARD — FATHER 1926
PROBES — UNMANNED & CHEAPER
STATION — 85 DAYS IN HOUSE

S P E N C E R — IS THE ACRONYM

I TOOK THE FIRST LETTER OF EACH OF THE KEY WORDS FOR EACH SENTENCE AND MADE AN EASY WORD TO REMEMBER. THEN, IF I CAN REMEMBER "SPENCER", I CAN REMEMBER THE REST OF THE TOPIC SENTENCE, WHICH IN TURN, WILL HELP ME REMEMBER THE REST OF THE CHAPTER.

PRACTICE!

WRITE-OUT YOUR ACRONYM WORD OR WORDS ON A BLANK PIECE OF PAPER AND DO THIS UNTIL YOU KNOW IT BY HEART.

EACH TIME YOU WRITE IT OUT, FILL IN THE REMAINDER OF THE TOPIC SENTENCE

FOR EXAMPLE:

CHINESE — INVENTED ROCKETS.

ALSO, KEEP RE-READING THE ORIGINAL CHAPTER TO KEEP IT FRESH IN YOUR MEMORY.

PEOPLE IN SCIENCE**Appendix R1****Robert H. Goddard (1882-1945)**

Goddard built and launched the first liquid-fuel rocket in 1926.

He launched many more rockets after that. It was his idea to build a multistage rocket. He is American and known as the father of modern rocketry. His ideas have been used in all of today's rockets.

People in space. An example of manned exploration of space was the Apollo flights. Six of the Apollo flights landed safely on the moon. All of the astronauts on these flights returned to earth. Since Apollo, many unmanned ships have been launched called space probes. Many kinds of space exploration are best done with a space probe. Some went to Venus through its atmosphere and were all destroyed by the high temperatures. But they sent back information before destructing. Another reason for probes is that no supplies for astronauts need to be carried, they are smaller and need to go only on one-way trips.

What is a space station? So far, almost all the ships used in space have been used only once. They have either remained in space, on planets, or burned on re-entering the atmosphere. This is wasteful and expensive. The space station Skylab was built to solve this problem. Skylab was an artificial satellite about the size of a small house. It was placed into orbit in May, 1973, staying in orbit while different teams of astronauts visited it. It was the first space station. In Nov., 1973, a team of three astronauts in Skylab for 85 days. They were able to perform many experiments, showing that people could live in space.

PRINCIPLE 1: DELETION

**"DO NOT INCLUDE UNNECESSARY OR REDUNDANT DETAILS
— EVEN IF ITS INTERESTING TO YOU"**

An old Chinese invention. Satellites are placed in orbit by rocket engines invented by the Chinese over 800 years ago to launch fireworks and weapons.

What were rockets first used for?

Where's the action? To understand how a rocket moves, we can look at some other examples of movement. Issac Newton stated the law of action and reaction. The law says that for every action, there is an equal reaction in the opposite direction. It is this law that explains how a rocket moves.

What is the law of action and reaction?

How does a rocket engine work? Fuel is burned inside the rocket. It may be solid or liquid. As the fuel burns, hot gasses begin to expand. They create pressure inside the rocket. The hot gasses are forced out of the rear of the rocket. This is the action. The rocket speeds off in the opposite direction. This is the reaction.

There is no air in outer space. Rockets need oxygen to burn fuel. They must carry their own. **Why?**

Down to Earth. Toss a coin into the air. The earth's gravity pulls it down again. Toss the coin harder, use more force, the coin moves faster. It moves higher. The greater the force of an object, the faster it moves, the higher it can go.

What happens to an object's speed when there is more force on it?

Getting away from it all. The force that pushes a rocket forward is called Thrust. The greater the thrust, the faster and higher the rocket will go. A rocket can get started into space if it has speed of 40 250 kilometers per hour known as the escape velocity.

The Multistage Rocket. Great thrust is needed to reach escape velocity and can be produced only by large rockets and amounts of fuel. Such rockets are very heavy. The multistage rocket is actually several rocket engines fitted one on top of another, the largest on the bottom, it supplies most of the thrust. The engine is fired first to lift the rocket. When its fuel is used up, the engine drops away from the rocket. This makes the ship lighter. Then the second engine is fired until its fuel is used up and it drops.

Blast off. As a rocket moves farther away, the pull of the earth's gravity on it becomes weaker. It uses little fuel out in space. There is nothing in space to slow down its motion. The rocket keeps moving because of its inertia. Fuel is needed in space only to change the rocket's speed or direction.

PRINCIPLE 2 SUBSTITUTION

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**"GENERAL TERMS CAN BE SUBSTITUTED
FOR A LIST OF SPECIFIC ITEMS AND ACTIONS"****Paragraph**

- 1 Satellites placed in orbit by rocket engines invented by the Chinese 800 years ago to launch fireworks-weapons.
- 2 How a rocket moves — Newton's law: every action has a reaction in the opposite direction. This law explains how it moves.
- 3 How an engine works: burns liquid or solid fuel hot gasses expand creating pressure inside. Hot gasses forced out of the rear — the action; it moves in the opposite direction — the reaction.
- 4 There is no air in space needed to burn fuel. Must carry own supply.
- 5 Gravity pulls. The greater the force on a object, the faster it moves-higher it goes.
- 6 Rocket force called thrust. More thrust-higher/faster it goes. Rocket needs to go 40 250 Kms then it can escape gravity. That speed called escape velocity.
- 7 A multistage rocket becomes lighter as it goes. Its made of several engines, largest at bottom is the first to fire then drops off and the second fires making the rocket lighter.
- 8 As rocket moves into space, pull of gravity is weaker and the rocket needs less fuel - nothing in space to slow it down. It moves by inertia and engine fire to change speed/direction.
- 9 Robert H. Goddard built and launched first liquid-fuel rocket in 1926. His idea for multistage, known as father of modern rocketry- his ideas still used today.
- 10 Manned explorations like Apollo-six of them landed on the moon safely. Unmanned rockets/space probes used for information like to Venus, they don't return can get burned in atmosphere. Why probes? need no supplies for humans, cheaper. smaller/only one-way.
- 11 Space station. Get used many times. Its an artificial satellite - size of small house. Send up in May, 73, the first one. In Nov., 73 three astronauts lived in it for 85 days doing experiments and proving man could live in space for long periods.

PRINCIPLE 3 INTEGRATION

**"A TOPIC CAN BE IDENTIFIED AS THE SUBJECT THAT
WAS MOST FREQUENTLY REFERRED TO IN THE PARAGRAPH"**

Paragraph

- 1 Chinese invented rocket engines which are used to launch satellites.
- 2 Newton's Law — every action has a reaction — explains how rockets move.
- 3 Engines work by burning fuel that creates pressure inside forcing gasses out the rear.
- 4 Rockets must carry their oxygen.
- 5 Gravity pulls rockets down.
- 6 A rocket's thrust needs to move it at 40 250 kms to get escape velocity.
- 7 Multistage rockets fire from the bottom up and become lighter.
- 8 Gravity gets weaker in space so the rocket needs less fuel only to steer or change speed - it moves by inertia because space doesn't slow it down.
- 9 R.H. Goddard built and launched first rocket in 1926.
- 10 Manned and unmanned rockets which are cheaper.
- 11 Space station can house humans longest time is 85 days and is the size of a house.

Appendix S

EXERCISE

DIRECTIONS: Write an outline for each one of the paragraphs using the new way that you have been taught. Include a main idea and as many supporting details as you think you need. Next to the words "MAIN IDEA" fill in your topic sentence and below it fill in the details.

PARAGRAPH

1) **MAIN IDEA:**

Supporting details:

2) **MAIN IDEA:**

Supporting details:

3) **MAIN IDEA:**

Supporting details:

4) **MAIN IDEA:**

Supporting details:

5) **MAIN IDEA:**

Supporting details:

6) **MAIN IDEA:**

Supporting details:

7) **MAIN IDEA:**

Supporting Details:

8) **MAIN IDEA:**

Supporting details:

9) **MAIN IDEA**

Supporting details:

10) **MAIN IDEA:**

Supporting details:

11) **MAIN IDEA:**

Supporting details:

Appendix T

MAIN THEME: Natural Resources

		Main Idea Terms			
Renewable resources.	Nonrenewable resources.	Conservation	Recycling	Energy sources from: fossil fuels, water, and wind.	

		Subordinate terms			
water,	oil, gas	the larger	many items	fossil:made from	
air,soil	coal.non-	the populat-	can be re-	dead organisms.	
renewable.	non-renew-	ion, the	used,conse-	non-renewable,	
	able.	greater the	rves both	running-out, larg-	
		demand.	non- & ren-	est used. water:	
			ewable.	kinetic energy,	
			-	moving water,e.g.,	
			-	a dam. use: elect-	
			-	ricity. Wind: e.g.,	
			-	a windmill. suppl-	
			-	mented by batter-	
			-	ies. last two don't	
			-	pollute/are renew.	

Possible Acronym for the Main ideas: RANCER

R A N C E R	R A N C E R
e n o o n e	Air n Oil Increases Liquid Used
n d n n e c	Water d Gas Volume Blow Materials
e - r s r y	Soil a Increases Ocean
w - e e g c	s Call
a - n r y l	
b - e v - e	R A N C E R
l - w e - -	A N O I L U
e - - - - -	W D G V B M
	S - A I O -
	- - S C - -

Appendix U

ESSAY QUESTION:

You were asked to read the hand-out on "What causes AIDS?" Please write a summary of what you have read. For example, include in your essay a description of what AIDS is, its cause, and its affect on the body. Use the sheet the paper that is attached to these directions to answer the question.

Appendix V

ESSAY QUESTION:

You were asked to read the hand-out on "What causes AIDS?" Please write a summary of what you have read. For example, include in your essay a description of what AIDS is, its cause, and its affect on the body. Use the sheet the paper that is attached to these directions to answer the question.

Appendix W

DIRECTIONS: Write your ACRONYM (your memory word) on the space below and fill-in what each letter spells-out-like "I-Immuno."

The first letter

Spells-out

DIRECTIONS: Use your memory-word (acronym) to help you answer the essay question. Be sure to include your main ideas and details.

ESSAY QUESTION: You were asked to read the hand-out on "What causes AIDS?" Please write a summary on what you have read. For example, include in your essay a description of what AIDS is, its cause, and its affect on the body. Use the sheet of paper - attached - to answer the question.

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