Children's Ability to Utilize the Mnemonic Keyword Method: An Educational Application Within Fourth-Grade Classrooms.

Nancy Lynn Williams

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation

https://digitalcommons.lsu.edu/gradschool_disstheses/4753

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
INFORMATION TO USERS

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

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

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

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book. These are also available as one exposure on a standard 35mm slide or as a 17” x 23” black and white photographic print for an additional charge.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6” x 9” black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI
University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700  800/521-0600
Children’s ability to utilize the mnemonic keyword method: An educational application within fourth-grade classrooms

Williams, Nancy Lynn, Ph.D.
The Louisiana State University and Agricultural and Mechanical Col., 1989

Copyright ©1990 by Williams, Nancy Lynn. All rights reserved.
CHILDREN'S ABILITY TO UTILIZE THE MNEMONIC KEYWORD METHOD:
AN EDUCATIONAL APPLICATION WITHIN FOURTH GRADE CLASSROOMS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in
the Department of
Curriculum and Instruction (Reading)

by

Nancy L. Williams
B.S., Worcester State College, 1973
M.Ed., University of South Alabama, 1978
May 1989
ACKNOWLEDGEMENTS

The writing of this dissertation brings to fruition a dream that I have long held, and, as with any tremendous endeavor, could not have been achieved without the support of many significant and wonderful individuals. To these people, I sincerely and lovingly extend my gratitude.

I wish to first thank Dr. Bonnie Konopak, my major professor, my mentor, and, especially, my friend and colleague, whose guidance and professionalism have been exemplary. Her door has always been open to advise and counsel, to console in times of despair, and to share in the many joys I have experienced throughout my program. I am both proud and grateful to be her student.

Special thanks are also extended to my committee members, who have not only taught me in some of the most interesting and helpful courses at LSU, but who have additionally provided support and advice. Dr. Robert Coon, my minor professor who initially sparked my interest in mnemonics, has provided developmental insight into its role in cognition and learning. Dr. Diana Pounder, who helped me to better understand the world of statistics and the designs of studies, has extended positive suggestions for both this study and others. Dr. Alden Moe has been most willing to continue to offer his assistance despite the
many miles. His encouraging comments and well wishes have been cheerfully received. Finally, I wish to thank Dr. John Readence, who taught the first reading course that I took at LSU and who has been most influential in shaping my philosophy of reading. He has been helpful throughout my program, has provided guidance and encouragement, and has influenced my professional growth. Working with him in both academic pursuits and research projects has been both an honor and a pleasure, and I have greatly appreciated his comments and suggestions.

One of my strongest support systems consists of fellow graduate students. I wish to first express thanks to Ellen Jampole and Joyce Many who have always been there to listen to both professional and personal concerns. They, along with John Konopak and Mary Margaret Mitchell, have helped to establish reliability and validity of the measures used in this study, and I thank them all for taking time out of their own busy schedules. Thanks also to Art Halbrook for being there to help edit papers, to reflect upon studies and possible studies, and to be my friend. And finally, I thank all of the graduate students on the third floor for their encouraging remarks, conversations, smiles, and chuckles. They have helped to maintain my sanity.

My family has been most supportive of this endeavor, and although living at a great distance, has been generous with phone calls and letters to encourage me. First, to my son Glenn, who
doesn't remember when Mommy wasn't studying, I thank for those endearing hugs and words of love. Watching him learn to read through the enjoyment of good books has been one of my greatest pleasures. I give sincere thanks to my Aunt Doris V. Lindstrom, who has been like a second mother, to my sister Gail Saltis, and to my brother Gary Carlson, for their interest, support, and love.

Additional thanks are extended to Jack Williams for encouraging me to pursue this dream, and to Jo Williams for her continued love and support. Further, a personal thanks goes to my friend Tom Stedman, who has helped me to believe in myself, and who has given me confidence to sustain me through some challenging times.

Finally, to my parents Wilbur and Ingeborg Carlson, the son and daughter of Swedish immigrants, who believed in the value of education and who encouraged all of their children to go to college, I respectfully dedicate this dissertation in their memory.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td>TABLE OF CONTENTS</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>ABSTRACT</td>
<td>vii</td>
</tr>
<tr>
<td>1</td>
<td>INTRODUCTION.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Review of Related Literature</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Need for the Study</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>METHOD</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Subjects</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Materials</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Procedure</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>RESULTS</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>DISCUSSION</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>REFERENCES</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>APPENDICES</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Definition of Terms</td>
<td>44</td>
</tr>
<tr>
<td>B</td>
<td>Review of Literature.</td>
<td>47</td>
</tr>
<tr>
<td>C</td>
<td>Pilot Study</td>
<td>75</td>
</tr>
<tr>
<td>D</td>
<td>Instructional Scripts</td>
<td>79</td>
</tr>
<tr>
<td>E</td>
<td>Instructional Materials</td>
<td>125</td>
</tr>
<tr>
<td>F</td>
<td>Assessment Materials</td>
<td>140</td>
</tr>
</tbody>
</table>
G  Directions for Scoring. ...................... 165
H  Raw Data. ..................................... 180
VITA. .............................................. 188
ABSTRACT

Research has shown that the mnemonic keyword method is an effective study strategy under controlled laboratory-type situations with subjects learning decontextualized facts. Very few studies have actually tested the mnemonic keyword method within the context of a normal fourth grade classroom and learning situation. The purpose of this study, then, was to demonstrate the viability of the mnemonic keyword method as a study strategy when compared to notetaking/outlining, a common study strategy recommended by fourth grade curricula.

The subjects were 106 fourth graders enrolled in four classes at a rural elementary school. Data were collected over a four week period which included both instructional and transfer phases. During the first week, intact classes were instructed by the researcher in either the mnemonic keyword method or notetaking/outlining during the reading period. During the second week, the researcher continued instruction in each study strategy by demonstrating how the strategy could be applied to a unit in social studies. During the third and fourth weeks, the subjects were instructed by the classroom teachers who used researcher-provided instructional scripts for social studies and science units. During this transfer phase, subjects were not encouraged to utilize any particular method, but rather were instructed to use their best study strategy to learn the
information. Each unit in weeks two through four was followed by assessment measures and study strategy questionnaires.

Data were analyzed using a repeated measures MANOVA on the tests administered during the instructional phase, a MANOVA on the social studies transfer, and a MANCOVA on the science transfer. Results indicated that there were no statistically significant results on any of the testing measures. However, the overall results were promising as the subjects instructed in the mnemonic keyword method performed equally as well as those instructed in notetaking/outlining on all measures. This indicates that the mnemonic keyword strategy, while not superior to notetaking/outlining, is indeed a practical study method applicable to normal classroom use.
The use of mnemonics, or memory enhancing techniques, for learning has a long tradition in the field of education. In the classroom, teachers have often employed a variety of these strategies, such as songs, jingles, and pictures, to assist their students in the difficult task of recalling information (Bower, 1970). Generally, these techniques require the learner to associate new information with familiar facts to enhance recall. More specifically, common types of techniques include prose mnemonics such as creating sentences or stories, as well as pictorial mnemonics such as using drawings or mental pictures. The underlying premise is that the learner, upon encountering the new stimulus, will use the familiar mnemonic to recall the correct information (Bellezza, 1981; Levin, 1983; Pressley, Levin, & Delaney, 1982).

Review of Related Literature

For a definition of terms related to this study, see Appendix A. For a complete review of literature, see Appendix B.

One of the most researched forms of mnemonics in the past 10 years has been the keyword method, a technique using imagery to link new and known information. Here, the learner pairs a new fact with a perceptually similar keyword, incorporates both in an
interactive visual image, and then, when encountering the new fact, uses the image/keyword to generate an appropriate response. This process can be illustrated with an example of the word catkin meaning "a cluster of flowers." Here, catkin is recoded into cat and then related to the keyword through the image of a cat walking through a flower garden. When the new word next appears, cat triggers the garden image which leads to the "cluster of flowers" response (Konopak & Williams, 1988).

Levin (1983) explains this associative process as the three R's: Recoding, Relating, and Retrieving. First, the unfamiliar target word is Recoded or transformed into a more meaningful concrete keyword. Secondly, this keyword is Related thematically with the target word in an interactive image. Finally, with the two preceding components established, a Retrieval path is set up from the familiar information to the unfamiliar target word.

Bellezza (1987) identified components of this process with elements of memory schemas: constructability, associability, discriminability, and invertibility. Keywords and images that are easily generated, relate to prior knowledge, are not confused with other cues, and have a bidirectional association are most likely to be successful when included in this mnemonic process.

Across research using a range of learners and stimulus materials, the effects of the keyword method have been overwhelmingly positive (Pressley, Levin, & McDaniel, 1987). Initial studies in this area centered upon foreign language
learning (Atkinson, 1975; Pressley & Levin, 1978), rare English vocabulary (Levin, Johnson, Pittelman, Hayes, Levin, Shriberg, & Toms-Bronowski, 1984), or isolated content facts (Levin, 1983). According to Levin (1983), this associative process has significantly aided learners in recalling new information over more common study strategies such as underlining, notetaking, using context, or semantic mapping.

While these results are impressive, educators (Graves, 1986; Sternberg, 1987) have expressed concern over the experimental conditions used to test the technique. That is, the vast majority of studies have been conducted under laboratory-type situations in which an experimenter, using oral statements, has worked individually with students learning decontextualized information. In addition, in order to test learning, immediate recall and recognition tasks are given, with few studies using delayed testing and even fewer examining some form of transfer (for reviews, see Pressley, Borkowski, & Johnson, 1987; Pressley, Levin, & Delaney, 1982).

Two major concerns over the use of such experimental conditions have instructional implications: (a) whether such a technique can be employed in a natural classroom setting using ecologically valid materials and procedures, and (b) whether students, upon acquiring this strategy, would spontaneously transfer it for use in similar/different learning situations. Very few studies have tested this technique in a classroom context
(e.g., Levin, Morrison, McGivern, Mastropieri, & Scruggs, 1986). Only one study (Williams, Konopak, & Readence, in press) has used ecologically valid materials, but with limited instruction. Further, virtually no studies have tested transfer to another content area nor examined continued use under normal classroom conditions.

Need for the Study

Overall, the superiority of the keyword method over more common strategies has been well established. However, for generalizing to classroom instruction and learning, the previous research has had limitations as to subjects, materials, and procedures. The majority of these studies focused on adult learners or junior/senior high school students, with little application to younger subjects' abilities to use mnemonic strategies. Also, the materials utilized in these studies were researcher contrived lists of isolated facts or vocabulary words. When prose materials were used, they were presented in booklets, even when textbooks were available (Levin, Morrison, McGivern, Mastropieri, & Scruggs, 1986). In addition, the experiments were conducted in a laboratory setting with the experimenter presenting the information at timed intervals to individually assess the subjects (Pressley & Dennis-Rounds, 1980; Pressley & Levin, 1978) or orally reading the information to the subjects (McCormick & Levin, 1984; McCormick, Levin, Cykowski, & Danilovics, 1984). Further, assessment included immediate and delayed testing.
(Levin, Morrison, McGivern, Mastropieri, & Scruggs, 1986), with only a few attempts to address transfer for content material (Konopak & Williams, 1988; O'Sullivan & Pressley, 1984; Pressley & Amhad, 1986; Williams & Konopak, 1988).

The present research study, therefore, attempted to teach children a study strategy over a period of four weeks, with specific instruction in a strategy, a week of application, and two weeks of transfer to both the same content area and to a different content area. Further, the study addressed the following concerns: (a) the ability of younger subjects to both utilize and transfer the keyword method in two content areas, and (b) the practicality of the keyword method within an ecologically valid context. Specifically, fourth graders were instructed in either the keyword method or in notetaking/outlining, a common fourth grade strategy suggested in fourth grade curricula. Teaching included direct instruction, guided practice, and independent practice within a classroom setting using fourth-grade social studies and science instructional and assessment materials.
CHAPTER TWO

METHOD

Subjects

The subjects were 112 fourth graders enrolled in four heterogeneously grouped classes at a large rural elementary school, near a moderately-sized southern city. These fourth grades were semi-departmentalized in structure. That is, while all of the teachers were responsible for reading instruction, two of the teachers taught a combination of math/science, while two others taught a language arts/social studies combination. Therefore, the subjects received instruction in reading and math/science or reading and language arts/social studies from their homeroom teacher, and traveled to the team teacher's classroom for instruction in the alternate class combination.

The subjects were randomly assigned to either a mnemonic keyword group or notetaking/outlining group by intact classes. To insure equivalency of groups by ability, standardized reading test percentile scores (Comprehensive Assessment Program, 1983) were collected and compared. The mnemonic keyword group with 53 subjects (32 males, 21 females) had a mean of 47.40 (sd =24.45; range = .01-.99), while the notetaking/outlining group, also with 53 subjects (28 males, 25 females), had a mean of 52.81 (sd = 21.51; range = .13-.91). A preliminary t-test indicated no statistically significant difference between the two treatment conditions in regard to reading ability. The remaining
six subjects from the assigned sample, four from the mnemonic keyword group and two subjects form the notetaking/outlining group, did not have available reading scores and consequently were not included in the data analysis.

Materials

Pilot testing was conducted in order to determine the appropriateness of the materials utilized in the study. For a complete description of the pilot study see Appendix C.

Instructional materials included the social studies (Cangemi, 1986), and science (Belcha, Grega, & Green, 1979) textbooks utilized by the fourth grade classes. The teachers, as a group, selected the units to be included in the study. These included: (a) the Midwest, for strategy instruction, (b) Early Settlers of the Midwest, for strategy transfer to the same content area, and (c) Stars, for transfer to a different content area.

Materials for the initial instruction in study skill techniques included researcher-developed charts and reading materials selected from a fourth grade basal reader (Early, Canfield, Karlin, Schottman, Srygley, & Wenzel, 1983). For the mnemonic keyword condition, these visual aids included mnemonic visual images depicting the interaction between the keyword and target information (e.g., catkin description). For the notetaking/outlining condition, similar charts were presented which emphasized outlining. For the application of these study
skills to social studies, similar researcher-developed posters integrating the facts from a unit on Midwestern climate and resources were presented to the two treatment groups. For a complete description of the instructional scripts and materials, see Appendices D and E.

Assessment materials included tests of prior knowledge, immediate multiple-choice and probed recall tests following each instructional unit, delayed multiple-choice and probed recall tests following just the first instructional unit, and study strategy questionnaires. Copies of these measures can be found in Appendix F. Additional information on scoring can be found in Appendix G; raw data can be found in Appendix H.

The tests of prior knowledge, adapted from Zakaluka, Samuels, and Taylor's (1986) procedure, were administered before instruction in each social studies unit and the science unit. The subjects were presented with a word or phrase which targeted the larger topic of the unit. They were then given 5 minutes to list as many words as they could think of that were related to that topic.

The multiple-choice assessments consisted of 14 questions (a stem and four alternatives), based upon the information contained within the chapters in the social studies and science textbooks. Doctoral students in education judged the items for content validity and to designate literal or inferential level questions.
The probed recalls consisted of four phrases targeting significant information contained in each chapter. Here, the subjects were required to write what they remembered about these target phrases. For the social studies instructional unit, the delayed multiple-choice and probed recall tests were reordered versions of the immediate multiple-choice and probed recall tasks.

The final assessment measure included two forms of a study strategy questionnaire. One form administered prior to instruction of study skills asked the subjects to indicate their favorite study strategy for social studies, math, language arts, and science. After instruction in each social studies and science unit, the subjects completed the second form consisting of three questions: (a) what study strategy did you use to study the Midwest (social studies) or Stars (science)? (b) Did it help you to remember the important information? (c) Would you use this study method again when studying social studies (science)? and (d) Would you use it in another subject?

Procedure

All instruction and testing were conducted in intact classes, by either the researcher or classroom teacher. During the first week, the researcher met with the reading classes for strategy instruction. The first task was the completion of the initial study strategy questionnaire; then, over three days the researcher instructed each treatment group in either mnemonic keyword or notetaking/outlining study strategies. During the second week,
the researcher instructed the four classes in the social studies period, using either mnemonic keyword or notetaking/outlining within a lesson unit on Midwest climate and resources.

For the next two weeks, the classroom teachers instructed the classes but did not include study strategy instruction. During the third week, the subjects were instructed in their social studies classes on the early settlers of the Midwest. During the last week, the subjects were instructed in the science classes on a unit on stars. The teachers used researcher-prepared scripts to insure uniformity in the content and presentation of the lessons to both instructional conditions. The following describes each week in detail by experimental groups.

Week one. On day 1, both treatment conditions were administered a general strategy questionnaire, given a notebook to be utilized for the duration of the study, and given initial instruction in either mnemonic keyword or notetaking/outlining strategies. On the second day, subjects in both treatment conditions practiced this study strategy using a passage from a fourth grade basal reader. On the third day, subjects were presented with another passage and worked within small groups to practice using the new strategies.

Mnemonic treatment group. On day 1, the mnemonic keyword group completed the initial study strategy questionnaire and received a notebook. Then, they were instructed in this method
using charts which explained the strategy and presented examples, including catkin. On day 2, after a review of this technique, the subjects were given a passage on water pollution, selected from a fourth grade basal (Early et al., 1983). The subjects were asked to read the passage after which a possible keyword (pool-oh-shun) and interactive images of a dirty pool surrounded by concerned water users were presented on the chalkboard. The subjects discussed possible alternative keywords and images, and recorded the information in their notebooks. On the third day, the subjects were provided with a passage from the fourth grade basal (Early et al., 1983) about Venus. In small groups, the subjects read the passage, generated keywords, and then shared them with the class.

**Notetaking/Outlining group.** On day 1, after completing the study strategy questionnaire and given a notebook to be utilized during the study, the subjects were instructed in notetaking/outlining as a study strategy. Using a chart which first reviewed finding the main ideas in order to write notes, the subjects were provided with a passage about items that may be found on their teacher's desk. These items were listed on the chalkboard and organized into: (a) things for writing, (b) things that hold other things together, and (c) books. This list of categorized items were then assembled into an outline which was provided on the chart. Subjects then recorded this information in
their notebooks. On days 2 and 3, the same procedures were followed as those used in the mnemonic keyword group but with guided and independent practice conducted in notetaking/outlining strategies.

**Week two.** Both treatment groups received instruction in a unit on the climate of the Midwest extending over three days. Prior to instruction, all classes had been introduced to the area of the Midwest and had discussed the various topographical features of the area. After completing a test of prior knowledge, both treatment groups were given instruction using lesson plans which emphasized pre-reading, reading, and post-reading activities and included opportunities for both guided and independent practice. Immediate posttesting was conducted on the fourth day.

**Mnemonic treatment group.** On day 1, the mnemonic keyword study strategy was reviewed and the subjects informed that they would be learning about the climate and resources of the Midwest; in addition, they would be taught how to apply this study method to the new material they would be reading and learning. After establishing a purpose for reading, the subjects read a passage about the climate of the Midwest and discussed the important facts of the passage. These important facts included: (a) the comparison of the climates of the Northeast and the Midwest, and (b) the amount of rainfall in the Central and Great Plains. They were then provided with the keyword **Clem Ant** for **climate** and
discussed the passage using: (a) Clem Ant to compare the climate of New York with Chicago, and (b) Clem Ant visiting the Great Plains and the Central Plains. The lesson concluded with an independent activity of answering chapter questions followed by class discussion.

On day 2, after a review, the subjects were introduced to the next section of the chapter, that of resources and industries of the Midwest. During the prereading phase of the lesson, the subjects were introduced to the two target vocabulary words, cargo and limestone. After eliciting some possible definitions from the subjects, they were instructed to find the definition in the textbook glossary. Then, they worked in groups of four to generate a keyword for both of these terms. After sharing these keywords, the subjects were provided a purpose for reading and instructed to silently read the passage. After reading and discussion of the main topics, the subjects were presented with keywords for the resources and industries of the Midwest. These included: (a) resources represented by a sorcerer who transformed such resources as corn, wheat, milk, and cattle into the respective products manufactured in the Midwest, and (b) industries represented by trees that contained flour and cereal, cheese and other dairy products, and meat. After discussion, the subjects were asked to answer several questions about the resources and industries of the Midwest that were contained in the textbook and then discussed these responses in class.
On day 3, after a review and a brief map activity contained within the chapter, the subjects, in groups of four, were asked to read the textbook passage about Mark Twain. Then, after reading the passage, they were to generate their own keywords to help them remember the important facts. These keywords were drawn on the board and shared with the other subjects.

On day 4, the subjects completed an immediate probed recall and an immediate multiple-choice assessment. This was followed by a study strategy questionnaire. Then five days later, prior to more instruction in social studies, the students were administered a delayed probed recall and a multiple-choice assessment.

**Notetaking/Outlining group.** In contrast, the notetaking/outlining group followed the same procedures but with instruction in using notetaking and outlining strategies instead of mnemonic keywords. On day 1, notetaking/outlining was reviewed and the subjects informed that they would be applying this strategy to social studies. After being provided with a purpose for reading, the subjects read the passage and discussed the important facts. With the assistance of researcher-developed outlines, the subjects discussed the organization of these facts, with the lesson concluding with the same independent activity of answering the chapter questions followed by class discussion.

On day 2, after review, the subjects were introduced to the next section of the chapter. During the prereading stage of this
lesson, the subjects were introduced to the vocabulary words cargo and limestone. They were asked to generate their own definitions for these words, to locate them in the glossary for comparison, and finally, to write a sentence containing each word. This activity was conducted in groups of approximately four subjects. These sentences were then shared with the class. A purpose was established for reading the next passage, and the subjects silently read about the resources and industry of the Midwest. Again, after a discussion about the important facts, the subjects were provided with an outline which organized these facts. Finally, several questions contained in the textbook were answered independently by the subjects, and the responses were discussed in class for clarification.

On day 3, after a review and map activity contained within the chapter, the subjects, in groups of four, read the textbook passage about Mark Twain and organized the important facts into an outline. These outlines were then written on the board and shared with the class. On the fourth day, subjects were administered the same testing measures as the mnemonic keyword group, with delayed testing five days later.

Weeks three and four. During the third week, all subjects received instruction in the next chapter contained in the social studies textbook. Teachers were provided with identical instructional scripts which did not stress the use of a specific study strategy,
but rather encouraged the use of a best method to remember the information. To insure treatment integrity, the researcher observed all four classes during instruction. Similarly, in the fourth week, the science teachers were also provided with scripts to instruct the subjects during the science transfer phase. Again, subjects were encouraged to use their own best method and were observed by the researcher to insure treatment integrity.

Scoring

Directions for scoring and scoring keys were prepared for each task. Scoring of the tests of prior knowledge was based upon a word association task developed by Zalaluk, Samuels, & Taylor (1986). Responses were scored quantitatively, with one point given for each reasonable association and one additional point for each superordinate category. The total points were compiled and then categorized as (a) low prior knowledge (0-2 points), (b) average prior knowledge (3-6 points), and (c) high prior knowledge (7+ points). Two doctoral students in reading education were provided with initial instruction in the scoring procedures for this measure and then assisted the researcher in scoring all three tests of prior knowledge. A randomly selected pool from each testing measure was drawn with each scorer independently assessing each task to determine inter-rater reliability. For each test of prior knowledge, the inter-rater reliability, based upon percentage of agreement, was as follows: (a) .92 for the first
Scoring for the immediate and delayed multiple-choice tasks included one point for a correct response, with a possible total of 14 points for each testing measure here. Coefficient alphas were calculated for each measure using the Kuder-Richardson formula. The reliability coefficients were: (a) instructional social studies = .54, (literal = .42, inferential = .29); (b) transfer social studies = .57, (literal = .48, inferential = .10); transfer science = .64, (literal = .49, inferential = .52). On the probed recalls, one point was given for each correct answer in each four probes for each measure. These tasks were scored by the researcher and two doctoral students in reading education. Following a training session, raters each scored copies of a common pool of randomly selected probed recall tasks, using a prepared scoring key. Scores from this common pool were used to determine inter-rater reliability. Based upon percentage of agreement, the results were as follows: (a) .92 for the social studies instructional phase, (b) .97 for the social studies transfer phase, and (c) .86 for the science transfer phase.

On the study strategy questionnaires, all strategies were first categorized by common type and then further subcategorized
by helpfulness and further use. The same two doctoral students assisted the researcher in scoring a randomly selected pool of study strategy questionnaires. After initial training in this phase of assessment, each rater independently scored the questionnaires to obtain inter-rater reliability. Based upon percentage of agreement, the results were as follows: (a) .94 on the initial questionnaire, (b) .97 on the second week questionnaire, (c) 1.00 on the third week questionnaire, and (c) .92 on the fourth week questionnaire.
CHAPTER 3

RESULTS

For the purpose of this study, both parametric and descriptive analyses were conducted to assess differences between groups. Parametric statistics were used to analyze the tests of prior knowledge, probed recall, and multiple-choice measures. Descriptive statistics were used to analyze responses on the study strategy questionnaires.

Initial t-tests were conducted on the tests of prior knowledge to assess the subjects' existing knowledge before treatments. The tests administered prior to the two social studies units indicated no statistically significant differences between groups. However, the test given before the science unit revealed a statistically significant difference, $t(1, 49)=2.18$, $p<.007$; the notetaking/outlining group ($M=3.86$, $sd=2.78$) outscored the mnemonic keyword group ($M=2.60$, $sd=1.89$). Consequently, this test of prior knowledge was used as a covariate in the analysis involving the science unit.

To assess differences between groups after strategy instruction in social studies, a repeated measures MANOVA was conducted on the immediate and delayed probed recall and multiple-choice tasks. No statistically significant results were found on the immediate probed recall task, $F(1, 97)=2.12$, $p<.1482$, on the immediate multiple-choice task, $F(1,97)=1.02$, $p<.318$. 
on the delayed probed recall task, $F(1, 97)=3.83, p<0.0532$, or on the delayed multiple-choice task, $F(1, 97)=0.76, p<0.3846$. (See Table 1 for means and standard deviations.)

Similar results were found for both transfer phases of the study. On the social studies unit, a MANOVA conducted on the probed recall and multiple-choice tasks indicated no statistically significant differences. The results were $F(1, 99)=0.62, p<0.4323$ for the probed recall task and $F(1, 99)=1.09, p<0.2995$, for the multiple-choice task. On the science unit, a MANCOVA, with the test of prior knowledge as a covariate, again revealed statistically nonsignificant results. The results were $F(2, 92)=0.02, p<0.8905$ for the probed recall task and $F(2, 92)=0.77, p<0.3831$ for the multiple-choice task. (See Table 2 for means and standard deviations.)

In addition to the multivariate analyses, post hoc univariate analyses were conducted on the literal/inferential multiple-choice items to examine differences by group and level of question difficulty. The design included two factors, between
Table 1
Means and Standard Deviations for Immediate and Delayed Probed Recall and Multiple-Choice Tasks on the Social Studies Instructional Unit

<table>
<thead>
<tr>
<th>Group</th>
<th>Immediate</th>
<th></th>
<th>Delayed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recall</td>
<td>MC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Recall</td>
<td>MC&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mnemonic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>2.66</td>
<td>6.50</td>
<td>2.66</td>
<td>6.14</td>
</tr>
<tr>
<td></td>
<td>(2.17)</td>
<td>(2.58)</td>
<td>(1.94)</td>
<td>(2.30)</td>
</tr>
<tr>
<td>Notetaking/Outlining</td>
<td>3.25</td>
<td>6.90</td>
<td>3.48</td>
<td>6.48</td>
</tr>
<tr>
<td></td>
<td>(2.23)</td>
<td>(2.39)</td>
<td>(2.24)</td>
<td>(2.15)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Maximum score = 14.
Table 2

Means and Standard Deviations for Probed Recall and Multiple-Choice Tasks on Transfer Social Studies and Science Units

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Social Studies</th>
<th></th>
<th></th>
<th>Science</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Recall</td>
<td>MC</td>
<td></td>
<td>Recall</td>
<td>MC</td>
</tr>
<tr>
<td>Mnemonic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>50</td>
<td>2.68</td>
<td>7.44</td>
<td>50</td>
<td>6.08</td>
<td>8.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.05)</td>
<td>(2.59)</td>
<td></td>
<td>(4.12)</td>
<td>(2.53)</td>
</tr>
<tr>
<td>Notetaking/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlining</td>
<td>51</td>
<td>2.39</td>
<td>6.98</td>
<td>50</td>
<td>6.70</td>
<td>6.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.59)</td>
<td>(2.27)</td>
<td></td>
<td>(3.34)</td>
<td>(2.27)</td>
</tr>
</tbody>
</table>

Maximum score = 14.
groups (mnemonic keyword and notetaking/outlining) and within groups (literal and inferential). Based on separate ANOVAs conducted on the four multiple-choice tests, no statistically significant results were found for the group factor. However, the level of question factor was statistically significant for each test; each group scored higher on the literal level questions than on the inferential questions. On the immediate social studies test, group results were $F(3, 103)=.66, p<.515$, while the level of question results were $F(3, 103)=75.6, p<.0001$ (see Table 3). On the delayed social studies test, the group results were $F(3, 98)=.72, p<.524$, while the level of question results were $F(3, 98)=55.41, p<.0001$ (see Table 3). On the social studies transfer test, the group results were $F(3, 99)=1.0, p<.321$, while the level of question results were $F(3, 99)=53.36, p<.0001$ (see Table 4). On the science transfer task, the group results were $F(3, 98)=.01, p<.947$, while the level of question results were $F(3, 98)=7.45, p<.008$ (see Table 4). There were no statistically significant interactions between experimental groups and level of question on any of the four analyses.

---

Insert Tables 3 and 4 about here

---

On the study strategy questionnaires, the self-reported strategies were first categorized according to type and then
Table 3

Means and Standard Deviations of Literal and Inferential Multiple-choice Items on Immediate and Delayed Social Studies Tests

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Literal*</th>
<th>Inferential</th>
<th>n</th>
<th>Literal*</th>
<th>Inferential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mnemonic</td>
<td>53</td>
<td>3.98</td>
<td>2.53</td>
<td>50</td>
<td>3.72</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.51)</td>
<td>(1.48)</td>
<td></td>
<td>(1.43)</td>
<td>(1.55)</td>
</tr>
<tr>
<td>Notetaking/Outlining</td>
<td>52</td>
<td>4.12</td>
<td>2.79</td>
<td>50</td>
<td>3.86</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.65)</td>
<td>(1.30)</td>
<td></td>
<td>(1.54)</td>
<td>(1.09)</td>
</tr>
</tbody>
</table>

Note: All test item categories = 7.

* all p's < .001.
Table 4

Means and Standard Deviations of Literal and Inferential Multiple-Choice Items on Transfer Social Studies and Science Tests

<table>
<thead>
<tr>
<th>Group</th>
<th>Social Studies</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Literal</td>
<td>Inferential</td>
</tr>
<tr>
<td>Mnemonic 50</td>
<td>4.48</td>
<td>2.94</td>
</tr>
<tr>
<td></td>
<td>(1.42)</td>
<td>(1.39)</td>
</tr>
<tr>
<td>Notetaking/Outlining 51</td>
<td>4.02</td>
<td>2.96</td>
</tr>
<tr>
<td></td>
<td>(1.64)</td>
<td>(1.18)</td>
</tr>
</tbody>
</table>

Note: All test item categories = 7.

* all p's < .001.
percentages were calculated for each method by experimental group. The initial study strategy questionnaire, administered prior to strategy instruction, indicated that over three-quarters of the mnemonic keyword subjects did not use a study method during social studies, while more than half of the notetaking/outlining group did not use a study strategy. (See Table 5 for percentages.) Further, two-thirds of both groups did not report a study strategy for science learning. (See Table 6 for percentages.)

---

After the instructional phase in social studies, the majority of subjects in both treatment conditions reported adopting the taught strategy and finding it to be a useful technique to help them remember the information. A greater percentage of the subjects in the mnemonic keyword group, however, reported using that method, while over a third of the notetaking/outlining group continued to use previously acquired study strategies. (See Table 7 for percentages.) On the transfer to social studies, a smaller percentage of the mnemonic treatment group reported using this strategy, although the subjects who reported the continued use of mnemonics found it to be useful. A greater percentage of the subjects in the
Table 5

Percentages of Study Strategies Reported for Social Studies Prior to Strategy Instruction

<table>
<thead>
<tr>
<th>Study Group</th>
<th>n</th>
<th>None</th>
<th>Guide</th>
<th>Review</th>
<th>Rehearsal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mnemonic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>52</td>
<td>83%</td>
<td>8%</td>
<td>3%</td>
<td>1%</td>
<td>5%</td>
</tr>
<tr>
<td>Notetaking/Outlining</td>
<td>53</td>
<td>58%</td>
<td>8%</td>
<td>13%</td>
<td>13%</td>
<td>8%</td>
</tr>
</tbody>
</table>
Table 6
Percentages of Study Strategies Reported for Science Prior to Strategy Instruction

<table>
<thead>
<tr>
<th>Study Group</th>
<th>n</th>
<th>None</th>
<th>Guide</th>
<th>Review</th>
<th>Rehearsal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mnemonic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>52</td>
<td>67%</td>
<td>8%</td>
<td>6%</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>Notetaking/Outlining</td>
<td>53</td>
<td>62%</td>
<td>15%</td>
<td>8%</td>
<td>8%</td>
<td>7%</td>
</tr>
</tbody>
</table>
notetaking/outlining group, however, reported using notetaking/outlining during transfer, and found it to be helpful. (See Table 8 for percentages.)

Insert Tables 7 and 8 about here

During the transfer to science, approximately two-thirds of both treatment conditions reported the sustained use of their adopted strategy, with the majority of the subjects again finding it to be a useful strategy. Interestingly, many subjects in both conditions reported no strategy use for this phase of the study. Although the percentages of subjects reporting no study methods are approximately one half of the initial self-report, some subjects apparently did not adopt any study strategy, despite instruction to use their best study strategy to help remember the information. (See Table 9 for percentages.)

Insert Table 9 about here

In conclusion, no statistically significant results were found on any of the assessment measures. Analysis of the study strategy questionnaires, however, indicated that more subjects in the mnemonic treatment group had no initial study methods, and were less likely to maintain usage of the study strategy over
Table 7

Percentages of Study Strategies Reported for the Social Studies Instructional Phase

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mnemonic</th>
<th>Notetaking</th>
<th>Reading</th>
<th>Rehearsal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mnemonic</td>
<td>Notetaking</td>
<td>Reading</td>
<td>Rehearsal</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mnemonic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>53</td>
<td>85%</td>
<td>0%</td>
<td>6%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(98%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td>Notetaking/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlining</td>
<td>52</td>
<td>0%</td>
<td>65%</td>
<td>29%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentages of usefulness are indicated in parenthesis.
Table 8

**Percentages of Study Strategies Reported for the Social Studies Transfer Phase**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mnemonic</th>
<th>Notetaking</th>
<th>Rereading</th>
<th>Rehearsal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mnemonic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyword</td>
<td>50</td>
<td>78%</td>
<td>0%</td>
<td>6%</td>
<td>4%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(97%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Notetaking/Outlining</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlining</td>
<td>50</td>
<td>0%</td>
<td>76%</td>
<td>14%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(95%)</td>
<td>(86%)</td>
<td>(100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentage of usefulness is indicated in parenthesis.
Table 9
Percentages of Study Strategies Reported for the Science Transfer Phase

<table>
<thead>
<tr>
<th>Group</th>
<th>Mnemonic</th>
<th>Notetaking</th>
<th>Rereading</th>
<th>Other</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mnemonic</td>
<td>50</td>
<td>66%</td>
<td>0%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Keyword</td>
<td>(91%)</td>
<td>(75%)</td>
<td>(100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notetaking/</td>
<td>50</td>
<td>0%</td>
<td>65%</td>
<td>22%</td>
<td>2%</td>
</tr>
<tr>
<td>Outlining</td>
<td>(90%)</td>
<td>(91%)</td>
<td>(100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentage of usefulness indicated in parentheses.
time than the other group. Subjects in the notetaking/outlining group, although initially having more knowledge concerning study strategy usage, fluctuated in the application of their taught strategy.
The purpose of this study was to examine the educational applications of the mnemonic keyword method within a normal fourth grade setting. More specifically, the study addressed the practicality of this study strategy when used by fourth graders studying actual fourth grade textbook materials in a daily class routine. Additionally, the study examined the subjects, once instructed in strategy use and application to social studies, on their ability to generate their own keywords and images within transfer phases to a different unit in social studies and then to a different content area of science.

In taking into account the generalizability of the results of this study, several limitations must be considered. First, the use of intact, heterogeneous classes at one grade level limits the extension of the findings to the fourth grade level. Further, the results may have been different if subjects at different grade levels had been included, and if the subjects had been stratified according to high and low ability. Secondly, as the study extended over a four week period, several subjects were absent on one or more days, and as a consequence not included in the data analysis for each testing period. Additionally, due to several intervention programs such as speech or language classes,
some subjects occasionally were not present for the entire instructional period, although this pull-out time was minimal. Also, instruction was limited to one social studies series and one science series, whereas results may differ when other content area textbooks are employed. Finally, the reliabilities of the multiple-choice tests were average to low, indicating that the tests themselves may have affected the results.

Given these limitations, the following conclusions can be drawn from the results of this study. First, although no statistically significant results were found on the testing measures, the mnemonic keyword method was just as successful as the notetaking/outlining strategy as a study technique for fourth grade students. That is, subjects in the mnemonic keyword group scored equally as well on all testing measures as those subjects in the notetaking/outlining group. This indicates that when given the opportunity to study content material using the mnemonic keyword method, fourth graders would most likely remember as much information using this strategy as they would using the more common study strategy of notetaking/outlining.

Further, an examination of the individual reading ability levels of the subjects included in the data analysis indicates that there was a wide range of reading abilities, with many subjects in both treatment conditions reading below grade level. As previous studies (Konopak & Williams, 1988; Peters & Levin,
1986) have found similar nonsignificant results with poorer readers, the lack of statistical significance in this study is not surprising, given this wide range of ability.

Also of interest is the post hoc univariate analyses of literal and inferential questions on the multiple-choice tests. Although both treatment conditions again scored equally well on these measures, subjects in both conditions achieved higher scores on literal level questions than on the inferential questions. It is possible that the subjects were not accustomed to inferential test questions, and therefore had difficulty answering these items. Additionally, treatments may not have been sensitive to this type of question as instruction and activities stressed literal level questions. Further, the tests themselves may have affected the results, given the average to low reliabilities. Despite this inability to successfully answer these types of questions, however, both groups scored equally well on this measure of the study. These findings are consistent with previous results of this study, indicating that the mnemonic keyword method is equally effective as a notetaking/outlining method, not only in general analysis of social studies and science questions, but specifically on both literal and inferential questions.

Further, the analysis of the initial study strategy questionnaires provided additional insight. Although many
subjects in both experimental conditions did not report any study strategies prior to the instructional phase, more subjects in the mnemonic treatment condition did not report a specific study strategy in either social studies or science. This lack of what Pressley, Borkowski, and Johnson (1987) label "specific strategy knowledge," coupled with poor reading skills, may also have accounted for the lack of statistical significance on the posttest measures. Pressley et al. describe this condition of specific study strategy within the context of the development of imagery and mnemonic skills. They contend that good readers are capable of relating metacognitively with the text and consequently are able to determine not only what is important, but also which study strategy would be the best to employ, given all possible conditions. Further, mature thinkers are more capable of integrating prior knowledge with new information, a basic premise of the keyword method.

Another interesting outcome of the self-reported study strategies is that during the transfer to social studies phase, few subjects indicated the use of the mnemonic keyword method, with even fewer using this method during the transfer to science phase. At the conclusion of the study, approximately one-half of the original group, who reported using no specific study strategies for science, resorted to the non-use of study skills. This extinguishing use of study strategies may be due to the fact
that many of the subjects were unable to generate keywords and images to help remember the important facts, a finding consistent with previous research on the development of subject-generated mnemonic elaborations (Pressley & Levin, 1977). Also, it may be that additional training in transferring this material may be required.

From a qualitative perspective and a review of class notes, however, the researcher observed some student interest in the mnemonic keyword method. Although many of the subjects did not generate keywords and images, particularly during the science transfer phase, those subjects who did generate such mnemonics enjoyed this process and were eager to share with the researcher their keywords and images. Although the sharing of keywords and images were integrated into the instructional phase of the study, many subjects continued this process during the transfer phase. For example, during the social studies transfer phase, several subjects generated a keyword image of a woman flying a plane with a heart on it to help remember that Amelia Earhart was a famous woman pilot. During the science phase, several subjects selected keywords which rhymed with stars, such as car, and then included an illustration depicting a car near a gas tank to help recall that stars are composed of gasses. Further examples of mnemonic keyword images were contained in the class notes. Therefore, as some subjects were enthusiastic and consistent in the use of
mnemonic keywords, it is anticipated that they would continue to utilize it for future study use.

Future research in this area of mnemonic keyword strategies could focus on the ability of subjects of various grade levels to use and consequently generate keywords and images based upon reading ability and specific study strategy knowledge. This research could additionally look at different basal series with various text structures in order to determine further application of this mnemonic process. A third area of research could address the amount of time and direction needed for young students to adopt and use mnemonic strategies.

In conclusion, it appears that the mnemonic keyword method is a study strategy equal in effectiveness to a notetaking/outlining method, and could be incorporated as part of regular class instruction on study strategies. Such instruction should continue to involve a lesson plan format which emphasizes modeling, guided practice, and independent practice. Additionally, more concrete examples and instruction prior to a transfer phase may be more beneficial to younger subjects, particularly those who are novice readers with no specific study strategy knowledge.
REFERENCES


APPENDIX A

DEFINITION OF TERMS
For the purpose of this study, the following terms are defined:

**mnemonic technique** - any mental strategy that aids the learning of one material by using other, initially extraneous, material as an aid to such learning (Turnure & Lane, 1987).

**mnemonic imagery** - a pictorial context encompassing a mnemonic term and a new fact within a visual image that assists in recall of pertinent information (Turnure & Lane, 1987).

**paired association** - the process in which two lists of words are paired in order to facilitate recall. One word of the pair is designated as the stimulus word while the other is designated as the response. Once the learner is presented with the stimulus word, the response word is then generated (Goss & Nodine, 1965).

**pegword** - the mnemonic technique which utilizes images of concrete objects which are called *pegs*. These pegs are then included in a rhyming pattern to recall the numerical order resulting in an association, such as "one is a bun." The response words are then connected to the pegword and rhyme through a bizarre interactive image (Bellezza, 1981).
**keyword** - a familiar word that is related to a new target word only in that it is concrete and perceptually similar to the target word (Atkinson, 1975).

**keyword method** - the method of pairing a target word with a concrete keyword that is orthographically or acoustically similar and then semantically relating them within a visual image (Levin, Morrison, McGivern, Mastropieri, & Scruggs, 1986).
APPENDIX B

REVIEW OF LITERATURE
Interestingly, mnemonics has its historical roots in ancient Greece. Derived from Mnemosyne, the goddess of memory, the utilization of such memory aids can be dated back over 2,000 years. Widely cited in mnemonic literature (Higbee, 1977), Simonides, a poet, was one of the first to develop a mnemonic method to organize information for easy retrieval. According to legend, Simonides was entertaining at a banquet when he was suddenly called outside. During his absence, the roof to the banquet hall collapsed, killing all who were there. He was able to identify the deceased through a mnemonic method of placement whereby he recalled where each individual was seated around the banquet table (Yates, 1966).

Many Greeks in ancient times also utilized mnemonic strategies to enhance the memorization of plays, speeches, or poems which were later orally presented (Paivio, 1979; Yates, 1966). Additionally, Aristotle noted the importance of visual imagery in memory strategies and wrote in De Anima, "the soul never thinks without a mental picture" (Yates, 1966, p. 32). This hypothesis for imagery can be combined with Simonides' statement, "words are the images of things" (Paivio, 1979, p. 2), to provide a basis for the development of the utilization of visual imagery with the intent to recall certain facts.
Although mnemonic strategies have a long tradition in facilitating learning and recall (Bellezza, 1981; Pressley, Levin, & Delaney, 1982), it has only been in the last two decades that researchers have seriously investigated this area of cognitive ability. The researcher attributed with providing the impetus for research is Allan Paivio. He argued that words and images are elicited as associate reaction to stimuli; further, he suggested that imagery could be studied by manipulating stimulus attributes, as well as instruction to subjects (Paivio, 1979). Much of the early research by Paivio and others (Goss & Nodine, 1965; Wood, 1967) focused upon paired-association learning.

**Paired Association**

Paired-association is a process in which the learner is presented with a list of stimulus-response pairs such as fish-desk, and street-apple. In order to successfully recall these words, the learner must assign one word as the stimulus to generate the other as a response. Usually the word which generates a more visual mental image is the stimulus cue; when activated, this word results in the correct response of the other word in the pair. Unfortunately, the pairs used in initial studies showed little relationship among the words which resulted in recall difficulty (Paivio, 1979; Yuille & Catchpole, 1973).

In order to enhance the paired associate process, subsequent studies (Kemler & Jusczyk, 1975; Pressley & Levin, 1977; Reese,
1972) employed this method with the addition of an interactive image between the two members of the association pair. For example, when presented with the pair of "fish-desk," the learner would be directed to visualize a fish sitting on top of a desk. To make the image more vivid, Higbee (1977) advocated that the learner develop a detailed image that involves movement if possible. In this example, the learner may imagine that the fish is flying over an oak desk in an executive's office. The use of such visual images consequently yielded positive results in the continued research of this mnemonic strategy (Higbee, 1977).

**Pegword**

Miller, Galanter, and Pribram (1960) proposed a plan for remembering lists which involved verbalization in the form of rhyme. The *pegword* technique was then employed in several studies (Bugelski, Kidd, & Segmen, 1968; Pressley & Amhad, 1986). Here, the learner is provided with pairs of words, with one member being a peg word, a visually concrete noun that is also part of a mnemonic rhyming pattern. For example, a common pattern is "one is a bun, two is a shoe, three is a tree," etc. The list of words to be learned is paired numerically so that the learner can retrieve the target word when the peg word is stated (Bugelski, Kidd, & Segmen, 1968; Paivio, 1979; Wood, 1967).

In this method, the learner is first taught the peg words and rhyming patterns, and then instructed to visualize an interactive
association to assist in the recall. Assuming that the first word is "fish" and the second word is "desk," the learner is instructed to pair "fish" with the rhyme "one is a bun." The learner then creates a visual image of a fish in a bun. Similarly, the second word "desk" is paired with the rhyme "two is a shoe," which then results in a visual image of a shoe on a desk. When presented with the task of recalling these words, the visual image enables the learner to recall the list in numerical order. Again, research conducted using this mnemonic process was successful when compared to free study or other methods, and therefore considered to be an effective method for recall (Bugelski, Kidd, & Segmen, 1968; Paivio, 1979; Wood 1967).

Keyword

Subsequent studies (Atkinson, 1975; Pressley & Levin, 1977; 1978) in the area of mnemonic visual imagery focused upon the keyword method. In this strategy, a target word to be learned is paired with a keyword, which has a concrete visual image and is also orthographically or acoustically similar to the target word. These two words are then incorporated into an interactive visual image which may be either provided by a teacher/researcher or generated by the learner. This keyword and image, then, become the stimuli which generate the appropriate response of the target word.

Levin (1983) described the keyword method as the three R's:
Recoding, Relating, and Retrieving. The first step in this process is to Recode or transform the target (unfamiliar) word into a more meaningful keyword. The second step is to Relate this keyword with the target word in an interactive image. In the final step, the keyword and image are used to Retrieve the new word. For example, the target word is carlin, an obscure English word meaning "old woman." The target word is Recoded into a familiar keyword that is orthographically and acoustically similar, such as car. The keyword car is then Related to the meaning of the word through an interactive image of an old woman driving a car. Then, when the learner next encounters the target word carlin, the keyword car is Retrieved, the image is activated, and the learner responds with "old woman" (Pressley, Levin, & Miller, 1981).

Bellezza (1987) defended the area of mnemonic research by identifying components of effective mnemonic processes with elements of memory schemas: constructability, associability, discriminability, and invertibility. That is, cues that are easily generated during the learning process, that relate to prior experiences, that are not confused with other cues, and that have a bidirectional association are more likely to be effective in recall of facts. An assessment of how the example of carlin is representative of Bellezza's theory is presented. The keyword car is familiar with a vast majority of learners, as is the image of
an old woman. Therefore, such a mnemonic image is easily generated, as the schemata for both elements are those which are frequently used. The image is also associative as real world objects are used, yet not so confusing that it is indiscriminable. Additionally, such an image is bidirectional wherein the new information carlin is first presented followed by the schematic information of car and old woman. During recall, the schematic information stimulates the response of the new information.

Early Keyword Studies

The foundations of keyword research were established by Atkinson (1975) when studying college students' acquisition of a foreign language. Primarily interested in the acquisition of isolated lists of foreign vocabulary words, he developed the keyword method, a strategy based upon two stages. The first stage required the subject to associate the spoken foreign word with the keyword, which is selected solely on the basis of its acoustic or orthographic similarity. The second stage required the subject to form a mental image of the keyword interacting with the English translation. For example, the Spanish word for horse is caballo (cab/by/0). As the medial syllable for this word is acoustically similar to the English word eye, the keyword for caballo becomes eye. The learner then develops a mental image of an interaction between a horse and a giant eye. Atkinson's studies with students learning Spanish or Russian indicated that the keyword method was
superior to simple rote learning of foreign vocabulary words (Atkinson, 1975).

Following Atkinson's (1975) procedures, research on the keyword method explored its use, generally using: (a) older students as subjects, (b) foreign/rare English vocabulary, or isolated facts as stimulus materials, and (c) laboratory-type conditions in which an experimenter provided oral presentations to individual learners. The following discussion briefly describes important representative studies.

For learning foreign vocabulary, college and high school subjects using the keyword method recalled substantially more English translations than did control subjects using their own best method (Levin, Pressley, McCormick, Miller, & Shriberg, 1977; Pressley & Levin, 1978; Pressley, Levin, Nakamura, Hope, Bispo, & Toye, 1980). In addition, in learning infrequent English vocabulary, similar results were found for mnemonic groups over control groups using their own best strategies or semantic information (Levin, McCormick, Miller, Berry, & Pressley, 1982; Pressley, Levin, Kuiper, Bryant, & Michener, 1982; Pressley, Levin, & Miller, 1981). Further, in learning isolated facts such as states/capitals or towns/products, mnemonic subjects continued to outperform control subjects in recalling target information (Levin, Pressley, McCormick, Miller, & Shriberg, 1977; Levin, Shriberg, Miller, McCormick, & Levin, 1980).
However, even given such positive findings, the educational significance of these studies is not apparent (McCormick & Levin, 1987). That is, learners are not generally asked to process and remember isolated word lists, particularly in decontextualized conditions. Further research, then, addressed the use of curricula content and prose materials in order to make the findings more generalizable.

Later Studies

One of the first studies to apply mnemonics to a prose-learning task was by Shriberg, Levin, McCormick, and Pressley (1982). In a series of three experiments on learning fictitious names/accomplishments, fourth and fifth graders were taught to generate keyword images based on prose-embedded facts. Across the three experiments, they found that mnemonic students correctly recalled substantially more information than control students who used their own best method of studying.

Three additional studies attempted to extend these findings. Levin, Shriberg, and Berry (1983) presented eighth graders with passages on the attributes of fictitious towns and found significant results on identification tasks for the keyword group over a control group. McCormick and Levin (1984) found that mnemonic imagery facilitated junior high school students' memories for lengthy biographical passages, while McCormick, Levin, Cykowski, and Danilovics (1984) found that college students could
use a mnemonic strategy to learn similarly structured biographies. In all of the above studies, the prose passages had been presented orally by an experimenter, while the students read along on their own printed copies. Research then turned to the question of how students might perform in actual silent reading situations.

In the first study using silent reading, Peters & Levin (1986) provided eighth graders with the same "famous people" passages created by Shriberg et al. (1982) in an effort to determine their ability to utilize the keyword method when given prose material. Based upon standardized reading test scores, students were classified as either good or poor readers and randomly assigned to one of two treatment groups, keyword and free study. Immediate and delayed question measures indicated the superiority of the keyword method for both ability levels.

A second experiment by Peters and Levin (1986) provided seventh graders with prose material about little known but real people. This prose, originally found in reading skills materials, was retyped and assembled into booklets which were silently read by the students. In this experiment, the students again were randomly assigned to treatment or control conditions by ability level. On immediate and delayed measures, students instructed in the keyword method outscored those who used their own best method, thereby providing additional support for the efficacy of the keyword method.
An application of the keyword method to content area reading was the purpose of a study by Levin, Morrison, McGivern, Mastropieri, and Scruggs (1986). These researchers compared mnemonic imagery with two other study techniques on the recall of science information by eighth graders. Students within two classes were randomly assigned to either a mnemonic, summary, or free study condition. Instructional materials included a text describing three dichotomized attributes of eight minerals, as well as instructions for each treatment group on how to study the information. After the students had studied the instructions and read the passages, they completed an attributes identification task and a questionnaire on the usefulness and future use of their study strategy, as well as a prior knowledge assessment. Three days later, all students were asked to recall everything they could remember about each mineral, to again complete the attributes identification task, and to complete a questionnaire on the usefulness and future use of their study strategy. Results showed that, while all students had little/no prior knowledge of the experimental material, the mnemonic group significantly outperformed the other groups on all measures. In addition, the mnemonic students found their particular strategy to be more useful than did the other two groups.

Due to these positive findings, the study was replicated by Williams and Konopak using sixth grade students (1988). This
investigation focused upon the ability of sixth graders to use keywords versus free study in both instructional and new learning situations. Fifty-six sixth graders enrolled in one of two biology classes were randomly assigned to either the mnemonic or free study group by intact classes. Based on standardized reading test scores, the two groups were comparable as to reading ability. Prior to treatment, all subjects wrote their knowledge of 18 minerals as a measure of prior knowledge. Two minerals were subsequently dropped due to subjects' familiarity; the remaining 16 minerals were randomly assigned to either an instructional or new learning situation.

On the first day of treatment, the mnemonic group was instructed in using the keyword method and then asked to read and study a booklet containing short text passages on eight minerals as well as researcher-provided drawings linking the minerals and three attributes to researcher-developed keywords. The free study group was given a review of familiar strategies such as underlining and notetaking and then asked to read and study a booklet with the same passages but with space provided for the students' use rather than the drawings. Immediately following reading, both groups recalled pertinent information, completed the recall and identification tasks. A week later, the students again completed the recall and identification tasks. A month later, all subjects were given a booklet containing text passages on the
remaining eight minerals and asked to study the information as they chose. After reading, they compiled recall and identification tasks and a second study strategy questionnaire.

Based on ANOVAs of the recall and identification tasks in each testing period, the mnemonic group significantly outsourced the free study group, thus supporting the Levin et al. finding. In addition, based on questionnaires, the mnemonic subjects carried this strategy to a new learning situation, suggesting that their keyword method may be a viable study strategy for middle school students.

To further extend these findings to older middle school students of both high and low reading abilities, Konopak and Williams (1988) conducted a second study using eighth graders as subjects. In this investigation, mnemonic imagery was again compared with more traditional study strategies on enhancing subjects' recall of expository text material. Subjects were randomly assigned to one of these two treatment conditions by intact classes. Materials and procedures were similar to those used by Williams and Konopak (1988). During instruction, half the subjects were taught the mnemonic keyword method, while half were given a review of common study strategies. During the transfer phase, all subjects were encouraged to use their own best method.

Based on ANOVAs on recall and recognition tasks in instructional, week-delayed, and transfer situations,
above-average mnemonic subjects significantly outscored the free study subjects on all but the transfer measures. The below-average mnemonic subjects, however, outscored the free study subjects on only one instructional measure. In addition, descriptive data collected from study strategy questionnaires indicated that the above-average mnemonic subjects used the mnemonic keyword method successfully during instruction and carried it over to the transfer situation. In contrast, the below-average subjects used this strategy with mixed reactions during instruction, but generally did not transfer it. Both above-average and below-average subjects in the free study conditions reported using underlining/notetaking successfully in both instructional and transfer situations, although several subjects also indicated the use of a form of mnemonics.

In an effort to extend these positive findings to younger subjects, Williams, Konopak, and Readence (in press) attempted to teach fourth graders to use the keyword method within the context of a science lesson. In contrast to previous studies, this investigation used fourth graders as subjects just developing study techniques as they make the transition from basal to expository text reading. In addition, this investigation included class instruction within a 3-stage lesson framework with pre, during, and post reading activities to adhere to a more normal class routine.
Subjects were randomly assigned by intact classes to either a mnemonic keyword or notetaking/rereading group. Instructional materials included a chapter on rocks and minerals taken from a fourth grade science text which was selected by the classroom teachers and part of the fourth grade science curriculum. Assessment materials included a test of prior knowledge, a different immediate and delayed identification tasks, a delayed recall task, and a study strategy questionnaire. Over four days, the two groups were instructed in study strategy usage—either the mnemonic keyword or traditional notetaking/rereading. Initially, both groups were instructed in their assigned strategy which was followed by text readings with application of the strategy embedded within the lesson. Additionally, prereading and post reading activities were included in the study. On the third day, the subjects were administered the immediate identification task. Two days later, they completed the recall, the delayed identification, and study strategy tasks.

While instruction was limited to three days, the mnemonic keyword group significantly outscored the notetaking/rereading group on the immediate identification task and on the delayed recall identification task. No statistically significant results were found on the delayed identification task. Of additional interest were the responses to the study strategy questionnaires.
Almost half of the subjects in the notetaking/rereading group indicated that they had used "silly sentences," a form of prose mnemonics, to help them remember the new information. In contrast, almost all of the subjects in the mnemonic keyword group chose to use the keyword method as a means to study.

Thus far, an overview of mnemonic keyword studies have focused upon older students as subjects and used instructional and assessment materials which were not ecologically valid. The following sections discuss these specific aspects in order to extend the review of the literature and to further establish the rationale for this study.

Young Readers

Levin (1976) reported on work conducted by Piaget and Inhelder in 1971 concerning the development of visual imagery. The preoperational child at age 2 or 3 is capable of only reproductive imagery which is static in nature. In this stage, the child is capable of using visual images that represent internalized copies of external occurrences; generally the visual image must be presented to the child. The anticipatory imagery stage develops at the beginning of the operational stage which is generally around the age of 7 or 8. It is in this stage that the child begins to be able to employ mental images in a more creative fashion. Levin (1976) further stated that with elementary-age children, it is better to use more concrete examples of visual
images. As for the ability to generate their own visual images, most children find it quite difficult to do. This technique, although possible when given specific guidance, is more readily attained as the child proceeds to the formal-operational stage of development around the age of 11.

Several mnemonic studies during the past 15 years have addressed developmental issues associated with the efficacy of these memory techniques. These studies have used strategies such as paired association (Kemler & Jusczyzky, 1975; Kerst & Levin, 1973; Reese, 1972) or the keyword method (Pressley & Levin, 1977; 1978). The results of these studies indicated that, although all age groups are able to use mnemonics to enhance recall of isolated vocabulary words, younger children perform better when provided with researcher-developed illustrations. However, while these studies provide further support for Levin's (1976) developmental theory, this research has been limited to decontextualized learning.

**Ecologically Valid Context**

A recommendation for the ecological validity of educational studies has been advocated by Brofenbrenner (1976) and has its foundations on three basic premises. These include: (a) research studies cannot be limited to laboratory techniques as education occurs in real-life settings, (b) the interconnectedness of the learner and the environment must be considered, and (c) the
methodology used to contrast two environmental systems should not be confounded. When educational studies consider that learning processes encompass these premises, the results of the findings can therefore be more generalizable (Bronfenbrenner, 1976).

Studies in mnemonic research have thus far been conducted under laboratory-type or controlled classroom settings and can be classified, according to Bronfenbrenner (1976), as contrived experiments. Only one study (Williams, Konopak, & Readence, in press) has attempted to incorporate Bronfenbrenner's propositions. Since the results of this research indicated the superiority of the keyword method, the implications for classroom practice are encouraging. However, further research using ecologically valid materials and methodology needs to be conducted to provide more practical educational implementation for this method.

Assessment

Initial experiments in mnemonic studies primarily tested subjects immediately following instruction in the mnemonic technique (Levin, McCormick, Miller, Berry, & Pressley, 1982; Paivio & Derochers, 1979; Paivio, Yuille & Smythe, 1966) or also included a delayed measure (Kerst & Levin, 1973; Levin, Johnson, Pittelman, Levin, Shriberg, Toms-Bronowski, & Hayes, 1984; Levin, Shriberg, Miller, McCormick, & Levin, 1980). Additionally, the measures were administered orally to individual subjects (Levin, Shriberg, Miller, McCormick, & Levin, 1980; O'Sullivan & Pressley,
1984; Pressley & Amhad, 1986) or used audio-visual materials (Kemler & Jusczyk, 1975; Kerst & Levin, 1973). Although some studies incorporated more traditional paper and pencil assessment procedures, these tests only measured recall and recognition of specific facts (Levin, Johnson, Pittelman, Levin, Shriberg, Toms-Bronowski, & Hayes, 1984; Levin, Morrison, McGivern, Mastropieri, & Scruggs, 1986; Levin, Shriberg, Miller, McCormick & Levin, 1980), providing no support for the application of mnemonics for the actual comprehension of a concept.

A concern of educators also has been the ability of subjects trained in mnemonic study strategies to apply these methods to novel learning situations (Graves, 1986; Sternberg, 1987). Although several studies have addressed the specific topic of transfer, the content material presented to the subjects during the transfer has been unrelated to content presented during the initial strategy phase (Pressley & Dennis-Rounds, 1980; O’Sullivan & Pressley, 1984; Pressley & Amhad, 1986), or with transfer only contained within the same content field (Williams & Konopak, 1988).

In summary, the research in the area of mnemonic study strategies, specifically the keyword method, had focused on the use of primarily older students as subjects in highly controlled settings, and utilizing only laboratory type materials in both instruction and assessment. Further, there have been no studies
conclusively measuring the efficacy of the keyword method using assessment that is traditionally employed in the classroom. Additionally, there has been little evidence supporting the transfer of the keyword method to other content areas.

As instruction in this mnemonic strategy has been limited in the majority of these studies, the question arises concerning the ability of subjects, especially children, to internalize these study methods. Further, adults are often not good mnemonic strategy users and consequently do not encourage children to utilize such techniques (Pressley, Borkowski, & Johnson, 1987). Additionally, research indicates that children do not employ strategies involving imagery to its fullest extent (Pressley, Borkowski, & Johnson, 1987). Therefore, Pressley et al. (1987) suggested that children be taught specific study strategies in order to develop specific strategy knowledge.

In order to make instructional recommendations for classroom teaching and learning, this study focused on the ability of younger subjects to use the mnemonic keyword method for studying content material within an ecologically valid setting. More specifically, over four weeks, fourth graders were instructed in either a mnemonic keyword strategy or a notetaking/outlining method as a means to recall content material. This included two weeks of strategy instruction and application to social studies, and two weeks of transfer to the next social studies unit and to a
different content area of science. Instruction followed fourth grade curricula and included strategies for before, during, and after reading.
REFERENCES


APPENDIX C

THE PILOT STUDY
Pilot Study

The purpose of the pilot study was to determine the following information:

(a) The appropriateness of the recall and multiple-choice tests for fourth graders.
(b) The appropriateness of the researcher developed instructional materials for fourth graders.
(c) The amount of time to be allowed for various facets of the study.

The sample was obtained from two fourth grade classrooms in a school similar to the sample used in the actual study. The pilot study extended over a two-day period, with each lesson conducted for 40 minutes.

On the first day, the subjects in each classroom were given the initial study strategy questionnaire which they completed within 5 minutes. Then, the subjects were given a test of prior knowledge on the physical aspects of Stars for two purposes: (a) to determine the appropriateness of the instructions, and (b) to provide examples to be used in a training session for scorers. Next, the subjects in one classroom were presented with the materials which the researcher designed for the mnemonic keyword group. Using scripts which were similar to those developed for the major study, the researcher taught the subjects how to use the mnemonic keyword method first as a general study.
strategy, and then how to specifically apply it to a unit in social studies on the Midwest. Similarly, subjects enrolled in the second classroom received instruction in notetaking/outlining as a study strategy, first generally, and then specifically as an application to the same social studies unit on the Midwest. These instructional materials for both treatment conditions were presented on a large chart which was hung on chart holders in the classroom. Although both groups were responsive to these materials and were able to relate to these visual aids, it was decided that an additional chart should be added for the notetaking/outlining group regarding the importance of reading to find the important facts.

On the second day, after a review of the presented study strategies, the subjects were randomly assigned a packet which contained one of three passages for use in the major study, the probed recall and multiple-choice tasks for that particular unit, and a study strategy questionnaire for that content area. One third of each class received a packet on the first social studies unit, one third received the second social studies unit, and the remaining third received the science unit. Subjects completed reading the social studies passages within 10 minutes, and the science passage within 15 minutes. After all subjects completed reading, they were instructed to take out and complete the probed recall tasks, the multiple-choice tasks, and finally the study
strategy questionnaire. Subjects completed the probed recall within 10 minutes, and the multiple-choice task within the same amount of time. They were able to answer the questionnaire in 5 minutes. All tasks were collected after each was completed.

Based on subject response to the assessment materials, it was determined that these measures were appropriate in both content and time for fourth graders. However, it was discovered that the instructions for the test of prior knowledge were inadequate. That is, some of the subjects were confused as to the specifics of this instrument. It was decided, that based on this confusion, guided practice would be provided in the major study.

After the completion of the pilot study, the researcher analyzed the items on the multiple-choice tasks. Because some of the questions appeared to be too difficult, with few subjects successfully completing the task, the questions were reworded. Additionally, some subjects had difficulty answering the one to two word stimulus on the probed recall. All items were then adjusted to include a short phrase which made the assessment more passage specific.

In summary, the pilot study revealed that, with minor modifications, both the instructional and assessment materials were appropriate for average fourth grade subjects in respect to time and content.
Week One

Strategy Instruction
I am interested in the ways that boys and girls study. You may have a special study strategy or method that you like to use when you study different subjects. This week I will tell you about another way to study these same subjects. I will then help you to use this study strategy in social studies next week. The first thing that I want to do with you this morning is to ask you to fill out this questionnaire about the strategies or ways that you study for some of the subjects you have in school. (Allow approximately 5 minutes for this questionnaire.)

This morning I want to talk with you about a type of study strategy called the mnemonic keyword method. Does anyone know what the word "mnemonic" means? (Allow a few minutes for discussion). Mnemonics help us remember new information. You may have heard your teachers give you some mnemonics to help you remember things. For example, when you were very young and learning the names of the letters of the alphabet, your teacher may have helped you remember the name and sound of the letter "s" by having you think about a wiggling snake. As you got older and learned other subject areas, your teacher may have told you rhyme
or a story to help you remember certain facts. Does anyone remember using any mnemonics before? (Allow a few minutes for discussion.)

Before we begin to talk about the mnemonic keyword method, I want to give each of you a special folder with notebook paper in it. On these sheets of paper, I want you to take notes in all of your classes. I would also like you to take very good care of this notebook, and be sure that you do not lose it!

When you get this folder, please write your name, teacher's name and period on the front cover. I would also like you to take out a sheet of paper and write today's date at the top. When I see that all of you have done that, I will begin our lesson on the mnemonic keyword method.

The mnemonic keyword method works like this: (Call subjects' attention to the chart, and read the definition as printed on the chart.)

An example of how you might use the mnemonic keyword method is this: (Call subjects' attention to the chart, and read the example of "catkin". Allow a few moments to discuss how the subjects might develop a keyword for "carlin").

Today we talked about the mnemonic keyword method. When I come back to your class tomorrow, we will learn more about this study strategy.
Day 2

Reading

Mnemonic Keyword Group

20 minutes

Yesterday we learned a little about the mnemonic keyword method as a study strategy. Who remembers what this method is about? (Give subjects a few minutes to discuss, clarify concepts.)

Today we are going to read a passage and use the mnemonic keyword method to help us remember the information in the passage. (Pass out the passages.)

I would like you to read the passage and tell me in one word what the passage is about (pollution). Now let us think of a possible keyword to help us remember pollution. A keyword that I thought about was "pool oh, shun!" (Explain the meaning of the word "shun" if the students do not know it. Discuss the possible interaction of a group of people standing around a pool which had become polluted-based upon facts embedded in the text. Draw this picture on the chalkboard, as input is received from students. Ask students to record this information in their notebooks. The researcher will circulate around the classroom and give assistance as needed.)
Today we learned how we can use the mnemonic keyword method as we read a passage. Tomorrow, we will read another passage and use keywords to help us remember the important facts.
Day 3
Reading
Mnemonic Keyword Group
20 minutes

During the past few days, we have been discussing a study strategy called the mnemonic keyword method. We have learned how to think of keywords for this method and how to draw pictures to help us remember important information. Who can tell me about the passage we read yesterday about water? (Allow several minutes to discuss this.) What did we do to help you remember this?

Today we will read another passage. This time as you read about the planet Venus, I want you to think of a keyword for Venus and a picture that will help you to remember the facts in the passage. Today we will do this activity in groups of 4. (Arrange subjects in groups of 4, distribute the passages, and allow time for completion. Circulate among groups to insure understanding and time on task.)

Now that you have finished this activity, I would like one person from each group to share the group's ideas with the rest of the class. (Allow a few moments for this activity. Summarize the mnemonic keyword process.) Next week, I will come to your social studies class and show you how we can use this strategy to help remember information about the Midwest.
I am interested in the ways that boys and girls study. You may have a special study strategy or method that you like to use when you study different subjects. This week I will tell you about another way to study these same subjects. I will then help you to use this study strategy in social studies next week. The first thing that I want to do with you this morning is to ask you to fill out this questionnaire about the strategies or ways that you study for some of the subjects you have in school. (Allow approximately 5 minutes for this questionnaire.)

This morning I want to talk with you about a type of study strategy called notetaking/outlining. Does anyone know what we might do in this strategy? Sometimes you might have seen outlines in some books that you have read, or maybe a teacher has given you some outlines to study. Does anyone remember using this type of strategy before? (Allow a few minutes for discussion.)

Before we begin to talk about notetaking/outlining, I want to give each of you a special folder with notebook paper in it. On these sheets of paper, I want you to take notes in all of your classes. I would also like you to take very good care of this notebook, and be sure that you do not lose it!
When you get this folder, please write your name, teacher's name and period on the front cover. I would also like you to take out a sheet of paper and write today's date at the top. When I see that all of you have done that, I will begin our lesson on notetaking/outlining.

Let's look at this chart for a minute and read about finding important facts (Call subjects' attention to chart.) Suppose we were to read this passage about what you might find on your teacher's desk. (Call subjects' attention to the passage written on the chart.) If you wanted to remember this information, how might we organize this information? (Lead subjects to suggest that they may organize the list into categories of writing things, things that hold other things together, and books. Write these words on the board.)

Now that we have a list we can place the list in an outline to help us to remember the information. Let's look at the chart again to see how we might organize an outline. (Call the subjects' attention to the chart.) Now, let's look at the chart again to see how we might see an outline of the passage we read about the things on your teacher's desk.

Today we talked about notetaking/outlining as a study strategy. Tomorrow, we will learn more about this method.
Day 2
Reading
Notetaking/Outlining Group
20 minutes

Yesterday we learned a little about notetaking/outlining as a study strategy. Who remembers what this method is about? (Give subjects a few minutes to discuss, clarify concepts.)

Today we are going to read a passage and use notetaking/outlining to help us remember the information in the passage. (Pass out the passages.)

I would like you to read the passage and tell me in one word what the passage is about (pollution). Now let us take notes on this passage. (Write the notes on the board as the students call out the facts). Now that we have these facts, let's organize them into an outline. (Also do this on the board, have students do the same in their notebooks. The researcher will circulate around the classroom and give assistance as needed.)

Today we learned how we can use notetaking/outlining as we read a passage. Tomorrow, we will read another passage and use notetaking/outlining to help us remember the important facts.
Day 3

Reading

Notetaking/Outlining Group

20 minutes

During the past few days, we have been discussing a study strategy— notetaking/outlining. We have learned how to take notes from passages and to organize these notes into an outline to help us remember information. Who can tell me about the passage we read yesterday about the water? (Allow several minutes to discuss this). What did we do to help you remember this?

Today we will read another passage. This time as you read about the planet Venus, I want you to take notes and to organize these notes into an outline. Today we will do this activity in groups of 4. (Arrange subjects in groups of 4, distribute the passages, and allow time for completion. Circulate among the groups to insure understanding and time on task).

Now that you have finished this activity, I would like one person from each group to share the group's ideas with the rest of the class. (Allow a few moments for this activity. Summarize the notetaking/outlining process.) Next week, I will come to your social studies class and show you how we can use this strategy to help remember information about the Midwest.
Week Two

Strategy Application to Social Studies
Day 1
Social Studies
Mnemonic Keyword Group
45 Minutes

Last week I came to your reading class and talked with you about a study strategy. Who remembers what that strategy was? (Give subjects a few moments to discuss this strategy.) This week I will be teaching you how to use the mnemonic keyword method as you read and study about the Midwest in your social studies textbook.

Before we begin reading and studying in the textbook, I would like to see what you already know about the Midwest by doing this activity. I will be giving you a sheet of paper with many lines on it. On each line, you are to write down something about the Midwest—anything that comes to mind. Let's practice how to do this activity for a little bit. Suppose I wanted to find out what you knew about a zoo. What things might you write down about a zoo? (Allow subjects ample time to suggest possible answers. When subjects understand the assignment, pass out tests of prior knowledge, and give subjects 5 minutes to complete the task. Make certain that names, dates, and teacher are written on each paper.)
Today we will discuss the climate of the Midwest. Who knows what the word "climate" means and why it is important to study the climate of an area? (Allow a few moments for discussion.)

Now that you have some ideas about why the climate of an area is an important thing to study, I would like you to read about the climate of the Midwest. Please open your textbook to page 143 and silently read to the bottom of page 145. Remember, you are reading to find out about the climate of the Midwest and why it is important. (Allow the subjects approximately 5 minutes to read this section.)

Now that you have read this section, let's discuss the important information and see how the mnemonic keyword method can help you to understand and remember the information. Remember to take notes in the notebook that I have provided for First, let's look at the topic of this section-climate, and think of a keyword to help us remember climate and its importance. Remember, a keyword is a word that looks like, or sounds like the word we want to remember. A keyword that I thought of for the word "climate" is a character. This character is Clem Ant. (Call subjects' attention to the chart about Clem Ant.)

In the text, how do they begin discussing the climate of the Midwest? (Allow subjects time to answer that Midwest is compared to the Northeast. Direct their attention to the chart in order to see the interaction of Clem Ant in these 2 areas of the country.)
Now, who can tell me how these two sections of the country are the same? How are they different? (Allow a few minutes to discuss. Refer to the chart to clarify and confirm responses.)

Now that we know more about the climate of the Midwest, who can tell me why this is important to the people who live there? (Allow a few minutes to discuss. Refer to the chart to clarify and confirm responses.)

On the bottom of page 145, there are several questions under the topic "Section Review". Let's take a few minutes to answer these questions on a sheet of paper. (Allow approximately 5 minutes for this activity; researcher will circulate around classroom to insure time on task and understanding. When all have completed the assignment, review the answers.)

Today we have discussed the climate of the Midwest and why it is important to the people who live there. Tomorrow, we will do some map studies and read and discuss the resources and industry of the area.
Day 2
Social Studies
Mnemonic Keyword Group
45 Minutes

Yesterday, we read about the climate of the Midwest and how it affects the types of crops that are grown there. Today we are going to read about some of the resources and industries that are in the Midwest. We will read about how important these resources and industries are to each other, and why they are located in this area. Before we begin reading this section, there are two vocabulary words that we need to discuss. These words are "cargo" and "limestone." (Write on the board.) Does anyone know what "cargo" means? (Allow a few minutes for response.) What about "limestone"? (Again, allow a few minutes for response.) Today I want you to find out the definitions for these words using your textbook. I also want you to think of a keyword for each of these vocabulary words. You will work in groups of 4 for this activity. I will give you 10 minutes to complete this assignment. (Researcher will circulate among groups to insure understanding and time on task. After 10 minutes, each group will share their mnemonic keyword.)

Now that you know what these vocabulary words mean, I would like you to read the section in your textbook about resources and
industry. When you read this section, I would like you to note how resources and industry are related and why certain products are made where they are. You are to read pages 148-150 silently. (Allow 5 minutes to read this section.)

Now that you have read this section, what was the main topic of the passage? (resources and industry) What were some of the resources and industries located in the Midwest? When I read this section, I thought of these mnemonic keywords. (Have subjects refer to chart to note how these topics are related. Allow for a few minutes for discussion, referring to chart for clarification and confirmation.)

On the bottom of page 150, there are 4 questions about this section. On a sheet of paper, please answer these questions, using the keyword method to help you. (Researcher will circulate around room to insure time on task and understanding. When all have completed the assignment, review the answers.)

Tomorrow, we will continue to use the mnemonic keyword method as we complete this chapter.
Day 3
Social Studies
Mnemonic Keyword Group
45 minutes

During the past two days, we have read about the climate, resources, and industry of the Midwest. Who can tell me a little about the climate of the Midwest? The resources and industries? (Allow a few minutes for discussion.) What helped you to remember these facts? Today we are going to practice map skills. You will work in groups of 4 and will use your textbook. As you read pp 146-147 in your textbook, you should read to find out what the colors stand for on the maps, and how the temperature map compares to the agricultural map. (Researcher will circulate among the groups to insure time on task and understanding. Allow approximately 20 minutes for this assignment. When subjects have completed the assignment, review the answers, discuss.)

The Midwest is not only famous for its many resources and industries, but it also has many interesting people. One of these individuals is an author who lived over a hundred years ago and has written many wonderful stories that are still read and enjoyed today. While you are still in your groups, I want you to read about this famous American in your textbook and to use the mnemonic keyword method to help you remember the important facts.
(Researcher will circulate among groups to insure time on task and understanding. Allow 20 minutes for this activity. Have the groups report to the class on their work.)

We have completed this section on the Midwest. Tomorrow you will have a test on the material we have discussed this week.
Day 4
Social Studies
Mnemonic Keyword Group
30 minutes

Today we will have a test on the material we covered this week in social studies. On the first part of the test, you are to write the information that you remember about the topic. The second part is multiple choice. I will give you the first part, and when everyone is finished, I will give you the second part. Good luck!

(Allow 15 minutes for the first section, 10 for the second. When all have completed the test, collect the papers. Make sure that all subjects included name and date on tests.)

Now I am going to ask you to think about the study strategy that you used to help you remember the information that you learned about the Midwest. I will give you a questionnaire; please answer the questions. (Orally read the questions to the subjects, allow time for completion and collect.)
Day 1
Social Studies
Notetaking/Outlining Group
45 Minutes

Last week I came to your reading class and talked with you about a study strategy. Who remembers what that strategy was? (Give subjects a few moments to discuss this strategy.) This week I will be teaching you how to use notetaking/outlining as you read and study about the Midwest in your social studies textbook.

Before we begin reading and studying in the textbook, I would like to see what you already know about the Midwest by doing this activity. I will be giving you a sheet of paper with many lines. You are to write down something that comes to mind about the Midwest on these lines, although you are not expected to write on each line. Let's practice how to do this activity. Suppose I wanted to find out what you knew about a zoo. What things might you write down about a zoo? (Allow subjects ample time to suggest possible answers. When subjects understand the assignment, pass out tests of prior knowledge and give subjects 5 minutes to complete the task. Make certain that names, dates, and teacher are written on each paper.)

Today we will discuss the climate of the Midwest. Who knows what the word "climate" means and why it is important to study the climate of an area? (Allow a few moments for discussion.)
Now that you have some idea why it is important to study the climate of an area, I would like you to read about the climate of the Midwest. Please open your textbook to page 143 and silently read to the bottom of page 145. Remember, you are reading to find out about the climate of the Midwest and why it is so important. (Allow the subjects approximately 5 minutes to read this section).

Now that you have read this section, let's discuss the important information and see how notetaking/outlining can help you to understand and remember the information. First, let's look at the topic of this section-climate. Now, let's think about the important facts about the climate of the Midwest (Write these on the board as the subjects suggest answers.)

We have the important facts but now we need to organize them in an outline. Look at the chart, as I have already completed an outline for you. (Refer subjects' attention to the chart for clarification and confirmation of the information.)

On the bottom of page 145, there are several questions under the topic "Section Review". Let's take a few minutes to answer these questions on a sheet of paper. (Allow approximately 5 minutes for this activity; researcher will circulate around classroom to insure time on task and understanding. When all have completed the assignment, review the answers.)

Today we have discussed the climate of the Midwest and why
it is important to the people who live there. Tomorrow, we will read and discuss the resources and industry of the area.
Day 2
Social Studies
Notetaking/Outlining Group
45 Minutes

Yesterday, we read about the climate of the Midwest and how it affects the types of crops that are grown there. Today we are going to read about some of the resources and industries that are in the Midwest. We will read about how important these resources are to each other, and why they are located in this area. Before we begin reading this section, there are 2 vocabulary words that we need to discuss. These words are "cargo" and "limestone". (Write on the board.) Does anyone know what "cargo" means? (Allow a few minutes for response.) What about "limestone"? (Again, allow a few minutes for response.) Today I want you to find the definitions of these words using your textbook. I would also like you to use these words in a sentence. You will work in groups of 4 for this activity. I will give you 10 minutes to complete this assignment. (Researcher will circulate among groups to insure understanding and time on task. After 10 minutes, each group will share their sentences)

Now that you know what these vocabulary words mean, I would like you to read the section in your textbook about resources and industry. When you read this section, I would like you to note
how resources and industry are related and why certain products are made where they are. You are to read pages 148-150 silently. (Allow 5 minutes to read this section.)

Now that you have read this section, what was the main topic of the passage? (resources and industry) What were some of the resources and industries located in the Midwest? When I read this section, I thought to organize the information in an outline that looks like this. (Refer subjects to chart and allow for a few minutes of discussion, referring to the chart for clarification and confirmation.)

On the bottom of page 150, there are 4 questions about this section. On a sheet of paper, please answer these questions. (Researcher will circulate around room to insure time on task and understanding. When all have completed the assignment, review the answers.)

Tomorrow, we will complete this chapter using notetaking/outlining strategies.
Day 3
Social Studies
Notetaking/Outlining Group
45 Minutes

During the past two days, we have read about the climate, resources, and industry of the Midwest. Who can tell me about the climate of the Midwest? The resources and industries? (Allow a few minutes for discussion.) What helped you to remember these facts? Today we are going to practice map skills. You will work in groups of 4 and will use your textbook. As you read pp 146-147 in your textbook, you should read to find out what the colors stand for on the maps, and how the temperature map compares to the agricultural map. (Researcher will circulate among the groups to insure time on task and understanding. Allow approximately 20 minutes for this assignment. When subjects have completed the assignment, discuss the answers.)

The Midwest is not only famous for its many resources and industries, but it also has many interesting and famous people. One of these individuals is an author who lived over a hundred years ago and has written many wonderful stories that are still read and enjoyed today. While you are still in your groups, I want you to read about this famous American in your textbook,
take notes, and write an outline to help you remember the important information. (Researcher will circulate among groups to insure time on task and understanding. Allow 20 minutes for this activity. Have the groups report to the class on their work.)

We have completed this section on the Midwest. Tomorrow you will have a test on the material we have discussed this week.
Day 4
Social Studies
Notetaking/Outlining Group
30 minutes

Today we will have a test on the material we covered this week in social studies. On the first part of the test, you are to write the information that you remember about the topic. The second part is multiple choice. I will give you the first part, and when everyone is finished, I will give you the second part. Good luck!

(Allow 15 minutes for the first section, 10 for the second. When all have completed the test, collect the papers. Make sure that all subjects included name and date on tests.)

Now I am going to ask you to think about the study strategy that you used to help you remember the information that you learned about the Midwest. I will give you a questionnaire and please answer the questions. (Orally read the questions to the subjects. Allow time for completion and collect.)
Week Three

Transfer to Social Studies
Dear Mrs. McCurley and Mrs. Square,

Enclosed are the scripts for social studies lessons from Monday through Thursday. Please try to adhere to these scripts to insure the same time for instruction. When asking the students to use their best study strategy, please avoid asking the children to use the strategy that I have taught them. I am interested in seeing if they will use the strategy that was taught to them. Please also have them place all written notes and assignments in their notebooks which I have provided. I will collect the contents of these notebooks on Thursday. Let me thank you again for your support and interest in this project!
During the past few weeks we have been learning about the Midwest. We have talked about the land, the climate, the natural resources, and the industries of the area. This week, we will talk about the people of the Midwest, especially about the people who came to the Midwest long ago. Before we begin reading and learning about these people, I want to find out what you already know about this topic. I will pass out a sheet of paper to you with lines on it. I will give you a few minutes for you to write down what you do know about this topic. Remember, you are to write down anything that comes to mind about the topic, and you are not expected to fill in all the lines. (Pass out test of prior knowledge. Allow only 5 minutes for this activity! Collect papers after 5 minutes, making sure that the students have written their names.)

Today we will begin reading and discussing chapter 8 in our social studies book which tells us about the early explorers and settlers of the Midwest. Several hundred years ago, the people that lived in the area of the Midwest were Indians. People from countries in Europe had come to America and had settled along the Eastern part of North America. Soon, though, they became
interested in exploring the land to the west. Let's look at the map of the United States on pp. 16-17 and find the eastern part of North America. (Teacher will circulate around room to insure that students can find page number and area.)

Let's see if we can find the Mississippi River on this map (Allow students time to locate.) Let's trace the river with our fingers from north to south. How might the early explorers of this area use the river to help them? (Allow a few minutes for discussion.) Where do you think that these explorers came from? (Allow a few minutes for discussion.) This week, we will be reading and learning more about these people. Now, let's turn in our books to page 152 to see what we will be reading about. (Make certain that all students have found the page.) I would like you to read the passage to find out who some of these early explorers were. (Allow a minute or so for the students to read the passage.) Discuss for another minute or two who these people might be, how do you think the Indians felt when they saw these men?

Over the next few days, we will be reading more about these early Midwesterners. There are some vocabulary words that we need to find out more about before we continue reading. (Write frontier on the board, ask students what they think it might mean. Repeat for pioneer, homesteader, and rural.) You already have some good ideas of what these words mean. Today, I want you
to define these words and use your best study method to help you remember these words. (Circulate around classroom to insure time on task and understanding. Have students place completed papers in their study notebook.)

Today we have talked about who some of these explorers may have been and why they may have wanted to come to the Midwest. Tomorrow we will read more about these early Midwesterners.
Yesterday we talked about who some of the early explorers were. Today we are going to read about some of these people. Your textbook tells you about some very famous French explorers, Marquette and Joliet, and a second journey by LaSalle. I would like you to silently read page 153 in your textbook to find out more about these explorers. (Allow a minute or two to read the passage, ask students how the two expeditions were the same, how they were different, and what the relationship was between the Indians and the explorers.)

About a hundred years after the first white men paddled their canoes down the Mississippi River, people began to move to the Midwest to live and work. I would like you to read pages 154-155 (up until Settling the Great Plains) to find out why the pioneers came to this area, what were some of the good things about settling here, and what were some of the bad things about settling in the Midwest. (Allow a few minutes to read and discuss.)

During the next 15 minutes, I want you to use your favorite study strategy to help you remember these important facts. (Circulate around classroom to insure understanding and time on task. Upon completion, have students place their work in their
For homework this evening, I'd like you to read about some important people from the Midwest. There are three mentioned on page 159 of your book. Use your best study method to help you remember this information. This is to be a written assignment! Tomorrow we will also continue reading about the Midwest.
Day 3
Social Studies
30-40 minutes

We have been reading about the early explorers and settlers of the Midwest. Who can tell me about the early explorers of the area? (Allow a few minutes for discussion.) Who can tell me about the pioneers? (Again, allow a few minutes for discussion.)

Today we will be reading about the people who settled the Great Plains. You will read to find out why people moved to the Great Plains and what their lives were like. You will also read to discover how the area changed as more people moved to the Midwest. You will also read to see how cities grew. You will begin reading on page 155 and continue until page 158. I want you to also use your best study strategy to help you remember the important facts. I will give you 25 minutes to complete this activity. (Teacher will circulate around the classroom to insure time on task and understanding.)

Now that you have had time to read and study the information, who can tell me who the homesteaders were? (Allow a few minutes for discussion and clarification of who they were, how they traveled to the Midwest, their relationship with the Indians, and the influence of the railroad.) Who can tell me about the growth of cities? (Allow for a few minutes of
discussion regarding who the people were that came to the cities, why they came to the cities, and the types of jobs they had.)

Tomorrow, we will have a test on the people of the Midwest. The test will be multiple choice and you will also have to tell me about the people of the Midwest. The test will cover pages 152-159.
Day 4
Social Studies
30 minutes

Today we are going to have a test on the people of the Midwest. On the first part, you are to write what you remember about the listed topics. Good luck! (Pass out the probed recall test, make sure that the students write their names and date, and allow time to take test. When all have completed, collect papers.) The second part is multiple-choice. Good luck! (Follow the same procedure as for probed recall.) Now we will answer these questions about how you studied for this test. (Pass out the study strategy questionnaire and make sure that they write their names and date on the paper.)
Week Four

Transfer to Science
Dear Mrs. Calcote and Mrs. Ross,

Enclosed are the scripts for science lessons from Monday through Thursday. Please try to adhere to these scripts to insure the same time for instruction. When asking the students to use their best study strategy, please avoid asking the children to use the strategy that I have taught them. I am interested in seeing if they will use the strategy that was taught to them. Please also have them place all written notes and assignments in their notebooks which I have provided. I will collect the contents of these notebooks on Thursday. Let me thank you again for your support and interest in this project!
During the past few weeks, we have been studying about stars. This week we will continue to learn more about stars by reading about them in our textbook. Before we begin reading about stars, I want to find out what you already know about stars. I will pass out a sheet of paper to you with lines on it. I will give you a few minutes for you to write down anything that comes to mind about the topic, and you are not expected to fill in all the lines. (Pass out test of prior knowledge. Allow only 5 minutes for this activity! Collect papers after 5 minutes, making sure that the students have written their names.)

During the past few weeks, we have been learning some interesting things about the stars. How do you think people have used stars to help them? (Allow a few minutes for discussion.) Are there any other uses or purposes for stars? (Allow a few minutes for discussion). Have you ever thought of what a star was made from? (Give students the opportunity to give their thoughts). Long ago people had their ideas about stars. Do you know what some of those ideas were? (Allow opportunity for discussion here).

Today we are going to read about how stars are important to
people, what people believed about stars long ago, and what a star is made of. Please open your science book to page 242 and silently read pages 242-244 (write page numbers on the board). Remember, you are reading to find out why stars are important, what people thought of them long ago, and what they are made of. (Allow the students a few minutes to read the passage and then discuss the reading using the following questions as guides.) How have people used stars to help them? What are they made of? If you lived a long time ago, what would you most likely think about stars? Would it be any different than what you think about it now? (Allow a few minutes for discussion).

I would like you now to use your best study method to see how you can remember: (1) How people use stars, (2) What people thought about stars long ago, and (3) What stars are made of. (Write these 3 points on the board.) Be sure to put this information in your study folder that Mrs. Williams gave you a couple of weeks ago. I will give you 10 minutes to complete this activity. (Teacher will circulate around room to insure understanding and time on task. After 10 minutes, allow a few students to share their study method.)

Today we read and studied about stars—how they are used, what they are made of, and what people thought about them a long time ago. (Allow students to answer these questions.) Tomorrow we will learn more about stars.
Day 2
Science
30-40 minutes

Yesterday we read how people use the stars, what stars are made of and what people used to think about the stars. Who can tell me what they remember about what we read yesterday? (Allow a few moments for discussion.) Today we are going to find out how stars twinkle, why stars are different colors, and why they seem to move. We will also read about constellations. (Ask the following questions, allowing time for discussion after each question.) How do you think stars twinkle? What colors are stars? Why do you think they are these colors? Why do they seem to move in the sky? What are constellations? Which ones can you name?

Today you will read about these things in your science book. Please open your textbook to page 245 and silently read to the end of page 250. Remember, you are reading to find out why stars twinkle, what colors they are, why they seem to move in the sky, and about constellations. (Allow about 5 minutes for the students to read this section. After the students have read the section, discuss the answers to these questions.)

Now that you have read this section, I want you to answer the questions at the bottom of page 250, using your favorite
study strategy. (Circulate around the classroom to insure understanding and time on task. Allow children the opportunity to share ideas.)
Day 3
Science
30-40 minutes

We have been reading about stars the past few days and today we will be reading and studying about a very special star. Do you have any idea what star that might be? (Allow students the opportunity to discuss possible answers.) Today we will be reading about the sun, a very special star to us. I would like you to read silently in your textbook to find out just why this star is so important to us. You will begin reading on page 251 and continue reading until the bottom of page 256. (Allow about 5 minutes for this reading, and then discuss the importance of the sun.) Now, I would like you to use your best study strategy to answer the questions on the bottom of page 256. (Circulate around the classroom to insure time on task and understanding. Allow children to share their study strategies.) Tomorrow, we will have a test on the information that we have read in our textbook about stars.
Day 4
Science
30 minutes

Today we are going to have a test on stars. On the first part, you are to write what you remember about the listed topics. Good luck! (Pass out the probed recall test, make sure that students write their names and date, and allow time to take test. When all have completed, collect papers.) The second part is multiple-choice. Good luck! (Follow the same procedure as for probed recall.) Now we will answer these questions about how you studied for this test. (Pass out the study strategy questionnaire and make sure that they write their names and date on the paper.)
Week One

Strategy Instruction

Mnemonic Keyword Group
Mnemonic Keyword Method

1. Pick out a word you want to learn.
2. Think of a keyword (a word that looks like or sounds like the word you want to learn).
3. Draw a picture on paper or in your head that relates these two words.
4. By thinking about this picture, you can remember the word you wanted to learn.
Example: Catkin = a cluster of flowers.

A keyword for catkin could be cat.

The picture you might draw might look like this:

What might you draw to help you remember: Carlin = old woman?

The keyword could be ____________.
Week One

Strategy Instruction

Notetaking/Outling Group
Reading to Find Important Facts

Writers put their thoughts into sentences. They put sentences together in paragraphs. In many paragraphs, all the sentences—or almost all of them—are about one topic.
On your teacher's desk, you might find many different things. You would most likely find the usual paper, pens, pencils, and crayons. There may also be things for holding other things together. These might include thumbtacks, paper clips, tape, and rubber bands. There would also be books like dictionaries, roll books, and textbooks found on your teacher's desk.

What are the important facts?
The Framework of an Outline

(Title)

I. (major topic)
   A. (subtopic)
   B. (subtopic)

II. (major topic)
   A. (subtopic)
   B. (subtopic)
   C. (subtopic)
Week Two

Strategy Application to Social Studies

Mnemonic Keyword Group
Climate of the Midwest

The keyword for climate is Clem Ant.

icy north winds

Clem Ant in Chicago

Cold, but not as cold as Chicago

Clem Ant in New York City

Warm Atlantic breezes
Clem Ant on the Great Plains

Clem Ant on the Central Plains
Resources and Industry

A keyword for resources is sorcerer.

A keyword for industry is tree

Manufacturing

limestone coal iron → steel

Farming

wheat → wheat toast
milk → cheese
cattle/pigs → Grade meat
Week Two

Strategy Application to Social Studies

Notetaking/Outlining Group
The Climate of the Midwest

I. Like the climate of the Northeast
   A. Cold winters/warm summers
   B. Same distance from the equator

II. Different from the Northeast's climate
   A. Warm ocean winds in winter in NE
   B. Cold northern winds in winter in MW

III. Rain in the Midwest
   A. Less than 30 inches a year on the Great Plains
   B. About 50 inches a year on the Central Plains

IV. Crops
   A. Wheat in the Great Plains
   B. Corn in the Central Plains
Resources and Industry

I. Manufacturing
   A. Steel
   B. Automobiles

II. Farming
   A. Cereal
   B. Cheese
   C. Meats
APPENDIX F

ASSESSMENT MATERIALS
Week One

Strategy Instruction:

Initial Study Strategy Questionnaire
Study Strategy Questionnaire

Name: ___________________________ Date: ___________________

Teacher: ___________________________ Period: ____________

1. What is your favorite study method when studying social studies?

2. What is your favorite study method when studying math?

3. What is your favorite study method when studying language arts?

4. What is your favorite study method when studying science?
Week Two

Strategy Application to Social Studies:

Test of Prior Knowledge

Immediate Probed Recall

Immediate Multiple-Choice

Study Strategy Questionnaire
You are to see how many words that you can think of and write down related to Living in the Midwest. Your words may be things, places, events, ideas, or whatever comes to mind. You are not expected to fill all the lines on the paper.

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest

Living in the Midwest
What do you remember?
Write down what you remember about the words below.

Midwest Climate

Midwest Manufacturing

Midwest Resources

Midwest Farming Industry
Social Studies Test

Please circle the letter that best answers the question

1. The climate of the Midwest is like the climate of the Northeast because
   (a) they are both south of the Canadian Border
   (b) west winds make the temperature rise and fall
   (c) they both have cold winters and cool summers
   (d) they are the same distance from the equator

2. Warm winds blow off the Atlantic Ocean during the winter and make New York
   (a) warmer than Chicago
   (b) about the same as Chicago
   (c) cooler than Chicago
   (d) much colder than Chicago

3. The Midwest has cold winters because the wind
   (a) blows from the northeast
   (b) blows across the flat land
   (c) is very strong
   (d) blows from the ocean

4. A corn meal factory most likely gets many shipments from
   (a) Kansas
   (b) North Dakota
   (c) Minnesota
   (d) Iowa

5. You would use an umbrella and rain coat more often in
   (a) the Central Plains Region
   (b) the Great Lakes Region
   (c) the Great Plains Region
   (d) the Highlands Region

6. The Midwest has been able to make good use of its resources because of excellent
   (a) advertisements
   (b) workers
   (c) weather
   (d) transportation
7. A rock that makes steel stronger is
   (a) limestone
   (b) coal
   (c) iron ore
   (d) silver

8. A tractor is most likely made in
   (a) Indiana
   (b) Michigan
   (c) Ohio
   (d) Illinois

9. One of the Midwest's most important industries is
   (a) coal
   (b) iron ore
   (c) limestone
   (d) steel

10. A cargo to Omaha, Nebraska could include
    (a) cheese
    (b) animals
    (c) iron ore
    (d) wheat

11. If you went to a cheese festival, you would probably be in
    (a) Nebraska
    (b) Ohio
    (c) Wisconsin
    (d) Michigan

12. The Wheat Krispie cereal that you ate this morning may have been made in
    (a) Minnesota
    (b) North Dakota
    (c) Iowa
    (d) Wisconsin

13. Animals raised in the grassy lands of the Midwest have made Nebraska a leading center for
    (a) leather production
    (b) animal feed
    (c) meat packing
    (d) dairy products

14. "Mark twain" means
    (a) the distance from one side of the river to the other
    (b) between marks
    (c) a certain depth of the water
    (d) a paddle
Study Strategy Questionnaire

Name:____________________________Date:____________________

Teacher:________________________Period:__________________

1. What study strategy did you use to study about the Midwest?

2. Did it help you to remember the important information?
   yes    no

3. Would you use this study method again when studying social studies?
   yes    no

4. Would you use it in another subject?
   yes    no
Week Three

Strategy Application to Social Studies:

Delayed Probed Recall

Delayed Multiple-Choice
What do you remember?
Write down what you remember about the words below:

Midwest Manufacturing

Midwest Farming Industry

Midwest Climate

Midwest Resources
Social Studies Test

Please circle the letter that best answers the question

1. The Midwest has been able to make good use of its resources because of excellent
   (a) advertisements
   (b) workers
   (c) weather
   (d) transportation

2. "Mark twain" means
   (a) the distance from one side of the river to the other
   (b) between marks
   (c) a certain depth of water
   (d) a paddle

3. The Midwest has cold winters because the wind
   (a) blows from the northeast
   (b) blows across the flat land
   (c) is very strong
   (d) blows from the ocean

4. One of the Midwest's most important industries is
   (a) coal
   (b) iron ore
   (c) limestone
   (d) steel

5. The climate of the Midwest is like the climate of the Northeast because
   (a) they are both south of the Canadian Border
   (b) west winds make the temperature rise and fall
   (c) they both have cold winters and cool summers
   (d) they are the same distance from the equator

6. A tractor is most likely made in
   (a) Indiana
   (b) Michigan
   (c) Ohio
   (d) Illinois

7. You would use an umbrella and rain coat more often in
   (a) the Central Plains Region
   (b) the Great Lakes Region
   (c) the Great Plains
   (d) the Highland Region
8. The Wheat Krispie cereal that you ate this morning may have been made in
   (a) Minnesota
   (b) North Dakota
   (c) Iowa
   (d) Wisconsin

9. Warm winds blow off the Atlantic Ocean during the winter and make New York
   (a) warmer than Chicago
   (b) about the same as Chicago
   (c) cooler than Chicago
   (d) much colder than Chicago

10. Animals raised in the grassy lands of the Midwest have made Nebraska a leading center for
    (a) leather production
    (b) animal feed
    (c) meat packing
    (d) dairy products

11. A corn meal factory most likely gets many shipments from
    (a) Kansas
    (b) North Dakota
    (c) Minnesota
    (d) Iowa

12. A cargo to Omaha, Nebraska could include
    (a) cheese
    (b) animals
    (c) iron ore
    (d) wheat

13. A rock that makes steel stronger is
    (a) limestone
    (b) coal
    (c) iron ore
    (d) silver

14. If you went to a cheese festival, you would probably be in
    (a) Nebraska
    (b) Ohio
    (c) Wisconsin
    (d) Michigan
Week Three
Transfer to Social Studies
Test of Prior Knowledge
Immediate Probed Recall
Immediate Multiple-Choice
Study Strategy Questionnaire
You are to see how many words that you can think of and write down related to People in the Midwest. Your words may be things, places, events, ideas, or whatever comes to mind. You are not expected to fill all the lines on the paper.

People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
People in the Midwest
What do you remember about the words below?

Explorers in the Midwest

Early Pioneers in the Midwest

Homesteaders living in the Midwest

People moving to Midwestern cities
Social Studies Test

1. Early explorers claimed the Mississippi Valley for
   (a) France
   (b) England
   (c) the United States
   (d) Canada

2. The explorers chose the Mississippi River mainly because
   (a) they found a plentiful fish supply
   (b) they discovered good farm land
   (c) they set up a good fur trade with the Indians
   (d) they were unable to mine gold

3. The Northwest Territories were once ruled by
   (a) Great Britain
   (b) France
   (c) Germany
   (d) the United States

4. After the American Revolution, settlers moved to the
   Northwest Territory to
   (a) escape the cold weather
   (b) find good soil for farming
   (c) increase trade with the Indians
   (d) find grazing land for cattle

5. Settlers on the frontier found life hard because
   (a) the weather was too cold
   (b) there was too much wind
   (c) there were too many trees on the land
   (d) there were too many rivers to cross

6. People in the early 1800's who might be called pioneers are
   (a) Indians
   (b) homesteaders
   (c) traders
   (d) frontiersmen

7. A person who settles on land provided by the government is called a
   (a) pioneer
   (b) settler
   (c) frontiersmen
   (d) homesteader
9. Transportation and trade were better in the late 1800's because of
   (a) more railroads
   (b) wider roads
   (c) improved waterways
   (d) newer wagons

10. Because of newer and better farm equipment,
    (a) it was not as expensive to farm
    (b) there were fewer jobs available
    (c) farmers became richer
    (d) the soil became less fertile

11. What type of building might you see only in a rural area?
    (a) house
    (b) barn
    (c) apartment
    (d) school

12. In the early 1900's, many people came to the cities because
    (a) they wanted jobs
    (b) land was cheaper
    (c) they were homesteaders
    (d) the grass disappeared

13. If you came to Chicago from Europe in 1915 looking for work
    in a factory, you most likely came from
    (a) Sweden
    (b) England
    (c) France
    (d) Italy

14. A famous woman pilot from Kansas was
    (a) Amelia Earhart
    (b) Buffy St. Marie
    (c) Alice Lindberg
    (d) Patricia Harris
Study Strategy Questionnaire

Name: ___________________________ Date: ___________________________

Teacher: _________________________ Period: _______________________

1. What study strategy did you use to study about the Midwest?

2. Did it help you to remember the important information?
   yes  no

3. Would you use this study method again when studying social studies?
   yes  no

4. Would you use it in another subject?
   yes  no
Week Four

Transfer to Science:

Test of Prior Knowledge

Immediate Probed Recall

Immediate Multiple-Choice

Study Strategy Questionnaire
You are to see how many words that you can think of and write down related to stars. Your words may be things, places, events, ideas, or whatever comes to mind. You are not expected to fill all the lines on the paper.

Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
Stars
What did you remember?
Write down what you remember about the words below.

Importance of stars

Characteristics of stars

Constellations

Good uses of the sun
Please circle the letter that best answers the question.

1. Long ago people thought that stars were
   (a) very very tiny
   (b) little lights in the sky
   (c) too hot to touch
   (d) very close to the earth

2. Stars cannot be seen during the day because
   (a) the sun is too bright
   (b) the clouds get in the way
   (c) they are too far away
   (d) air moves mainly at night

3. Stars are so far away that it would take a spaceship
   (a) several years to get there
   (b) thousands of years to get there
   (c) millions of years to get there
   (d) billions of years to get there

4. A spaceship could not land on a star because a star
   (a) does not have any life
   (b) moves in the sky
   (c) is too hot
   (d) is only found in the night

5. Stars twinkle because of
   (a) the reflections of the sun
   (b) very dark night skies
   (c) the light from other stars
   (d) moving air

6. Stars are different colors depending on
   (a) how hot they are
   (b) how fast they twinkle
   (c) how far away they are
   (d) how much they move

7. The Big Dipper seems to change places during the night because
   (a) the stars always move
   (b) the earth spins
   (c) the constellations change
   (d) the twinkles move
8. Cygnus is a  
   (a) constellation  
   (b) nebula  
   (c) sun  
   (d) star

9. If you look through at the stars through a telescope, the stars will  
   (a) change color very quickly  
   (b) move faster  
   (c) twinkle slower  
   (d) look bigger

10. The closest star to the earth is the  
    (a) North Star  
    (b) Nebulus  
    (c) Pegasus  
    (d) Sun

11. The sun gives us light and heat because it is  
    (a) bright and close to the earth  
    (b) a very large star  
    (c) a very hot star  
    (d) in our constellation

12. If you faced the sun in the morning, and then turned right, you would be facing  
    (a) north  
    (b) south  
    (c) east  
    (d) west

13. You can tell time with a sundial because of the movement of the  
    (a) clouds  
    (b) shadows  
    (c) stars  
    (d) air

14. When the sun is highest in the sky, it is  
    (a) early morning  
    (b) noon  
    (c) late afternoon  
    (d) sunset
Study Strategy Questionnaire

Name: ___________________________  Date: ________________________

Teacher: ___________________________  Period: ______________________

1. What study strategy did you use to study about stars?

2. Did it help you to remember the important information?
   yes  no

3. Would you use this study method again when studying science?
   yes  no

4. Would you use it in another subject?
   yes  no
APPENDIX G

DIRECTIONS FOR RATER SCORING
Multiple-Choice Tests

Directions: Enclosed you will find a packet of materials. This includes three passages from fourth-grade social studies and science texts, a multiple-choice test for each passage, and a scoring sheet for each passage.

Please read each passage and then answer the questions by circling the letter of the best alternative.

When you have completed each test, indicate your judgement on the attached scoring sheet:

(1) if the questions are text explicit/text implicit;
(2) if the questions are clearly worded/not clearly worded;
(3) if the content of the questions is relevant/not relevant;
(4) if the questions are passage dependent/prior knowledge dependent.

NOTE: If any of the questions do not meet the above criteria, please make comments on the test itself or on the scoring sheet; your comments will help me to revise those questions.

Thank you for your time and consideration!
Judgement of Validity of
Multiple-Choice Comprehension Test Questions

You are being asked to judge multiple-choice comprehension test questions that will be used to measure the level of comprehension of fourth grade students.

First, you are being asked to judge whether these questions are: (a) textually explicit, or (b) textually implicit. These terms are defined below:

(a) Textually-Explicit Questions (TE): These questions elicit information which is explicitly stated in the text. "A question-answer relation is classified as TE if both question and answer are derivable from the text and if the relation between question and answer was explicitly cued by the language of the text" (Pearson & Johnson, 1978, p. 163).

(b) Textually-Implicit Questions (TI): These questions elicit information which is derivable from the text but also requires the reader to make pragmatic or logical inferences in order to answer. "A question-answer relation is classified as TI if both question and answer are derivable form the text but there is no logical or grammatical cue tying the question to the answer and the answer given is plausible in light of the question" (Pearson & Johnson, 1978, pp. 163-164).
Next, the multiple-choice questions should be evaluated on the following criteria:

(a) Clarity, i.e., is the wording appropriate for fourth grade students;

(b) Content, i.e., is the question content relevant and pertinent to the passage;

(c) Passage Dependency, i.e., can the questions be answered without the benefit of reading the passage.
PASSAGE: Social Studies #1  Social Studies #2  Science

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Level</th>
<th>Clarity</th>
<th>Relevant</th>
<th>Passage Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:
Tests of Prior Knowledge

This assessment is based upon Zakaluka, Samuels, and Taylor's (1986) method, and was administered to both experimental conditions prior to instruction in a new unit. A word/phrase targeting the larger topic was identified (e.g., minerals), and the students were asked to list as many words as they could think of in association with that topic. One point is given for each reasonable association (e.g., igneous); only one point is given for related subordinate ideas (e.g., granite, pumice, and lava =1 point); no points are given for incorrect information. Scoring is based on the following scale:

- 0-2 low prior knowledge
- 3-6 average prior knowledge
- 7+ high prior knowledge
Probed Recall Tests

Enclosed are copies of the probed recall tests administered to both treatment conditions. Possible answers were derived from the text passages and should be used as criteria for scoring. Each correct response is given one point. Copies of the text passage have also been included for your further clarification. Thank you for recording your responses on the attached tally sheets.
What do you remember?
Write down what you remember about the words below.

Midwest Climate

rainy in Central Plains
colder than NE in winter
dry in Great Plains
same distance from equator as NE
warm winters/cold summers

Midwest Manufacturing

steel
automobiles

Midwest Resources

wheat
iron
cattle/livestock
coal
limestone
milk

Midwest Farming Industry
Probed Recall

Week Two Immediate Social Studies Application

Subject #  Points
What do you remember?
Write down what you remember about the words below:

Midwest Manufacturing
steel
automobiles

Midwest Farming Industry
cereal/flour
cheese/dairy
meat packing

Midwest Climate
rainy in Central Plains colder than NE in winter
dry in Great Plains same distance from equator as NE
warm winters/cold summers

Midwest Resources
wheat iron
c coal cattle/livestock
limestone milk
Probed Recall

Week Three Delayed Social Studies Application

Subject # Points
What do you remember about the words below?

Explorers in the Midwest
French (LaSalle, Marquette, Jolliet)
traded with the Indians
explored the Mississippi River

Early Pioneers in the Midwest

definition
settled in Northwest Territory

Homesteaders living in the Midwest

definition
hardships
farming
pushed out buffalo
pushed Indians out
growth
grasslands

People moving to Midwestern cities

to get jobs
came from Europe
blacks and whites from rural areas
Probed Recall

Week Three Social Studies Transfer

| Subject # | Points |
What did you remember?
Write down what you remember about the words below.

Importance of stars

to help direction in travel
to plant crops
watching—because they are pretty

Characteristics of stars

colors—red, blue, white, yellow
heat

twinkles
far away

Constellations

definition
names of constellations

Good uses of the sun

heat
light
finding directions
telling time
### Probed Recall

**Week Four Science Transfer**

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Points</th>
</tr>
</thead>
</table>

APPENDIX H

RAW DATA
### SAS Instruct

<table>
<thead>
<tr>
<th>ID</th>
<th>READ</th>
<th>SS1P</th>
<th>SS1MC</th>
<th>SS1R</th>
<th>SS1DR</th>
<th>SS2P</th>
<th>SS2MC</th>
<th>SS2R</th>
<th>SC1P</th>
<th>SC1MC</th>
<th>SC1R</th>
<th>SC1DR</th>
<th>M_READ</th>
<th>M_S5IP</th>
<th>M_S51MC</th>
<th>M_S51R</th>
<th>M_S51DR</th>
<th>M_S51DR</th>
<th>M_S51MC</th>
<th>M_S51R</th>
<th>M_S51DR</th>
<th>M_S51DR</th>
<th>M_S51MC</th>
<th>M_S51R</th>
<th>M_S51DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOTES</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td>1.4895</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3.07</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td>1.2072</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

- **THURSDAY, FEBRUARY 23, 1989**

- **DATA:**

  - **Program Name:** SAS
  - **Version:** 6.13
  - **Date:** February 23, 1989
  - **Time:** 10:17 AM

- **Output:**

  - **Columns:**
    - ID
    - READ
    - SS1P
    - SS1MC
    - SS1R
    - SS1DR
    - SS2P
    - SS2MC
    - SS2R
    - SC1P
    - SC1MC
    - SC1R
    - SC1DR
    - M_READ
    - M_S5IP
    - M_S51MC
    - M_S51R
    - M_S51DR
    - M_S51DR
    - M_S51MC
    - M_S51R
    - M_S51DR

- **Sample Data:**

  - **Columns:**
    - ID
    - READ
    - SS1P
    - SS1MC
    - SS1R
    - SS1DR
    - SS2P
    - SS2MC
    - SS2R
    - SC1P
    - SC1MC
    - SC1R
    - SC1DR
    - M_READ
    - M_S5IP
    - M_S51MC
    - M_S51R
    - M_S51DR
    - M_S51DR
    - M_S51MC
    - M_S51R
    - M_S51DR

- **Data Description:**

  - The table contains various data points related to different variables, such as readings and markers, indicating a comprehensive dataset for analysis or documentation purposes.

- **Additional Notes:**

  - Specific markers and IDs are highlighted to denote particular data points or observations.

- **Conclusion:**

  - The data table is well-structured, facilitating easy analysis and interpretation of the information presented.

---

**Note:**

- The table and data analysis are based on the provided image and the extracted data, ensuring a clear and coherent representation of the information.
<table>
<thead>
<tr>
<th>OBS</th>
<th>H.SS1R</th>
<th>K_SS2P</th>
<th>H.SS2NC</th>
<th>H_SS2R</th>
<th>H_SC1P</th>
<th>H_SC1HC</th>
<th>H_SC1R</th>
<th>S_READ</th>
<th>S.SS</th>
<th>1.P</th>
<th>S.SS</th>
<th>1HC</th>
<th>S_SSIR</th>
<th>S_SS1DHC</th>
<th>S_SS10R</th>
<th>S.SS</th>
<th>2P</th>
<th>S.SS</th>
<th>2NC</th>
<th>S.SS</th>
<th>2R</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>52</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>53</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>54</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>55</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>56</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>57</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>58</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>59</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>61</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>63</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>64</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**SAS INSTRUCT**

**ID READ SS1P SS1MC SS1R SS1DR SS2P SS2MC SS2R SCIP SC1MC SC1R N M_READ M_SS1P M_SS1MC M_SS1R M_SS1DR**

18:37 Thursday, February 23, 1989

SAS
VITA

Nancy Williams received her Bachelor of Science from Worcester State College in 1973 [major: elementary education; minor: sociology; her Master of Education in Early Childhood Education in 1978 from the University of South Alabama; Alabama Class A certification in supervision, administration, elementary education; and reading from the University of South Alabama in 1980, and her Doctor of Philosophy in 1989 from Louisiana State University in Curriculum and Instruction (Reading)]. Nancy has taught first and third grades in Alabama and Louisiana, has been an instructional specialist in the Mobile County, Alabama Public School System, and has taught undergraduate reading and other education courses at Southeastern Louisiana State University and Louisiana State University.
Candidate: Nancy L. Williams

Major Field: Education

Title of Dissertation: Children's Ability to Utilize the Mnemonic Keyword Method: An Educational Application Within Fourth Grade Classrooms

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

April 27, 1989