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The Use of Mapping as an Instructional Technique with Difference Model Readers

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The Use of Mapping as an Instructional Technique
with Difference Model Readers

By

Anne Louise Dasch

A Dissertation Submitted to
the Faculty of the University of the Pacific
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

1986

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This dissertation, written and submitted by

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Abstract

Purpose: This study investigated the use of mapping as an instructional technique to improve reading comprehension in readers exhibiting word-calling behavior (difference model readers). Mapping is a graphic display of the events and ideas in a passage, depicting sequence and subordination. It was hypothesized that mapping would provide means for processing information from the text at the levels of concept formation, association and integration. Procedure: Six students in grades 7 through 10 were selected as subjects. They received instruction in mapping in conjunction with their regular reading program. At the conclusion of each instructional unit, a test passage was administered to measure change in comprehension abilities. The study utilized a single case experimental design; specifically, multiple baseline across subjects. Treatment lasted between 17 and 21 weeks, depending on the subject. In addition, pre- and post-test scores on the Reading Miscue Inventory were compared. Graphs generated by the multiple baseline procedure were analyzed through visual interpretation and the Rn statistic. All other data were subjected

to descriptive analysis. Conclusions: The Rn statistic approached but did not achieve significance. Visual interpretation of the graphs indicated two trends: (1) the decreasing of variability in passage scores, and (2) the decreasing of extremely low scores of the lowest functioning subjects. Data from the Reading Miscue Inventory indicated substantial positive change in the subjects' comprehension abilities. These findings give preliminary, limited support to the effectiveness of mapping in improving comprehension with difference model readers.

DEDICATION

To all students in their struggle
to learn and understand.

ACKNOWLEDGEMENT

An undertaking such as this one may have been instigated and directed by one person, but the final outcome very much depended on a number of important people.

The members of the Dissertation Committee come foremost to mind. Dr. R. Ann Zinck, Committee Chair, gave unfailing support, encouragement and advice throughout the long process. Dr. Steven Trotter helped unravel the mysteries of research design and statistical analysis. Dr. Hugh McBride, Dr. Jean Longmire, and Dr. Suzanne Hanser each contributed to the integrity of the final product.

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TABLE OF CONTENTS

	Page
DEDICATION.	ii
ACKNOWLEDGEMENTS.	iii
Chapter	
I. INTRODUCTION.	1
Statement of the Problem.	5
The Problem	5
Purpose of the Study.	8
Delineation of the Research Problem	10
Research Questions	12
Definition of Terms	13
Delimitations	14
Organization of the Paper	15
II. REVIEW OF THE RELATED LITERATURE.	17
Reading as an Interactive Psycho-	
linguistic Process	17
Psycholinguistic Models	18
Passive and Active Models	21
Goodman's Interactive Model	23
Language as the Basis for the Inter-	
active Model	26
Language Concepts and Reading	
Comprehension	31

	Page
Focusing on a Specific Type of Compre-	
hension Disability.	33
Difference Model Readers.	35
Behavioral Description.	35
Research and Treatment.	41
Application of Psycholinguistic Model .	48
Specific Instructional Activities	50
Description of Selected Instructional	
Techniques.	53
Research and Instructional Uses of	
Mapping	57
Rationale for Effectiveness	65
Rationale for Use with Difference	
Model Readers	72
Summary and Conclusions	74
III. METHODOLOGY	77
Research Design	77
Dateline Stability.	78
Rationale	80
Research Questions.	82
Hypotheses.	83
Delimitations	83
Definitions	84
Assumptions	85
Pilot Procedures.	85

	Page
Selection of Sample	86
Steps for Selection	86
Operational Definition of Word-Calling	
Behavior	88
Sample Description.	88
Instrumentation	89
Procedures	91
Teacher Training.	91
Establishment of a Baseline	92
Treatment	94
Data Collection and Recording	97
Data Processing and Analysis.	99
Statistical Analysis	100
Summary	103
IV. ANALYSIS AND EVALUATION.	105
Multiple Baseline Across Subjects	105
Sub-Experiment 1.	105
Sub-Experiment 2.	105
Sub-Experiment 3.	105
Sub-Experiment 4.	110
Sub-Experiment 5.	110
Sub-Experiment 6.	113
Percentage Score by Passage Type.	115
Percentage Score by Question Type	120
Statistical Analysis	123

	Page
<u>Reading Miscue Inventory</u>	125
Research Questions and Hypotheses	129
Research Questions	129
Hypotheses	130
Discussion	131
Summary	133
V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS. .	135
Conclusions	136
Recommendations	141
APPENDIX A: EXAMPLE OF A COMPLETED MAP	144
APPENDIX B: SAMPLE SCALED QUESTIONS.	145
APPENDIX C: OBSERVATION CHECKLIST FOR TEACHERS .	147
REFERENCE LIST.	148

LIST OF TABLES

Table	Page
1. Initial Profile of Subjects.	90
2. Example of Rn Procedure.	102
3. Comparison of Passage Score--Sixth Grade Level.	116
4. Ranking of Passages by Score--Sixth Grade Level.	118
5. Comparison of Passage Score--Third Grade Level.	119
6. Ranking of Passages by Score--Third Grade Level.	121
7. Average Score by Question Type	122
8. Rn Statistic	124
9. <u>Reading Miscue Inventory</u> Pre-test/Post- test Comparison.	126

LIST OF FIGURES

Figure	Page
1. Example of Mapping After Hanf (1971). . .	55
2. Example of Webbing After Freedman and Reynolds (1980)	59
3. Graph of Data--Subject 1.	106
4. Graph of Data--Subject 2.	108
5. Graph of Data--Subject 3.	109
6. Graph of Data--Subject 4.	111
7. Graph of Data--Subject 5.	112
8. Graph of Data--Subject 6.	114

CHAPTER I

Introduction

The incidence and severity of reading disability is one of the current concerns in education. Cunningham, Cunningham and Arthur (1981) describe the situation as a national reading problem. Several trends are cited to account for the development of this problem:

1. Every child is expected to learn to read.
2. The reading demands of society have become more complex.
3. Less reading is done for entertainment.
4. Most occupations require reading at some point. (p. 4)

Figures on learning disabled students alone, who comprise 2 to 15% of the school age population, indicate that as many as 70% have a reading disability (Chall, 1977). Of the different types of reading disability, difficulty in comprehension is the most prevalent (Lerner, 1976; Lindsey and Kerlin, 1979). From this it can be seen that reading is regarded as a skill of utmost importance but one that is not being fully developed by present educational practices.

How the problem of reading disability is approached depends significantly on a teacher's view of the reading process. Many models of the reading process exist, and each seems to call for a different focus in instructional strategies and activities. One widely held view, which is derived from a psycholinguistic perspective, describes reading as a language-based communication process of deriving meaning from printed matter. Graphic symbols are decoded, organized and integrated into the cognitive structure of the reader. To be successful in deriving meaning from the text, readers must utilize their language processing skills at the cognitive level of operation (Adams and Collins, 1979). With this focus on comprehension as the crux of reading, the prevailing incidence of comprehension difficulties becomes even more significant.

The need for looking at reading--especially for disabled readers--through the framework of psycholinguistic based applications is supported by two points. The first is that reading is a derived language process, a communicative act between people, involving reasoning and thinking. This has been reinforced many times by definition, as exemplified by Adams and Collins (1979):

What we really mean by reading is not the ability to decode words but the ability to extract the

meaning, both implicit and explicit. . . . At the highest level, one has successfully read a passage if one understands it both as it was intended by the author and in terms of its impact on oneself. (p. 1)

Teachers usually regard reading as an intellectual or reasoning activity, also. In a survey giving elementary and secondary teachers a choice in definitions of reading comprehension, a significant pattern emerged showing that teachers regarded reading as a thinking and processing activity, involving higher order language skills. The skills approach to reading, where instruction is focused on isolated skills, frequently of a decoding rather than comprehension nature, was the least chosen definition (Greenlaw and Kurth, 1980).

Empirical evidence for this position is provided by Idol-Maestas (1980) in a comparison of the oral language behaviors of normal and disabled readers. Measures of complexity and variability of syntactic forms and constructions, mean length of utterance (for morphemes), the number of different words used, the proportion of word types used and the number of verbal prompts were all significantly higher for normal readers than for disabled readers. Since the additional variables of non-verbal problem solving and socioeconomic status had

no effect on the above measures, Idol-Maestas concluded that the problem was a linguistic one. This is not to say that all disabled readers have poor language skills; some with adequate skills have not learned to apply them to the reading situation (Adams, Anderson and Durkin, 1978; McConaughy, 1978). The point is that skill in reading is based on skill in language. Difficulties arise when language skills either are not fully developed or they are not adequately applied to the reading situation.

The second point supporting the adoption of a psycholinguistic perspective is the need to treat reading and reading instruction as a more global and integrated process. Historically, reading instruction for beginning and disabled readers has focused on phonics and isolated skills. There has been little effort to focus on reading as a meaning deriving process, with comprehension as a unitary whole (Lindsey and Kerlin, 1979; Pflaum, Walberg, Karegianes and Rasher, 1980). Even Greenlaw and Kurth (1980), who found that teachers usually define reading comprehension as a processing activity, observed that actual practice did not follow stated theory. Thirty-five percent of instructional time was spent on phonics and structural analysis of words. Time spent on comprehension itself centered on

assessment, not instruction.

It seems that better integration and balance needs to be struck between the component parts of the reading process. Smith, Goodman and Meredith (1976) state:

Any strategy of reading construction based on a single principle or tactic is incomplete, no matter how valid the principle. Reading methods must be based on a complete understanding of the complex reading process. (p. 285)

For the disabled reader, two instructional implications are clear. First, the language base of reading must be tapped in order to facilitate understanding of the text. Second, comprehension skills, in the form of higher order processing abilities, need to be emphasized in reading instruction. In that way, readers will gain meaning from written text and not just decode isolated words and phrases.

Statement of the Problem

The Problem

As it is seen here, the problem at hand is that reading disability is a major educational concern and that current instructional practices are not providing an adequate solution. The focus of both instruction and research has been in specific skill areas rather than on

reading for meaning with emphasis on comprehension processes (Baker and Stein, 1981). The findings of recent research have accounted, at least to some extent, for this dilemma and have given rise to the call for specific changes in research and instruction.

A research review conducted by Pflaum, et al., (1980) with a final sample of 97 studies on instructional methods, contained a total of 134 different experimental vs. control treatment comparisons. Of these comparisons, only 17 were described as focusing on meaningful units larger than the word. It was found that little difference existed in the effectiveness of any one method over another. The authors concluded that the particular method used is not the critical factor in reading instruction. What seems to be more important are "systematic, focused methods of teaching that are more often found in experimental studies and innovative programs" (p. 18). This same conclusion was reached by Kaufman and Kaufman (1979) in a study investigating the effect of development of non-academic processing skills on improvement in academic achievement, and by Kavale and Schreiner (1978) in an article regarding the applicability of psycholinguistic based concepts to beginning reading.

The matter does not rest, however, with the

consideration of methodology alone. A crucial counterpart to this is the match between specific interventions and the abilities and disabilities of the learner. The principle of such matching is recognized but has been subjected to only limited investigation. Research is needed that will specify which instructional strategies will be most beneficial to which type of students (Pearson, Hansen and Gordon, 1979). An exception to this position is taken by Guthrie and Taylor (1978), who state that the evidence to support instruction/learner match is poor. However, their research interests dealt with modality preferences for learning, not levels of cognitive processing.

The final point covered in recent research concerns the nature of successful comprehension strategy. McConkie (1977) describes the skilled reader as ". . . an active processor of information, rather than simply a receiver and storer of a copy of the stimulus" (p. 32). The key word is "active," indicating that the reader does something with the information from the text. Wide agreement exists for the principle that a reader must actively manipulate the content of the text on a cognitive level in order to fully understand the intent and message of the writer. Levin and Pressley (1981) hold that the most effective strategies for information

processing, storage and retrieval involve "personal cognitive constructions" (p. 65) where the material is re-organized and sometimes elaborated upon. Examples of specific tasks suggested to accomplish this include the use of advanced organizers, visual imagery, note-taking, underlining, paraphrasing, summarizing, visual graphing, and the use of prior knowledge.

In summary, four points have been identified that mark the current status of reading instruction and provide guidelines for needed areas of research:

1. No one method or technique of reading instruction is best.
2. A significant number of students are not benefiting from any current practices.
3. Instructional methods and strategies need to be more precisely matched to the abilities and disabilities of specific types of learners.
4. Readers need skill in organizing and manipulating information from the text in order to fully comprehend the material.

Purpose of the Study

In following the above points and utilization of methodology derived from a psycholinguistic framework, this study serves to match a particular instructional

strategy with readers exhibiting a specific type of disability. The nature and constructs of the framework based on psycholinguistic concepts are discussed in Chapter 2 to substantiate its validity as a working model of reading. Specifically, an interactive psycholinguistic model (Goodman, 1970) is described that adequately accounts for the phenomena of reading abilities at all developmental levels, in terms of language-based processing activities. In addition, this model allows for the study of the reading process in an applied setting through the utilization of the Reading Miscue Inventory (Goodman and Burke, 1972).

The focus of the study centers on whether or not the instructional technique of semantic mapping (Hanf, 1971) will improve the comprehension abilities of difference poor readers (Cromer, 1970). Mapping is an instructional technique used to teach writing, organizing, reading, speaking and listening or note-taking. It is a non-linear alternative to outlining with some variation in form and several different names (Williams, 1983). Mapping was selected as the treatment variable because it provides a simple and efficient way for information to be organized and integrated. In addition, it is consistent with a psycholinguistic instructional framework and the recommendations of researchers in

reading instruction by actively involving the reader with the meaning and organization of the text. This technique was paired with difference poor readers, informally referred to as word-callers, because of the distinct nature of their reading disability. These readers have adequate decoding and vocabulary skills but are significantly delayed in comprehension skills. It appears that difference poor readers do not approach reading as a language-based, meaning deriving activity, and thus do not use language skills to process the information they have taken from the printed page. With mapping, readers visually graph the text information, which compels them to reconstruct the writer's message in an organized and understandable manner.

Delineation of the Research Problem

This study followed a single case experimental design; specifically, multiple baseline across subjects (Hersen and Barlow, 1976). Data points from baseline and treatment phases were graphed and compared as a measurement of treatment effect. Data points reflect the number of correct responses to comprehension questions covering periodically administered reading passages. The reading passages were independent of instruction in the treatment variable.

A second comparison of pre- and post-test scores from the Reading Miscue Inventory (Goodman and Burke, 1972) was made also. This test does not yield standardized scores, so only a descriptive analysis was done. Scores were analyzed to identify possible change in the proportional use of the graphophonic, syntactic and semantic cue systems.

The above comparisons were the only formal ones made. Supportive data generated by the multiple baseline graphs were a source for informal analysis. First, information was gathered on the consistency of specific passages in yielding a pattern of scores. This was used in the interpretation of subject scores as well as to evaluate the applicability of mapping to a variety of reading passages. Secondly, information was gathered on score patterns as they varied with the type of comprehension question presented (literal, comparative, sequence, inferential or application). Again, this information was used to evaluate the applicability of mapping to a variety of processing tasks. Neither of these comparisons was delineated in the original study proposal, but their possible usefulness became apparent as the study progressed.

Research Questions

Three major subproblems were identified, giving rise to several research questions:

1. Under psycholinguistic based applications described by Goodman (1970), readers are described as having three cue systems (graphophonic, syntactic and semantic) available to supply text information. Given readers characterized as word-callers, how would these systems be utilized? Would their use be proportional, as ideally theorized, or would there be over-dependency on one system?

2. Many instructional techniques and activities have been suggested to promote the development of processing and comprehension skills. Which, if any, of these would be best in improving the language processing areas of concept formation, organization and integration?

3. Difference poor readers appear disabled primarily in the use of language processing skills. Would reading instruction focused on language based activities be beneficial? Would the strategy of mapping in particular be of any benefit?

Two hypotheses were generated from these research questions:

1. Readers characterized as word-callers will be over-dependent on use of the graphophonic cue system,

thus under-using language processing skills in concept formation, organization and integration for comprehension.

2. Teaching the application of language processing skills to readers characterized as word-callers, through the instructional technique of mapping, will result in improved reading comprehension.

Definition of Terms

Language processing is the cognitive activity of receiving, using and remembering information. For readers, this means decoding written material and attaching meaning to it. The meaningful information is linked to previous knowledge and experience, leaving it readily available for any subsequent use.

Concept formation is a component of language processing entailing the establishment of new concept boundaries. As information becomes meaningful, attributes are identified and used to form characteristics and limits of a concept.

Concept organization is a second component of language processing in which information is structured within a single concept. Superordinate and subordinate positions are identified, forming a concept's internal hierarchy.

Concept integration is a third component of

language processing, involving the blending of information. Old concepts may be combined or linked together through reorganization or the recognition of common attributes. In addition, old concepts may be revised or branched with the identification of new information.

Delimitations

This study will be concerned specifically with readers exhibiting word-calling or difference poor behavior. By definition, this excludes readers with primary difficulties either in decoding written material or expressive language and language processing. As an investigation of reading comprehension, this study will be concerned only with language processing skills as they relate to the decoding, not the encoding, of written material. In reference to language processing skills, the investigation will be limited to the areas of concept formation, organization and integration.

The theoretical basis of reading used in this study will be Goodman's (1970) psycholinguistic model of reading. It is based on the premise that reading is a language process closely integrated with thought. Comprehension is dependent on the interactive use of the graphophonic, syntactic and semantic language cue systems.

The treatment variable for this study will be Hanf's (1971) procedure of mapping. Mapping is an instructional technique used for the organization of information, with some variation in name and structure. Only Hanf's procedure will be used here, with simply the term "mapping" as a descriptor.

Organization of the Paper

Chapter I is an overview of the research questions, rationale, design and procedures of this study. Chapter II contains a review of the related literature, providing validation for this investigation's research questions. Specific points of discussion are the psycholinguistic framework of reading, the relationship of reading and language, the model of difference poor readers, the need for specific matching of instructional techniques to types of reading disabilities, and the comprehension strategy of mapping. Methodology is discussed in Chapter III, including a description of the experimental treatment and procedures, subject selection and teacher training. A discussion of single case experimental design follows, specifically covering the nature of and rationale for a multiple baseline across subjects format.

Chapter IV covers analysis and interpretation of

the research data. Baseline and treatment phases of the study are compared and analyzed through visual interpretation and use of the R_n statistic (Revusky, 1967). Subjective, descriptive analysis of pre- and post-test scores on the Reading Miscue Inventory, score patterns across the reading passages, and score patterns across the types of comprehension questions conclude the chapter. The final chapter, Chapter V, contains a summary of the research findings, conclusions of the study, and recommendations for the use of the research findings, in regard to both current application and future studies.

CHAPTER II

Review of the Related Literature

This chapter presents theoretical and empirical evidence to support the use of mapping as a technique to improve the reading comprehension abilities of difference poor readers. Discussion centers on a psycholinguistic model of reading which serves to adequately describe the reading process. The relationship between language (primarily at the conceptual level) and reading is established and is tied both to the psycholinguistic model of reading utilized in this study and to the need for modification of practices in reading instruction. Difference poor readers are identified as the target population because of the clear language-based nature of their reading disability plus the ability to distinguish them as a group. Finally, mapping is defined and illustrated, followed by descriptions of how it has been used in the field of education.

Reading as an Interactive

Psycholinguistic Process

Considerable controversy exists over which of the

many theoretical models adequately and accurately explains the process of reading. Much evidence supports a psycholinguistic model which essentially holds that reading is a derived language process. In spite of its many strengths, there are drawbacks to adopting such a model without serious consideration. One drawback is that there are several psycholinguistic models, with significant differences between them. Few of these models completely cover the full array of activities occurring during the reading process. Another drawback is that psycholinguistic models initially described the processing activities of only skilled, fluent readers. Only recently has a psycholinguistic model been applied to beginning or disabled readers. Modifications are needed because of substantial differences noted in the processing activities of these readers (Kavale and Schreiner, 1978). As presented here, an interactive model of reading based on psycholinguistic principles overcomes the deficiencies of other models and accounts for the continuum of reading abilities in a satisfactory manner.

Psycholinguistic Models

Generally, psycholinguistic models define reading as a communication process of deriving meaning from

printed matter. It stands as a communication process because information is transferred, via printed matter, from one person to another. It works as a process because of the dynamic and active way the reader is involved in restructuring the meaning of the passage being read. Deriving meaning becomes the crux of this definition, making it essential for the reader to be able to understand the intended message of the writer. That is the definition which will be accepted here because it succinctly answers the basic question, "Why read?"

Psycholinguistic models of reading, again generally, contain the elements necessary to meet this definition. The nature of psycholinguistic models is to ". . . conceptualize skilled reading behavior as a constructive language process where graphic, syntactic and semantic information is processed simultaneously to achieve a reconstruction of meaning" (Kavale and Schreiner, 1978, p. 34). Thus, reading operates as a language process where multiple cue systems are jointly analyzed to derive meaning and thus obtain information. Reading is the response to the writer's effort to communicate through written language.

Under a psycholinguistic model, the dynamic and active aspect of reading becomes apparent in looking at the nature and use of the cue systems involved. The

graphic system includes the visual information that can be gleaned off the page, from such things as letters, word patterns, spacing and punctuation. It is defined as the set of relations between the graphic and phonological representations of language. The syntactic system refers to the grammatical elements and word order of sentences, describing the relationships between words in a sentence. The third and last cue system is the semantic one, the system of word meanings. Composed of personal, prior experience and conceptual background, this system is the basis of comprehension because the thoughts of the reader are matched to those of the writer (Miller, B., 1977).

In essence, the writer uses his knowledge of these systems to construct a passage followed by the reader using his knowledge of the systems to reconstruct that passage. The knowledge that a reader brings to the reading situation stems from his experience in the world, his grasp of context, his ability with language concepts and relationships, and his peripheral sensory acuity (Hall, 1979; Wildman and Kling, 1978). The reading process is active to the extent that the reader brings the full potential of his knowledge to the task. The dynamics of the process are evident in the changing interrelationships of the cue systems (to be discussed later) and the

developmental expansion of the reader's knowledge of and experience in the world.

Passive and Active Models

The major dimension that distinguishes the different models following psycholinguistic theory is the amount of active cognitive effort that is required by the reader (Wildman and Kling, 1978). This effort constitutes the measure of knowledge and experience that the reader must bring to the reading process in order to read successfully. The passive or bottom-up model holds that reading is a letter-by-letter process, with word recognition based on phonemic decoding (Adams, Anderson and Durkin, 1978). The reader works his way up from the lower process of visual analysis of graphic information to the higher process of comprehension. The syntactic and semantic cue systems are not utilized (if at all) until the higher processing levels are reached. The process is passive since the reader does not have to contribute much knowledge in order to complete the reading task (Wildman and Kling, 1978).

In contrast, the active or top-down model requires a significant contribution of knowledge from the reader. Here the reader has a presupposed set of ideas and feelings about the reading material. A conceptual level

hypothesis is formed by compiling a list of features that the material should have. Reading takes place as the hypothesis is compared to the graphic information. Comprehension occurs when there is a match. If a mismatch occurs, the original hypothesis is rejected and a new one is generated. The comparisons continue until a match is made (Wildman and Kling, 1978).

Neither the passive nor the active models sufficiently accounts for all of the processing activities of reading if considered alone (Adams, Anderson and Durkin, 1978; Adams and Collins, 1979). The passive model makes minimal use of language abilities in what is actually a language process. The active model does not cover situations involving time constraints and large amounts of sensory information (e.g., long words). Neither model extends to include the distinctive activities of beginning or disabled readers. One theorist has offered an interactive model that combines the best of the active and passive models. The heuristic constraints of hypothesis testing and the decoding of bottom-up processing are retained while the degree of dependency on visual analysis of graphic information of both models is dropped (Wildman and Kling, 1978).

The interaction of passive and active processes explains and allows for fluent reading, since both higher

and lower level information will influence what is being processed. The reader attends only to what is needed as bottom-up activities make information available, and top-down activities organize and store what has been verified by hypothesis testing (Adams and Collins, 1979).

Goodman's Interactive Model

The interactive model receiving support here was developed by Goodman (1970). Grounded in linguistics, Goodman delineated the three language cue systems and how they are used in the reading process. Under his revised psycholinguistic model, Goodman defined reading as a selective process in which fluent reading stems from the use of the most productive, available cues. The model remains psycholinguistic based because Goodman emphasizes the interaction of thought and language. Readers need to think and anticipate meaning while processing cues to confirm or reject their expectations.

This interactive model receives support here precisely because of the gaps it fills: the distinctive activities of beginning or disabled readers can be explained and language processing is given the full due of its basis for reading. For clarification, the terms fluent and non-fluent will be used to describe readers at different levels of reading achievement. Fluent

readers are capable of independent reading, applying and integrating different strategies when needed, to derive meaning from the text. Non-fluent readers have not attained an independent, functional level of reading. This includes young children in the initial stages of reading instruction as well as older students and adults who exhibit reading difficulties.

According to the interactive model, the fluent reader simultaneously analyzes information from multiple cue systems to reconstruct the meaning of a given passage. A reader does this so rapidly that there is no real word identification, with the visual representation of language transformed directly into meaning (Kavale and Schreiner, 1978). The graphic cue system becomes the least relied upon source of information because it carries the least amount of meaningful information (Goodman, 1970). This system of simultaneous analysis is part of an overall process of hypothesis testing. The cognitive process supporting the entire structure has been termed "anticipation," and consists of "narrowing the set of candidates for up-coming words by using information from prior text" (Wildman and Kling, 1978, p. 131). The information comes from the graphic, syntactic and semantic cue systems already mentioned. An example would be a reader encountering "I went to the b-----" in a story

about summer activities. Syntactic cues would be the function word "to" operating as a preposition and "the" acting as an article marking a noun. Understanding of prior context would supply semantic cues giving associated meaning of the words. The symbol "b" gives the initial sound of the unknown word. The reader might then anticipate a noun that describes a place, has to do with summer activities and starts with /b/. This wealth of information (usually the semantic) allows the fluent reader to anticipate accurately and thus confirm a smooth and rapid succession of precise hypotheses.

Non-fluent readers, however, do not process information at that level of speed and precision. They may not have an adequate sight vocabulary or adequate decoding skills, allowing for automatic word recognition. They also may not have a complete sense of reading as language processing, understanding that reading is to get meaning, not just to call words. Finally, they may not have adequate ability in switching from one cue system to the next, as needed.

Aspects of both the bottom-up and top-down models, as integrated in the interactive model, are needed to explain the continuum of reading processing from non-fluent to fluent skill levels. The non-fluent reader initially needs the bit-by-bit visual analysis until he

can build up his word recognition skills. At the same time, practice in the use of syntactic and semantic cue systems meets the requirement of approaching reading as a language-based task of deriving meaning. Once a reader decodes a word, he must make sense of it in the context of the other words he has read. The reader learns to rely more and more on the syntactic and semantic cue systems as he develops fluency in reading. The ability to use all cue systems as needed is retained by proficient readers. However, there will always be times when a difficult passage may be encountered, temporarily necessitating a drop back to letter-by-letter or word-by-word graphic analysis. Goodman (1973) states:

Reading requires not so much skills as strategies that make it possible to select the most productive cues. These strategies will vary with the nature of the reading task. (p. 26)

Language as the Basis for the Interactive Model

A look back at the structure and process of language itself will further show how reading is a language process with an interactive nature. Language is defined as a system of abstract symbols used for communication. The symbols can be auditory (for spoken language) or graphic (for written language). Four facets of language

use are identified and include listening comprehension, meaningful speaking, reading comprehension and meaningful writing (Hammill and McNutt, 1980). Each of these identifies and conveys meaning through the specific use of the dimensions of language:

1. phonological--the sound system of language, including stress, juncture, pitch and intonation
2. morphological--the system of meaningful units; for example, word endings to identify verb tense or plural forms
3. syntactic--the order of words in sentences
4. semantic--word meanings and the relationships among words
5. pragmatic--the social uses of language for controlling or changing attitudes or behavior.

(Pearson and Johnson, 1978; Lucas, 1980)

Since words and meaning exist only within the boundaries of these dimensions, the individual components of language would be void and empty without them (Athey, 1971). In reading, the reader uses his experience and knowledge of language dimensions like an overlay on the page of graphic, abstract symbols to reconstruct the writer's message.

The interactive nature of language is apparent in

looking at two of the above dimensions, syntax and semantics. The concepts of semantic markers and selective restriction explain how the syntactical and semantic dimensions interact. Word meanings are developed and refined through the acquisition of semantic markers, which constitute the attributes of a word. Semantic markers for "dog" would include "furry," "four legs," "barks," and "wagging tail." Selective restriction comes into play when words are combined into sentences and syntactic rules must be followed. Some words cannot be combined because the aspects of one or the other dimension may be incorrect. "The paper eats the dog's dinner" is syntactically correct but the semantic markers of "paper" and "eats" are in conflict. The process of selective restriction would demand that an appropriate noun replace "paper" (Hopper and Naremore, 1973, pp. 53-56).

The nature of language as an interactive process can also be illustrated at the level of concept formation. Children begin to form concepts in the earliest stages of language acquisition through joint interaction between the child and adults or the environment. Sensory input provides bits and pieces of information that become referents or lexical tags of objects, actions and events. These referents, in the form of phonological,

morphological or syntactic units, are sorted by means of discrimination skills and integrated through perceptual skills. Eventually, they are organized into a mental structure, a storage structure that keeps them available for future retrieval (Lucas, 1980). A concept, then, consists of this mental structure or network of organized information. Major alterations or minor reorganization occurs continually as new referents are perceived, discriminated and integrated.

An example of this process can be seen in a child's learning the difference between "cat" and "dog." An initial experience with a cat might provide the lexical referents /k/ (the initial phoneme), and the ideas that it is "pretty" and "little." Concept boundaries are formed as these referents are processed into a mental structure. Any object possessing those attributes may now be identified as a cat. Over time, the concept boundaries change as the mental structure expands to include new referents, such as /t/ (the final phoneme), "tail," and "meowing," from new experiences. Eventually, the child encounters an object that should fit within the concept of cat, since it is little and pretty with a tail, but its name starts with /d/ and it barks. Having information that does not fit necessitates the formation of a second concept, non-cat, so that this

unattached information can be saved. Subsequent exposure to these non-cats culminates in the mental structure for the concept of dog. Thus, new and old information from a variety of sources interacts in a cyclical pattern of concept formation, organization and integration (branching and reformation). Simple and distinct concepts evolve into a highly complex and overlapping hierarchy of stored information.

Many components of thinking and language interact during this continual process. They operate in the reading process in the same way as described, except that the source of new information is the printed page. The young reader may find that living things need food for growth. In subsequent reading, that concept is refined and divided as it is discovered that different foods are needed for different parts of the body, not all animals eat the same foods, and plants do not take in their food by eating at all.

Language, then, has a complexity of dimensions that are shared and borrowed between component parts on an interactive basis. It follows, then, that reading, as a language process, also would be an interactive system where parts and processes are activated as needed.

Language Concepts and Reading
Comprehension

The importance of this discussion is apparent when reconsidering reading comprehension as explained within a psycholinguistic framework. As stated above, personal, prior experience and conceptual background (generally referred to as prior knowledge) forms an integral part of comprehension abilities. Full comprehension depends on the interaction of information coming in from the text and prior knowledge. Sentence and paragraph meanings are processed into the structure of the reader's prior knowledge for memory and retrieval purposes (Bartlett, 1932; Guthrie and Taylor, 1978). This interaction and transformation is equivalent to the formation of "cat" and "dog" concepts as previously illustrated. The difference is that with reading, language competencies from an oral system, based on temporal relations, are applied to a graphic system of spatial configurations (Schadler and Jucla, 1979).

Many investigations have shown how prior knowledge interacts with new information to facilitate comprehension and make learning more efficient (Levin and Pressley, 1981). Brown, Smiley, Day, Townsen and Lawton (1979) had second, fourth and sixth graders read a passage about the Targas, a fictitious group of people. Two experimental groups were given information about the

Targas before reading the passage, while a control group received no information. For the first experimental group, the Targas were portrayed as gentle, Eskimo-like people but for the second group, they were characterized as fierce, Indian-like people. In measuring recall of the passage, two significant points were indicated. First, the experimental groups recalled 25% more information than the control group. Second, for the experimental groups, the information recalled tended to be consistent with the prior information given.

Davidson (1976) conducted a similar investigation using the passage, "The Mat Maker," from Moby Dick. In this passage, the metaphor of weaving on a loom was used to illustrate the interrelations of three abstract ideas: fate, chance, and free will. Experimental subjects were taught about looms before reading the passage; control subjects received no pre-instruction. On a true/false comprehension test, experimental subjects identified 50% more items than the controls. In free recall, the experimental subjects used the organizing structure of the loom metaphor to relate the abstract concepts while the controls, not having that structure, exhibited separate concept clusters.

In a separate different type of study, it was found that simple paraphrasing also enhanced comprehension and

recall.

Doctorow, Wittrock and Marks (1978), using sixth grade subjects, had an experimental group read a passage and write a summary statement about each paragraph as they read. The control group just read the same passage. It should be noted that both groups took the same amount of time to complete the task. On an immediate and on a one-week delayed modified cloze test, the experimental group scored over 50% better than the controls, a significant finding. The authors concluded that paraphrasing during reading was beneficial because the reader was processing and integrating information as he went along, relating back to his own storehouse of experience and vocabulary.

In summary, it was shown that prior knowledge influences and enhances comprehension and recall. The reader must not only have but use this knowledge base in the active manipulation of the information. Interaction takes place as the mental structures of prior knowledge provide a concrete base for the attachment of unfamiliar or abstract ideas.

Focusing on a Specific Type of Comprehension Disability

The differences between fluent and non-fluent readers

stand as an area of frequent research within the field of education. Non-fluent readers are said to be plagued with poor mechanical skills, including a limited sight vocabulary, confusion and reversal of letters, inefficient tracking, and the inability to pronounce words (Lindsey and Kerlin, 1979). Other researchers have found that poor readers have adequate mechanical and decoding skills but are poor comprehenders. Reading disability in these instances has been attributed to slow reading rate (Steig, 1979); too many meaning-changing errors that are not self-corrected (Pflaum and Bryan, 1980; Steig, 1979); insufficient insight into comprehension strategies and the ability to switch between them as needed (Stark, 1975; Steig, 1979); and the need to understand the rules of language and the logic of the language system (Rees, 1974; Stark, 1975).

All of these findings have given rise to attempts to categorize disabled readers into subgroups. The main division is usually whether the disability is primarily of a decoding or a comprehension nature. Guthrie and Taylor (1978) do not feel that research substantiates such subgrouping, with two notable exceptions. One exception is those readers with very limited sight vocabularies. The other refers to readers who have poor comprehension stemming from the lack of organization and

reasoning in dealing with the complex relations in printed text. This second description fits word-calling, or difference model, readers.

Difference Model Readers

Difference model readers have been selected for consideration in this review for several reasons. Research calls for the specific study of identifiable subgroups within the population of disabled readers. Even though subgrouping as a whole is controversial, difference poor readers are recognized as being distinguishable from other disabled readers. Finally, difference poor readers were selected out of need. The main disability here is in comprehension, which stands as the crux of the reading process and is currently a highly prevalent concern in the field of reading.

Behavioral Description

General descriptions of the word-calling process equate the reading disability with a deficiency in language processing. The reader characteristically attends to small, non-meaningful fragments of language, rather than larger, natural units of meaning. Lefevre (1964) refers to this as "poor sentence sense" (p. 24), while Smith (1971) states ". . . the difficulty is the inability to make full use of syntactic and semantic redundancy,

the nonvisual sources of information" (p. 221).

Substantial work in expanding and operationally defining the word-calling process was done by Cromer (1970). He presented four models to account for reading disabilities: defect, deficit, disruption and differences. Defect readers have a sensory impairment that precludes their learning to read, unless corrected or compensated. Deficit readers are capable of learning to read but are lacking in a basic skill that needs to be learned or reinforced. All functions are present in disruption readers but one is considered atypical and interferes with learning. With difference readers, in spite of adequate intelligence, language skills and vocabulary skills, comprehension suffers because information is not organized into meaningful units.

The essential question regarding difference readers centers on what it is that they do differently. Cromer elaborated on the general description cited above in stating:

. . . Although they have the skill to read aloud and say individual words correctly, they do not organize their reading input in a meaningful way; that is, they organize input in a word-by-word fashion rather than into meaning units such as phrases, and they lose that part of the

meaning which is carried by combinations of words. (p. 472)

Steig (1979) concurred in this description and expressed it in psycholinguistic terms by stating that a difference reader's approach is ". . . a mismatch between the reader's mode of response and the responses necessary for adequate comprehension" (p. 126). Word-calling behavior is changeable, as Steig goes on to point out that if a passage is divided into meaningful units, the reader can then read with normal comprehension.

Considering word-calling as a process, Smith (1971) gave a concise illustration:

The more difficulty a reader has with reading, the more he relies on the visual information; this statement applies both to the fluent reader and the beginner. In each case, the cause of the difficulty is inability to make full use of syntactic and semantic redundancy, the non-visual sources of information. (p. 221)

It is interesting to note that even fluent readers can get caught in the word-calling trap. The difference is that the truly disabled reader does not have the ability to get himself out. Thus, difference readers need to respond in a manner that utilizes language processing skills, a manner that focuses on taking information in

in meaningful chunks that can be efficiently organized and integrated for comprehension and storage.

In his same 1970 study, Cromer compared good, deficit poor and difference poor readers on a multivariable basis. Sixty-four male college freshmen and sophomores were evenly divided into good and poor reader groups. The poor reader group was evenly divided again into deficit and difference readers. Grouping was done on the basis of intelligence, vocabulary, and reading comprehension scores. All subjects scored in the average or above range of intelligence. Good readers placed in the 75th or higher quartile of the comprehension test while poor readers were in the 25th or lower quartile. Deficit and difference readers were distinguished by vocabulary scores: deficit readers scored below the national norms for college students while difference readers were at or above the norm, comparable to good readers. Thus, good readers placed high on all three measurements, difference readers were low only in reading comprehension, and deficit readers were low in both comprehension and vocabulary.

Two hypotheses regarding the groups were made: first, that difference readers read differently from both good and deficit readers; second, that this difference stems from the way each reader organizes

information from the text. The hypotheses were tested by having each subject read four passages presented in a variety of modes, including regular sentences, single words, meaningful phrases and fragmented phrases. Manipulation of the text in this manner was expected to enhance or inhibit each group's comprehension score in a predictable way. Comprehension scores were obtained from twenty questions given after the silent reading of each passage. Additional scores were taken from word identification errors and timings of reading rate.

Statistical analysis of the post-test scores supported the two hypotheses. Difference readers made significantly more comprehension and word identification errors, plus read slower than good readers, as was expected. In comparison to deficit readers, however, the opposite is true--difference readers were faster and more accurate. The interaction of group and mode of presentation brought the greatest distinction, though. Deficit readers scored highest on the single-word mode while difference readers performed best with the meaningful phrase mode, at a level comparative to good readers. Each group was shown to have an identifiable profile over measurements of intelligence, reading comprehension and vocabulary, as well as a distinctive pattern of response with artificially manipulated

material.

A broader look at the group by mode of presentation interaction gave support to the second hypothesis, also. Differences between the groups were expected to be accounted for by the way each organized the text material. As predicted, good readers (those with flexible and intact comprehension strategies) scored adequately on all but the fragmented phrase passage. With the material so disorganized, they were unable to structure and understand the material. Deficit readers, lacking in vocabulary and thus a concept base of prior knowledge, did not do well on any of the passages. Even the highly structured organization of the meaningful phrase mode was not beneficial. Finally, difference readers, who have the ability but not the strategies to comprehend material, were made to function as good readers by organizing the material for them. This is evidenced by significantly higher scores on just the meaningful phrase passage. The fragmented phrase mode was not especially disruptive, since that is the way they normally deal with printed material.

In summary, difference poor readers were found to be distinguishable from good and from deficit poor readers. Characteristically, they exhibit poor comprehension in spite of adequate intelligence and vocabulary skills.

Disability in comprehension can be traced to the lack of organizational and processing strategies. Given a structure for organizing and processing information from the text, difference poor readers can function as good readers.

Research and Treatment

Literature regarding research and treatment of difference poor readers does not appear to be plentiful. The original work cited is substantial in defining theoretical guidelines and behavioral characteristics, but is limited in terms of population applicability and specific treatment implications.

Three investigations in particular have provided substantiation and elaboration for the difference poor model of reading disability. Weissman (1978) conducted a study similar to Cromer's 1970 study, but used 60 students in the fifth and sixth grades. Treatment groups were divided equally into good, deficit poor and difference poor readers, as Cromer had done, although those terms were not used. The same format of presenting passages in single words, regular sentences and preorganized phrases yielded the same overall results. It can be concluded that difference poor reading behaviors are identifiable in less-than-mature readers. In addition, these

younger readers benefit from preorganized material, making the strategy of focusing on meaningful units, termed "semantic chunking" by Weissman, a viable instructional technique.

The utilization of existing mental structures also proved to be effective in improving the comprehension of disabled readers (Miller, V., 1980). "Activation," a researcher-designed instructional technique, was used with 50 sixth grade readers who met the behavioral characteristics of difference poor readers. The comprehension scores of good and poor readers were significantly different prior to, but not following, instruction in the activation technique for poor readers. Miller concluded that ". . . perhaps the notion regarding poor comprehenders' failure to use their existing mental structures in processing written material at the idea level may be valid" (p. 3028-A). A technique of this nature, one that engages and develops internal, existing ability and can be used with standard materials, has notable practical value.

Garner (1981) formulated the theory of "piecemeal processing" to explain the comprehension difficulties of difference poor readers. Ability in monitoring was considered an essential part of comprehension skill and consists of knowing about comprehension and monitoring

processes, knowing what is and is not understood, and knowing how to correct misunderstandings. Failure in monitoring was thought to stem from handling written language in a piecemeal fashion, focusing on fragmented word units rather than meaningful phrases and sentences. The major hypothesis stated that proficiently decoding poor comprehenders were more likely to attend to small, within-sentence pieces of information rather than larger whole sentence or between-sentence cues.

The preliminary test of this hypothesis was conducted on 20 fifth and sixth grade students, each exhibiting high decoding and low comprehension skills. Three passages were given to each student to read, after which the student indicated if the passage easily made sense, was just OK, or was difficult to understand. If a student chose the second or third answer, he was asked to explain his choice.

Garner's study differs from previously cited studies in the way the passages were altered. Passages were either informationally consistent (no modifications), informationally inconsistent (one word of the last sentence was changed so it no longer fit in) or had two unfamiliar, polysyllabic words inserted (i.e., multifarious, equinoctial). According to theory, poor comprehenders would not see the discrepancy in the

informationally inconsistent passage, but would be very aware of and bothered by the modifying words of the second passage. In contrast, good comprehenders would note discrepancies and judge the passage difficult to understand, but skip over the unknown words since they were not necessary for comprehension.

Statistical comparison of the responses poor comprehenders gave on the different passages met expectations and supported the research hypothesis. Ratings of informationally consistent and informationally inconsistent passages were statistically the same; both passages were judged as easy to understand, and making sense most of the time. This confirms that poor comprehenders did not note discrepancies (which made the passage not make sense) and were not aware that they had done so. Both of these passage ratings were significantly different from the ratings of modifying word passages, which were primarily rated as hard to understand and not making sense.

Analysis of why readers felt a passage did not make sense or was hard to understand provides an explanation for this difference, and lends further support to the research hypothesis. Comments regarding the informationally inconsistent passage were vague and incomplete, making no reference to inconsistent facts. In sharp

contrast, poor comprehenders quickly indicated long, hard, unknown words as troublesome in the modifying word passage. When asked to specify which words, the inserted polysyllabic words were pointed out almost without exception.

Thus, poor comprehenders attended to small, sometimes fragmented pieces of language that countermanded the processing of larger, sentence units and the relationships between them. As a result, not enough information was available to monitor and facilitate comprehension. Failure in monitoring left the reader oblivious to his lack of comprehension and without cues to increase available information by processing additional, larger units of language. Garner (1981) suggested breaking this cycle by training poor comprehenders to deal with big ideas, rather than specific words, and to be alert to contextually inconsistent or incorrect information.

Mavrogenes and Galen (1980) conducted a study at the secondary level with difference poor readers. It is notable because they take a different stand when translating the conceptual "mismatch of response and text" into objective terms. Mavrogenes and Galen see difference readers as users of restricted code language, a subsystem that is very concrete and dependent

on extra-verbal cues to convey full meaning. The mismatch, and thus disrupted comprehension, occurs when the restricted code reader confronts written material that is elaborate code language. These readers do not have the ability to process the more complex and abstract syntactic and semantic constructions typical of elaborate code, usually found in written material. Basically, the investigators see the conflict as a cultural difference in communication systems and advocate instruction in elaborate code forms of syntax and semantics.

Fifty-five remedial readers at the ninth grade level were placed in four groups, one control and three experimental. The major hypothesis was that instruction in syntax training (for example, sentence combining) would result in better reading and writing ability. The first experimental group received syntax training and listened to the teacher's oral reading for 55 minutes per day. The second group just listened to the teacher's oral reading, while the third group received only syntax training. Treatment lasted 30 minutes per day for the second and third groups. In addition, all groups continued work in a traditional remedial reading program. Treatment lasted 24 weeks.

Statistical analysis of post-test results indicated

that all three experimental groups scored significantly higher than the control group in the areas of syntactic ability and writing. There was no significant difference between the experimental groups on either of these measures. In the last comparison, results indicated the treatment variables had no effect on reading achievement. Mavrogenes and Galen concluded that the treatment helped subjects in the areas of syntax processing and writing but the benefits were not generalized to reading.

It is concluded here that research verifies and expands Cromer's model of difference poor reading. Three studies (Garner, 1981; Miller, V., 1980; Weissman, 1978) identified difference poor readers in the elementary school population. These younger readers characteristically had, but did not display, the ability to organize and process meaningful units of language. They all responded in the same positive manner as Cromer's original college-age subjects, to preorganized material. Miller and Garner each contributed alternative techniques for intervention. Rather than manipulating the text, Miller advocated the utilization of mental structures and abilities within the student while Garner supported the development of widespread monitoring skills. Garner's theory of piecemeal processing, even though

validated on only a preliminary basis, gave substantial weight to Cromer's model by providing an explanation of how word-by-word reading detracts from comprehension. Mavrogenes and Galen (1980) further substantiated the existence of difference poor readers, this time at the secondary level. Their study showed that intervention limited to syntax training and listening to oral reading was not enough to improve comprehension abilities. This lends further support to the need for more global intervention at the level of concept processing.

Application of Psycholinguistic Model

Many parallels are readily apparent that make the interpretation of difference model reading in psycholinguistic terms a straightforward task. The psycholinguistic model used here has defined reading as a language-based, meaning deriving process. Readers must have and actively use a base of prior knowledge to fully comprehend the content of written materials. Readers must also be flexible and efficient in gleaning information from multi-level cue systems, any one of which could be a primary contributor, depending on the reading situation. Information made available by the cue systems is compared to and integrated with prior knowledge through the process of hypothesis testing. Confirmation

of given hypotheses completes the comprehension task.

Difference model readers are described as capable of being, but not functioning as, successful comprehenders. Limited processing of written text as language, especially complex, higher-order cognitive levels, is observed behaviorally in word-by-word reading. Given preorganized material or strategies for more extensive processing, difference poor readers perform on a basis comparable to good comprehenders.

In psycholinguistic terms, difference poor readers do not approach reading as a language-based, meaning deriving process. These readers do not comprehend the text, do not realize they have not comprehended, and make little or no attempt to alter the situation. Excessive attention to word units and less meaningful bits of language precludes using full language abilities as the base of the activity. The component language cue systems, used to supply information for the generation and confirmation of hypotheses, are tapped in a limited and inflexible manner. Finally, the difference poor reader has an adequate base of prior knowledge, but does not use it. Comparisons between new information from the text and old information stored in mental structures are not made, again detracting from the smooth and efficient generation and confirmation of hypotheses.

Specific Instructional Activities

Strategies for comprehension are as varied as the reading tasks that call for their implementation. Some passages will be more difficult than others because of content, interest level, organization, presentation, and what strategies the reader has available for use. These variables can be divided into prose-dependent and processor-dependent strategies, which are what the writer and the reader each do, respectively, for comprehension. Strategies can also serve one of two functions: stage setting activities occur prior to reading and literally prepare the reader for comprehension, while storage/retrieval strategies take place during and after reading, resulting in the reorganization and transformation of content (Levin and Pressley, 1981).

This matrix of comprehension strategy dimensions provides a good structure for selecting instructional techniques and matching them to specific learner needs. From the standpoint of a psycholinguistic framework and the characteristics of difference poor readers, instructional techniques that develop storage/retrieval strategies, requiring the active manipulation of content material, seem paramount. From the standpoint of practicality and flexibility, instructional techniques that

are processor-dependent, inherent skills of the reader that can be applied as needed, also are of utmost importance.

Many different instructional techniques have been designed and successfully used to utilize processing skills in comprehending text. To relate a few:

In vocabulary and word recognition, teach morphemes and meaning rather than a linear sequence of unrelated sounds; i.e., cat (noun) plus /s/ (plural) rather than ca (sounds) plus ts (a blend of more sounds). (Stark, 1975)

Use increased visual salience (boldface type and indentations) to identify within-sentence and between-sentence meaning in content area books. (Marzano, 1978)

Work on how to identify, define and apply connectives (and, but, if, etc.) to teach relational meanings, such as consistency and cause-effect, among concepts (Soltis and Pflaum, 1979)

Integrate the construction of semantic webs or maps into basal reader lessons to organize the content and relate it to the reader's experience. (Freedman and Reynolds, 1980)

Use scaled questioning (going from the

literal to the inferential in a systematic manner) in assessment, instruction and curriculum to develop comprehension. (Crowell and Hu-pei Au, 1981)

Although all of these techniques have a common philosophical base and final goal, they differ in several respects. Not all of them have been empirically tested and only some have been tried with disabled readers. Most but not all of these techniques can be applied to at-hand materials with minimal modifications, as opposed to needing special materials. Only a few can be used with almost every age level.

The techniques of mapping with a basal reader and scaled questioning have been selected for use in this study for four reasons. First, they are compatible as two activities for one lesson. Second, they do not require special materials. Third, they have not been tested with readers displaying word-calling behavior. Last, comprehension skills are treated as a unitary whole, not isolated abilities, tying into the theory of reading comprehension as an overall language processing activity. The process of constructing the map and using it to answer the scaled questions makes use of all components of language and reading. Individual, key words are decoded, key phrases are delineated as

meaningful units, associated ideas are placed together and ranked for importance, showing how all the pieces fit together. The final activity of answering the scaled questions puts the integrated old and new information to use, along the full continuum of conceptual levels. It is a good means of assessing specific points of difficulty in order to provide clarification and reinforcement.

Description of Selected Instructional Techniques

Mapping is a long-standing technique used as an alternative to traditional outlining. According to Williams (1983), it is a graphic, non-linear method of organizing information in preparation for writing or for note-taking from a text or lecture. It has been known by several different names, including semantic mapping, semantic webbing, cognitive mapping, mind mapping and clustering. The form and procedure for mapping is fairly consistent, with some variation in structure and the symbols used to denote relationships. The purpose of mapping is two-fold: one, to encourage ease and flexibility in thinking and, two, to encourage use of both right and left brain thinking processes. The technique is closely aligned with the fields of educational and cognitive psychology with the greatest

application to writing and study skills.

For clarity, simply the term mapping will be used in this study. The specific structure and procedure to be followed will be Hanf's 1971 model. Hanf defines mapping as ". . . a graphic representation of intellectual territory traveled or to be traveled via reading" (p. 225). As a task for organizing and symbolizing ideas, it involves three essential steps. The reader begins by identifying the main idea of a passage. The secondary ideas are located next and connected to the main idea in a circular fashion. The map is completed with the addition of supporting details. The net result is a compact display of ideas and their relationships (see Figure 1).

The success of mapping centers on its ability to provide depth of understanding and organization within a simple and flexible structure. In using the mapping technique, readers must actively participate with the text, are given immediate feedback, and engage in critical thinking. At the same time, since the maps are self-constructed, room exists for individuality, creativity and shift between various reading tasks (Hanf, 1971).

Scaled questioning (Crowell and Hu-pei Au, 1981) provides a hierarchy of five question levels which will

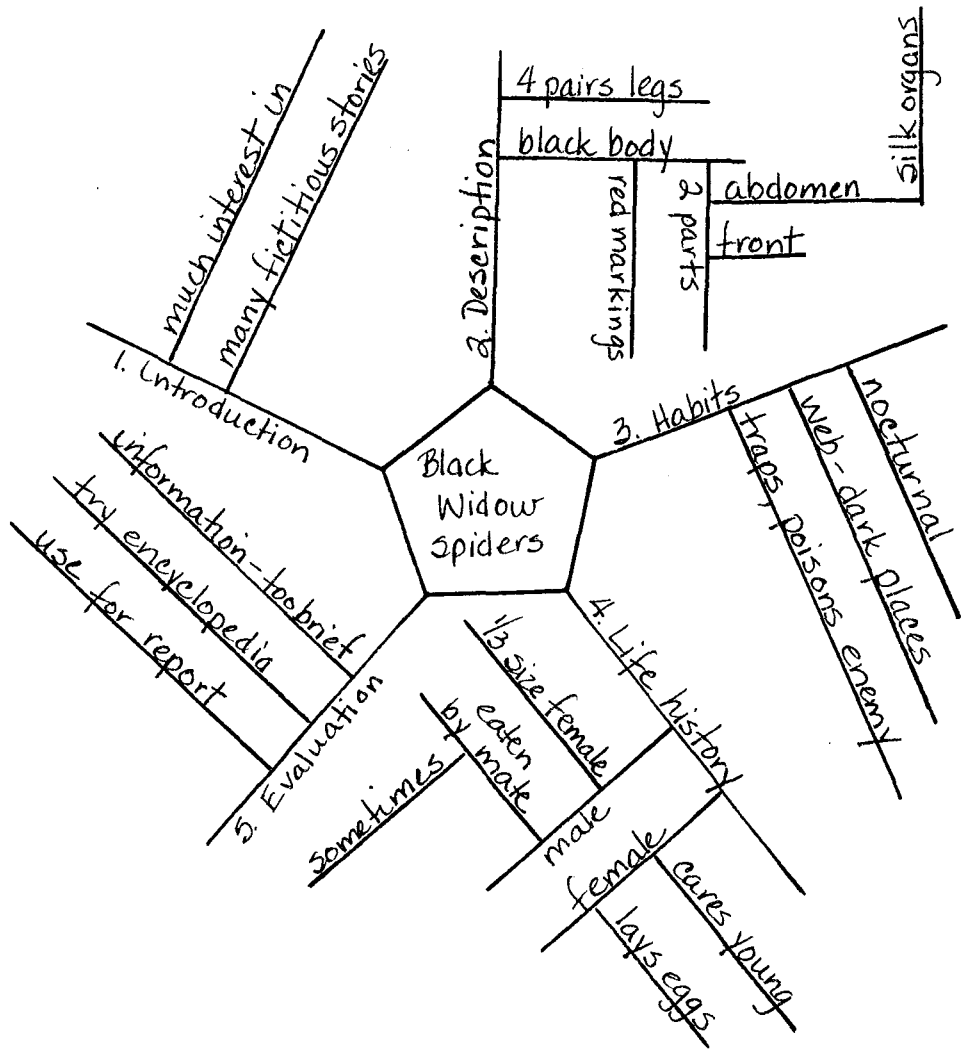


Figure 1. Example of Mapping

(Hanf, 1971, p. 228)

be used to check comprehension of the ideas organized in the map. Following the form and intent of Bloom's taxonomy (Bloom, 1956), these levels range from the simple and concrete to the more complex and abstract. Under Bloom's original taxonomy, a theoretical framework was supplied to delineate, classify and rank educational objectives within the cognitive domain of intellectual skills and abilities. Crowell and Hu-pei Au compressed Bloom's lengthy taxonomy, as follows:

1. Association--the recall of literal information.
2. Categorization--describe similarities and/or differences of elements of the story, based on information from the text.
3. Seriation--describe interrelationships among details, including cause/effect and the sequence of events, based on explicit text information.
4. Integration--combine elements of the story that are not explicit; make interpretations.
5. Extension--apply understanding of the story to other situations.

The use of these scaled questions allows for testing comprehension at five levels of difficulty, as it directly relates to reading comprehension. See

Appendix A for examples of questions at each level.

Research and Instructional Uses
of Mapping

Mapping has been expanded, refined and utilized in numerous instructional settings. Hanf's initial description advocated the use of mapping as a preorganization tool for writing projects and as a substitute for traditional note-taking. Freedman and Reynolds (1980) described an extended version, which they called semantic webbing, to add variety and challenge to basal reader lessons. The teacher provided a core question, around which students placed web strands (main ideas), support strands (secondary ideas and details), and strand ties (conceptual relationships between strands). The advantage of this method came in the group process of developing the web. First, the core question set the purpose for reading, then students drew and revised the web as they read. Freedman and Reynolds' example concerned a task in predicting events. Students read an opening passage, made predictions, and then continued to alternate reading and discussion until their ideas were confirmed or discounted. This method provided the opportunity for readers to explore concepts and relate them to their own feelings and experiences in a discussion format. In the final step of the

process, the web was summarized and applied to supplemental activities such as further reading on the topic, art or drama (see Figure 2).

Pearson and Johnson (1978) also recommend maps to promote reading comprehension, but were more exact in identifying the relationships between words and ideas. They described three types of relationships, the first being class relation, where two things would be in the same class (a dog and a cat are both animals). Second is example, the opposite of a class relation, where a member of a class is named (a collie is a kind of dog). The last type is a property relationship, which shows what a thing has, is or does (a dog barks) (p. 26).

Not all applications of mapping have been related to instruction in reading comprehension. Cleland (1981) followed Freedman and Reynolds in suggesting the construction of semantic webs with children's literature. Episodal, inductive and emotions webs, each drawn separately, helped students clarify and relate themes or issues within literature. A similar configurational strategy, based on word clusters, provided the focal point for literature, science concepts and creative writing (Rico, 1978). Schwab and Coble (1982) cited Cleland (1981) in presenting the use of semantic webbing in science courses. The format remained the same,

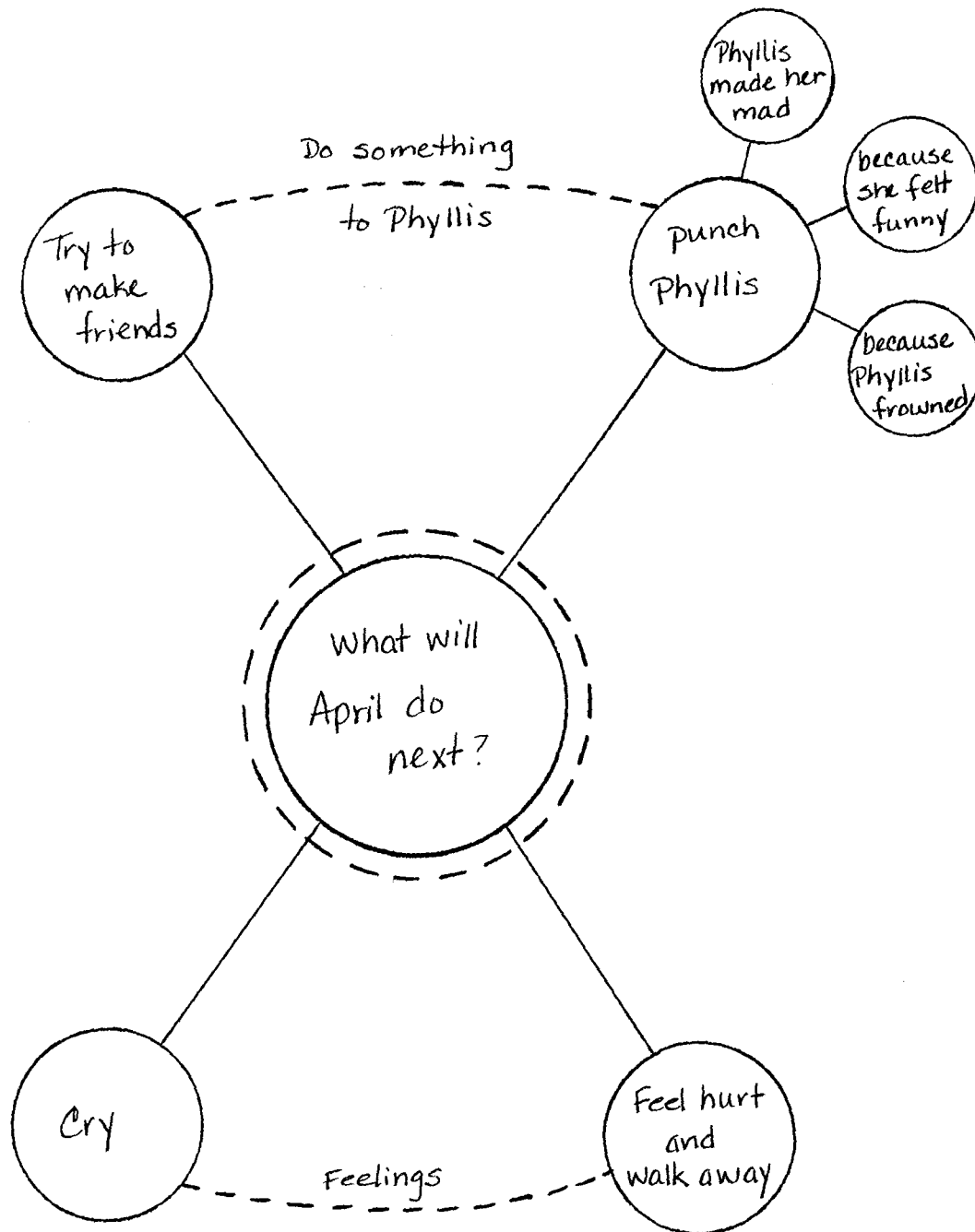


Figure 2. Example of Webbing

(Freedman and Reynolds, 1980, p. 683)

with a core question setting the purpose for reading followed by group discussion to construct a web. Besides providing organization for students, Schwab and Coble saw this as a way for teachers to assess students' prior knowledge and ways of thinking. In a more novel situation, webbing was employed in developing instructional tasks for the gifted. Students constructed webs in order to organize, expand and explore possible areas of study. Interrelated group and individual tasks were undertaken from within the boundaries of the web (Baldwin, 1980).

One cluster of activity with cognitive mapping involves study skills. Successful use has been demonstrated in research studies covering a wide range of subject populations and task comparisons. For sixteen college students in a reading and study skills course, mapping strategies were more helpful on a delayed recall test covering the main topic, subtopics and details of a passage, than either self-selected strategies or reading alone. This is significant in that the mapping skills were newly acquired at only two short sessions, while the self-selected strategies had been practiced for years (Rauch and Fillenworth, 1980). In a second college-age study involving 59 graduate and undergraduate students, results from mapping activities indicated

again that recall for ideas and relationships was enhanced and that the focus of the map drawn varied with the reader's interest, purpose and level of involvement with the material (Davidson and Triplett, 1979). Effective support in the recall of detail was demonstrated with 36 medical students using neuroanatomy course content. The experimental group (trained in mapping) scored the same as the control group (no instruction) when considering the first and second order concepts, but recalled significantly more specific details. In addition, the two groups maintained the same reading rate, indicating that mapping is as efficient as it is effective (Vaughn, Stillman and Sabers, 1978).

The effect of mapping as a study strategy for middle school students was investigated by Armbruster (1979). An experimental group of eleven students receiving instruction in mapping recalled significantly more idea units than the control group receiving no instruction, on a delayed recall test. Of interesting note is the variation in the technique used. Rather than just sketching ideas, Armbruster employed specific symbols to represent fundamental relationships, such as, "equal to," "instance of," "cause/effect," and "if/then." Even though adding a large element of complexity, mapping still proved beneficial. This was not the

case, however, in a subsequent, more extensive investigation. Lack of motivation and interest due to task complexity was cited as a major factor in the poor and conflicting results (Armbruster and Anderson, 1980). It appears that one of the true merits of mapping lies in its original simplicity.

Galloway (1983) conducted a large investigation with 321 seventh grade social studies students, comparing the effectiveness of a new mapping study technique and a well-known reading-study technique. It was found that both treatments were more effective than no formal study method at all. Of greatest interest was the evidence that students with average reading ability fared much better in improving their skills than students of high or low ability.

Four experimental studies concerning mapping and reading comprehension have been completed at the elementary and middle grade levels. Sinatra, Stahl-Gemake and Berg (1984) studied 27 reading disabled youngsters, ranging from second to eighth grade, at a university reading clinic. Each subject completed ten reading assignments which involved pre-reading activities, reading the selection, and ten multiple choice comprehension questions. All subjects did five selections under a verbal format (a traditional directed reading lesson)

and five under a mapping format. Three types of maps were used (episodic, thematic or classification) depending on the type of reading selection. Seventy percent of the children exhibited higher total comprehension under the mapping format. Students and teachers reported subjectively that maps were beneficial in demonstrating main and subordinate ideas plus establishing how ideas connect.

Margosein, Pascarella and Pflaum (1982) tried to improve reading comprehension and vocabulary by using mapping to teach vocabulary. Their main concern was the low reading scores of Mexican-American students, who may need a greater command of English vocabulary. Forty-four seventh and eighth grade students were divided into two treatment groups, one being taught vocabulary through mapping, and the other taught through context. Under the mapping format, a word was studied in reference to three other words that were similar, simpler in meaning, and familiar. The example given was solitude, taught through quiet, lonely and alone (p. 5). For each set of words, similarities and differences were stressed on the map. Under the context format, the same group of words was used in a paragraph explaining the target word.

Overall, the mapping group performed better than

the context group on measures of vocabulary. There was no effect for either group on reading comprehension. Even though the focus on word similarities and differences heightens categorical knowledge, it does not generalize to the reading task. As with an earlier study (Mavrogenes and Galen, 1980), it appears that reading comprehension must be dealt with directly to elicit positive change.

A final study in this area investigated the effect of a graphic post organizer on the ability to understand text. Huard (1983) divided sixth graders into an experimental group, which received graphic post organizer training, and a control group, which read the same material but completed different activities. T-test results indicated that the experimental group was significantly better in producing graphic organizers, but there were no other significant differences or strong correlations. These results may be based on the fact that only a post organizer was used. It may be necessary, as in other mapping formats, to use the map in pre-reading activities to establish the foundation of target concepts.

In conclusion, these studies have supported mapping as beneficial to recall and comprehension of idea units, vocabulary development, and study skills in the content areas. The findings, however, must be accepted with

moderate reservation. Minor conflicting results, seemingly based on task variations and frequently small sample size, leave shadows over the final position drawn from these studies.

Rationale for Effectiveness

The question yet to be answered is why mapping proves to be an effective instructional technique overall. Hanf (1971) offers a concise explanation when she states:

Mapping is thinking; constructing and creating the organizational design of ideas, selecting the information that is relevant, and sorting this into its proper place, relating all the facts to the whole and relating facts to other facts, and finally responding with personal reaction to the material.

(p. 229)

Mapping acts as an external way of representing and structuring ideas, providing a basis for the integration of old and new information. This directly relates back to the earlier discussion of concept formation, mental structures and prior knowledge. It also relates back to the earlier discussion of word-calling behavior described in psycholinguistic terms. The information at

hand is analyzed for meaning, fit into the established organization structure, and pulled out again if the need arises. Clearly, mapping activity, in a graphic form, parallels these cognitive processes. Hanf (1971) underscores this position in a reminder that reading ability is not based on a distinct set of skills. Language operations, of which reading is one, are anchored in central skills of high order cognitive processing and critical thinking.

The discussion here would not be complete without addressing the more recent theory of schema or script as it relates to comprehension. Tannen (1979) writes of the "structures of expectation" (p. 138) that are described across the fields of linguistics, artificial intelligence, cognitive psychology, social psychology, sociology and anthropology, among others. The terms, "frame," "schema," and "script" have been used to name the mass of organized knowledge that each individual possesses. By definition, some may be more static (conveying a sequence of events) or more dynamic (representing conceptual relationships). Their commonality lies in their function. Given a social, personal, communicative or reading situation, the structure of expectation is called up to provide the individual with the means to recognize, evaluate and respond to a given stimulus.

In her 1979 Study, Tannen selected the term "frame" in explaining how structures of expectation operate in the area of verbal language; specifically, oral narratives. A frame is the mental structure that determines sentence level expression about encountered events, individuals and the role of individuals in the event. Tannen illustrated her point by showing a film with music, but no dialogue, to college women in America and in Greece. After viewing the film, each subject related what she had seen to a female interviewer. It was found that the film was interpreted along the lines of cultural and linguistic expectations. For example, the Greeks (mostly from the countryside) expected to see a man walking with a goat and usually deleted this from their narrative. On the other hand, Americans (mostly urban) were surprised by that and frequently remarked on it. The Greeks showed their expectations by omitting comments about something well-integrated into their frame. The Americans did the same by commenting, in an evaluative or judgmental way, on something that was not integrated into their frame.

A variety of speech forms provide evidence of expectations. Tannen outlined a great many in her analysis of oral narratives, including: omission, repetition, false starts, backtracking, negatives, contrastic

conjunctions, inference, moral judgment, incorrect statements and additions (p. 166). In each instance, the speaker is attempting to align his verbalization with what's in his frame (his expectation) and what he actually encounters.

These "structures of expectation" are not foreign to researchers in the field of education, especially in the area of reading comprehension. Pearson and Johnson (1978) define script as ". . . the mundane, taken-for-granted knowledge that a person brings to a real-life situation. . . ." (p. 45), such as riding a bus or eating in a restaurant. In the process of comprehension, a reader takes information from the text, matches it against his prototype (script) for such events and integrates the two, producing complete knowledge (p. 46).

Other writers express this same, basic sequence of events. Clewell and Haidemos (1983) state that schema is the representation of background information and that "when reading, the reader chooses conceptual schemata to account for the text to be understood" (p. 315). Comprehension is poor when background knowledge does not include a schema covering the subject of the text. Adams and Collins (1979) take that same position, but at an earlier date, when they state:

". . . spoken or written text does not in itself

carry meaning. Rather, text only provides direction. . . as to how they should retrieve or construct the intended meaning from their own, previous acquired knowledge." (p. 3)

This ties back to a psycholinguistic framework in the concepts of prior knowledge of the world and hypothesis testing. Prior knowledge of the world can be equated with a person's organized mass of knowledge, termed "frame," "schema," or "script," depending on the field of study. Hypothesis testing parallels the functioning of "structures of expectation." A reader forms a hypothesis, or expectation, based on background, and matches it against information from the text.

It has already been shown that mapping has a positive effect on comprehension by providing a means to organize information, establish hierarchies and relate details. It is not surprising when mapping is suggested as a technique that specifically addresses schema theory (Clewell and Haidemos, 1983; Widomski, 1983; Sinatra, Stahl-Gemake and Berg, 1984). It follows that a relatively simple and flexible strategy would be effective across the tasks of writing, reading comprehension, study skills and vocabulary development, because of linkage to the global, mental process of "structures of expectation" that operates across human interactions. It

thus seems to follow also that the specific problem of word-calling behavior could be reduced by providing a focus away from graphic cues, toward more meaningful semantic and syntactic cues. As Adams and Collins (1979) summarize, "Every input event must be mapped against some schema" (p. 5):

Two related areas of investigation provide final support in this discussion. One, the effect of mapping on memory, further serves to explain why the activity enhances comprehension. Human memory operates in its most efficient form when detail is woven into a structural whole. If not, the detail is lost and forgotten (Hanf, 1971; Smith, 1978; Wilson, 1979). The construction of a map connects ideas by establishing superordinate and subordinate relationships. By association, one recalled component triggers the recall of another component, in a potentially endless fashion. In addition, the establishment of these relationships allows pieces of information to be grouped or chunked. With this, a greater amount of information can be stored, since details are strung out along larger units (Black and Bower, 1979; Hanf, 1971).

The consideration of neurological processing sheds final light on the workings of mapping activity. Fox (1979) reviewed split-brain studies that substantiate the

ability of each hemisphere to generate a complete picture of a stimulus, even when the stimulus is incomplete, according to its own manner of processing. Thus, in reading, the right (visuospatial) side of the brain creates an overall image or framework of the text as a whole. The left (verbal) side of the brain structures events sequentially, clusters details and judges the validity of the writer's statements. Fluent reading depends on the integration of these two images so that global, nonliteral information is blended with specific, literal information. The resultant unitary whole consists of the author's message, the reader's prior knowledge and the reader's response to the author's message. Configurational strategy (Rico, 1978), akin to mapping, is cited as providing the necessary integration. This is accomplished by having the circular, graphic display form the overall framework for the verbal concepts and details.

Mapping activity is not without limitations, however. Some deficiencies of the technique can be compensated for, while others offer more of a barrier. Spiegel (1981) lists semantic webbing (Freedman and Reynolds, 1980) as beneficial, but only with material containing familiar themes or topics. Webbing or mapping activity stirs motivation, encourages predictions and sets a

purpose for reading, but does not provide vocabulary or develop background. An alert instructor would need to provide that support as necessary, regardless of the task being completed.

Some ability in distinguishing main ideas from details as a prerequisite to mapping is a second limitation. Also, the complexity of the map needs to be matched to the complexity of the material. With a mismatch, the student may lose interest in the activity or fail to produce a useable map (Rauch and Fillenworth, 1980). In both of these situations, the instructor could initially provide the main idea or information on how complex the map might be, until the student is able to do that unaided. Rauch and Fillenworth's final drawback to mapping stands as a true limitation. Highly abstract information or text with an extremely difficult organizational pattern seems beyond the capabilities of mapping. As seen in the research cited above, the positive effects of mapping were less as the task complexity increased; value lay in simplicity.

Rationale for Use with Difference Model Readers

Strong support exists for the use of mapping with virtually all readers, as evidenced by the above discussion. Mapping provides a way for the reader to actively

manipulate the content of the text, a factor considered crucial in the comprehension process. Elementary and middle school students of normal intelligence, gifted school-age students and college students in general education and professional programs all have used mapping effectively. The versatility of mapping in terms of application to different populations and tasks lies in the simplicity of the technique, along with the fact that no special materials are required. Mapping can be adjusted both for the purpose and the materials at hand.

Difference model readers stand to gain specific benefits which apply directly to the ability areas in which they are the most deficient. As stated earlier, difference readers do not regard reading as language and thus do not read for meaning. Emphasis is on the graphophonic cue system as evidenced in word-by-word reading. Prior knowledge is not utilized in hypothesis testing to predict and confirm the content of the passage. Mapping utilizes all of these processes at a high level of integration.

The overall purpose of mapping is to end up with a global conceptualization of the content of the text based on relevant detail. This demands that the reader read for meaning and relationships. The task is accomplished primarily by dealing with the text as language,

in large meaningful chunks, something that has already been shown to be beneficial to difference readers (Weissman, 1978). This forces the reader to attend to all of the cue systems, with the semantic and syntactic ones assuming the major role of providing conceptual information. Flexible switching between the cue systems, the use of prior knowledge, and hypothesis testing are brought into play as decisions regarding superordinate and subordinate relationships are made. The reader must analyze a considerable amount of information before an appropriate placement is completed. Finally, the graphic representation of the map shows exactly how the language/idea units fit together to form an overall conceptualization of the author's message. This transformation of content into a concrete form gives substance to the phrase, "read for meaning." The reader actually sees the dynamic interrelationships of ideas, reinforced by the circular nature of the graph. The reader sees and experiences what the reading process is all about.

Summary and Conclusions

The need for specific instructional techniques to effectively remediate the disabilities of distinctive types of readers formed the basis for this review.

Research has called for techniques in comprehension strategies, ones that emphasize the active participation of the reader, to be investigated on the basis of specific learner-to-technique match. These specifications were met by considering the possibility of using mapping to improve the comprehension abilities of difference model readers.

An interactive model of reading, based on psycholinguistic concepts (Goodman, 1970), was used to explain the process of reading for both fluent and non-fluent readers. Treating reading as a meaning-deriving language process stood as the key to efficient and effective comprehension. The behavioral characteristics of difference model readers, as well as the comprehension activities of mapping, were more than adequately described in psycholinguistic terms.

Difference model readers were selected for investigation for several reasons. As a group, they are distinguishable as a subtype within the total population of disabled readers. Their primary difficulty is with comprehension and they have been shown to be capable of functioning as good comprehenders repeatedly. Mapping was chosen as an instructional technique because it has been proven effective in various instructional settings and specifically addresses the needs of difference model

readers. The related literature did not show that this particular learner-to-technique match has been previously evaluated.

It can be concluded that the literature supports an investigation of this nature. The format meets the specifications called for in recent research and addresses a current and substantial need. Difference model readers exhibit considerable disability but, more importantly, the potential for improvement. Mapping stands out as a readily available and highly effective medium for change. If investigation bears out the conclusions drawn here, difference readers will have made the jump from non-fluent to fluent reading, plus gained a strategy that will afford them life-long benefits as readers.

CHAPTER III

Methodology

This research proposed to investigate the instructional technique of mapping as it related to the remediation of reading comprehension difficulties as characterized by word-calling behavior. This strategy focused on the development and use of language processing skills necessary in reading comprehension. Six students served as subjects under a single case experimental design, specifically multiple baseline across subjects (Hersen and Barlow, 1976).

Research Design

The research design for this study was a multiple baseline across subjects format as described by Hersen and Barlow (1965). With this format, one targeted behavior is studied as the same treatment is administered to different subjects, with the initiation of treatment staggered over time. Baseline information is gathered and graphed, followed by administration of the treatment. During treatment, data on the target behavior continues to be gathered and graphed. The efficacy of treatment is drawn from changes in the rate

of the target behavior in treated subjects, and in treated subjects as compared to subjects who have not yet started treatment. Essentially, comparisons are made between data gathered in the baseline and treatment phases of the study, across subjects.

The target behavior of ability in reading comprehension was studied specifically as follows: baseline and treatment data were gathered on 6 subjects, using selected passages and follow-up questions as described under Treatment. At least 4 subjects were necessary, since that is the minimum number required to warrant statistical analysis (Hersen and Barlow, 1976, p. 299). Once a stable baseline was attained, treatment was initiated with the first randomly selected subject. Treatment for additional subjects was started at weekly intervals, also on a random basis. Baseline data continued to be gathered on subjects not under treatment. It was proposed that treatment be continued until 15 data points were collected on each subject, but time did not allow for that--stabilization of the baseline graphs and completion of treatment procedures took longer than expected.

Dataline Stability

The question of stability and variability is of

primary importance when using a multiple baseline design. Variability is the range of difference between separate data points, while stability essentially is the lack of variability. As variability increases, in either the baseline or treatment phase, it becomes more difficult to interpret the data and draw conclusions about the treatment effects. It is necessary, also, to achieve some degree of stability in the baseline before treatment can be initiated.

When considering baseline stability, an optimal condition would be at least 3 data points (the minimum required to establish a trend) showing a flat trend within a 5% variability range (Hersen and Barlow, 1976, pp. 75-76). This would indicate a regular, predictable rate of behavior and the treatment could be initiated. In the event of excessive variability, there are several strategies for possible increased stability:

1. Analyze the data for a pattern and, if one is evident, use it for phase comparisons.
2. Extend the baseline phase.
3. If the range of variability exceeds 50%, use statistical analysis rather than just visual interpretation for phase comparisons.
4. Assess sources of variability and control for them. (Hersen and Barlow, 1976, pp. 79-80)

Establishing stability in the treatment phase is based on the same criteria and is equally important, but for a different reason. The lack of any trend and a low, fixed range of variability indicates a definite behavior change. At that point, treatment is terminated and the data are analyzed for treatment effect.

Rationale

The selection of a multiple baseline design was made primarily because of the small sample size of the study. Usually, research in education deals with large groups of subjects being compared on a pre-test/post-test basis. The problem described here, that of readers exhibiting word-calling behavior, is a significant one, but does not occur with enough frequency to support large group research designs. As cited above, research in reading disability calls for the matching of specific reading problems with specific remediation methods, a situation which quickly narrows the sample pool. In addition, problems in comprehension are of a complex, global nature and seem best studied by closely observing individuals as they process information. For these reasons, studying a small group closely appears justified.

Multiple baseline itself is one of many types of

single case experimental design. These designs are used extensively in the areas of clinical psychology, psychiatry, social work and education, where researchers are trying to change highly individual human behaviors. The basic format consists of graphing behavior frequency over baseline, treatment and non-treatment phases. The assumption is that the desired behavior change will be seen in the treatment phase only. The alternating of treatment and non-treatment phases will amount to replication within the individual, thus showing the controlling effect of treatment (Hersen and Barlow, 1976).

Single case designs can be advantageous to large group comparisons for a number of reasons. First, it could be unethical to withhold treatment, as with a control group, when the target behavior is socially unacceptable or destructive. Second, it may be impractical or impossible to gather enough homogeneous subjects for an adequate sized sample. Next, the statistical analysis of data in group comparison designs averages out the scores, which tends to hide individual performance. An offshoot of this is the difficulty of applying generalized findings back to the individual. Finally, variability can be a problem, since usually it is limited to between-subject differences and is measured only once (Hersen and Barlow, 1976, pp. 14-17). These points

all apply to the problem at hand and are addressed by, if not controlled for, the use of a single case design.

The final consideration is which type of single case design to use. Alternating treatment and non-treatment phases, a reversal design, would be untenable here because the treatment variable of reading comprehension instruction cannot be completely withdrawn; some residual effect would remain. A design of multiple baselines across subjects solves the problem by allowing the measurement of a single behavior over time in a number of subjects. By staggering the initiation of treatment, one subject's treatment phase is compared to the next subject's baseline, making the withdrawal of treatment unnecessary (Hersen and Barlow, 1976). The replication effect is based on comparison of baseline and treatment phases between subjects rather than comparison of baseline, treatment and non-treatment phases within one subject.

Research Questions

1. What are the specific behaviors of readers characterized as word-callers in terms of proportional use of the graphophonic, syntactic and semantic cue systems?

2. Of the strategies and activities in use in reading instruction, which ones would develop skill in

the language processing tasks of concept formation, organization and integration, and thus be beneficial to readers displaying word-calling behavior?

3. Does focusing directly on reading as a language-based activity through the teaching of mapping during reading instruction result in improvement in reading comprehension?

Hypotheses

1. Readers characterized as word-callers will be over-dependent on the use of the graphophonic cue system, thus under-using language processing skills in concept formation, organization and integration for comprehension.

2. Teaching the application of language processing skills to readers characterized as word-callers, through the instructional technique of mapping, will result in improved reading comprehension.

Delimitations

1. This study will not be concerned with readers whose primary difficulty is in decoding written material or expressive language and language processing.

2. This study will not be concerned with language processing skills as they apply to the encoding of written material.

3. This study will be concerned with language processing skills only in the areas of concept formation, organization and integration.

4. The theoretical basis of reading used in this study will be Goodman's (1970) psycholinguistic model of reading. This model holds that reading is a language process closely integrated with thought, in which comprehension is dependent on the interactive use of the graphophonic, syntactic and semantic cue systems.

5. The treatment variable of mapping will follow the procedure outlined by Hanf (1971). The procedure as used in this study will be referred to simply as mapping, although it is known by other, basically synonymous terms.

Definitions

Language processing--the cognitive activity of receiving stimuli, attaching meaning to it, relating it to prior knowledge and experience, and then storing it for future retrieval and application.

Concept formation-- the component of language processing in which meaning is attached to a stimulus for the purpose of identifying attributes and forming the boundaries of the concept.

Concept organization--the component of language

processing in which old and new information is systematically structured on the basis of superordinate and subordinate positions for the purpose of storage and retrieval.

Concept integration--the process of reorganizing or combining old concepts to form new ones or revising established concepts in the light of new information.

Assumptions

The identified instructional strategies and activities will benefit disabled readers characterized as word-callers even if a mild to moderate language processing disorder is exhibited in addition to the reading disorder. The instruction will facilitate the development of concept formation, organization and integration, and then foster the application of those skills to the reading task.

Pilot Procedures

Prior to the beginning of this study, pilot procedures were carried out to finalize the specific instruction and format to be used during the treatment phase. Students in the researcher's classroom, who were not considered potential subjects for the study, served as pilot subjects. No formal data were collected. Informal results of the pilot procedures were used to

determine materials for the reading passages, length of reading passages, time allotments for instruction in mapping between reading passages, and instructional steps for constructing maps.

Selection of Sample

Steps for Selection

A sample of students was drawn from the school population of a rural county in the foothills of central California. All of the students were enrolled in special education programs for the learning disabled. Approximately 200 students currently receive special education services throughout the county.

Step 1. As a screening device, a list of students in grades 5 through 12 who displayed possible word-calling behavior was drawn up by regular and special education teachers and administrators. Each informant had a complete behavioral description and test profile description of word-calling behavior for reference.

Step 2. Paper screening of the recommended students was done through the examination of student records. Grade level and standard scores from the Woodcock-Johnson Psychoeducational Battery (Woodcock-Johnson) (Woodcock and Johnson, 1977) were used for the preliminary verification of a significant disability in

reading (see Data and Instrumentation below for technical data). A significant disability is defined in two ways. First, reading scores may fall three or more years below expected grade norms. Second, age percentile scores may be either in the bottom quartile or within one point of it (Cromer, 1970, p. 473). Ten students met step 2 criteria and were considered potential subjects. They ranged from 5th to 10th grade, with most being in the 7th and 9th grades. Reading comprehension scores ranged from 3rd to 6th grade with a mean of 4th grade.

Step 3. In those cases where a significant disability in reading had been verified, students were given a battery of tests, individually, to confirm the presence of word-calling behavior. The battery consisted of three subtests of the Woodcock-Johnson (if not administered previously), the Reading Miscue Inventory (Goodman and Burke, 1972) and two subtests of the Fullerton Language Test for Adolescents (Fullerton) (Thorun, 1980) (see Data and Instrumentation for technical data). The Woodcock-Johnson subtests used were Letter-Word Identification, Word Attack and Passage Comprehension, which make up the Reading Cluster. Subtests from the Fullerton were Convergent Production, which taps vocabulary depth, and Divergent Production, which taps vocabulary breadth and flexibility. All tests were given and scored by the

researcher.

Operational Definition of Word-Calling Behavior

Students were identified as exhibiting word-calling behavior if they met the following operational definition:

1. Vocabulary scores at or within one standard deviation of the mean on the Convergent Production and Divergent Production subtests of the Fullerton.
2. A significant disability in reading, as evidenced by the Woodcock-Johnson Reading Cluster. Grade level equivalencies will be at least three years below expected norms, or age percentile scores will fall either in the bottom quartile or within one point of it. Decoding scores will be at least as good as comprehension scores.

Sample Description

Seven subjects were initially identified as exhibiting word-calling behavior. While still in the baseline phase, before treatment was started, one subject transferred to another school and was dropped from the study. The remaining six subjects completed both baseline and

treatment phases of the study. Table 1 summarizes pre-treatment data on the final six subjects. The subjects were in three different special day classes, based on their regular school of attendance. Four people acted as trainers: the researcher, the credentialed teachers from the two other classes, and the instructional aide of one class.

Instrumentation

The Woodcock-Johnson Psychoeducational Battery (Woodcock and Johnson, 1977) is a standardized test of global achievement used to measure current levels of academic function and annual growth. The Woodcock-Johnson was normed on 3,900 school-aged children and 832 pre-schoolers and adults. Split-half reliability scores for the Letter-Word Identification, Word Attack and Passage Comprehension subjects were all at least .80. Reliability for the overall Reading Cluster exceeded .85. No test-retest reliability scores were reported (Salvia and Ysseldyke, 1981, pp. 341-2). These scores indicate acceptable levels of reliability.

The Reading Miscue Inventory (Goodman and Burke, 1972) gives a qualitative and quantitative analysis of errors made during oral reading. The instrument does not yield standard scores but indicates, on a percentage

TABLE 1

Initial Profile of Subjects

Subject	Sex	Age	Grade	Woodcock-Johnson		Fullerton (Both Subtests)	Reading Miscue Inventory			Passage Grade Level
				Cluster Grade Level	% Rank For Age		Full/ Partial Compre- hension Loss	Full/ Partial Use of Grapho- phonics	Use of Syntax	
1	M	15-3	9	7.8	26th	at or near mean	78%	80%	weak	6.0
2	F	14-7	9	6.0	21st	below mean, with- in one standard deviation	48%	60%	partial strength, close to weakness	5.0
3	M	12-9	7	3.9	11th	one standard deviation below mean	76%	80%	weakness, close to partial strength	3.0
4	M	16-0	10	4.2	12th	below mean, with- in one standard deviation	63%	75%	weak	3.0
5	M	14-4	9	2.8	5th	below mean, with- in one standard deviation	77%	80%	weak	3.0
6	M	14-9	9	7.6	26th	below mean, with- in one standard deviation	43%	85%	partial strength close to weakness	6.0

basis, to what extent a reader is using each of the three cue systems. Additional information is provided on the amount of comprehension loss and the incidence of self-correction of errors. Reliability and validity information was not published in the test manual.

The Fullerton Language Test for Adolescents (Thorun, 1980) is a standardized test made up of eight subtests that assess specific areas of language functioning and use. This experimental edition was normed on 762 students, aged 8 to 18, in rural California and Oregon. The two subtests being used here, Convergent Production and Divergent Production, yielded test-retest reliability coefficients of .84 and .85 respectively. Split-half reliability coefficients for the same subtests were .71 and .78. All of these scores were significant at the .01 level of confidence, indicating good test reliability. Content validity for the choice of subtest topics and specific item selection was established through research of the literature on language development and the inclusion of items on similar, recognized tests of language development (Thorun, 1980, pp. 20-21).

Procedures

Teacher Training

~~During the process of selecting subjects, teachers~~

who referred potential subjects agreed to act as trainers if their students met subject criteria. Thus, trainers were enlisted on the basis of an identified research subject being present in their class. Three special education teachers (including the researcher) and one instructional aide served as trainers. All were assigned to special day classes.

Teachers acting as trainers received instruction in reading as a psycholinguistic process, language processing skills, the technique of mapping, and the hierarchy of scaled questioning during a one-day workshop prior to the beginning of the study. Trainers had the opportunity to observe the construction of a map, and to build their own in independent activities. The training workshop was conducted by the researcher. During the treatment phase of the study, the researcher made two follow-up observations for all trainers to maintain consistency in treatment procedures. See Appendix C for an observation checklist, which outlines the specific steps in constructing a map.

Establishment of a Baseline

Data points for both baseline and treatment phases were generated by the administration of reading passages, each with ten scaled follow-up questions (see Data Collection and Recording for a full description). During the

baseline phase, subjects participated in their regular reading program, without any instruction in mapping. At regular intervals, averaging one to two per week, subjects independently read the passages and answered the follow-up questions. Data points represented the number of correct responses out of the ten possible.

The collection of baseline data continued until all six subjects had established stability or a recognizable pattern in their performance. A minimum of three data points is required to show a trend, and it is recommended that the points be within a 5% variability range (Hersen and Barlow, 1976, pp. 75-6). This low variability range reflects a flat, stable rate of behavior. If the variability rate is higher, collection of baseline data continues until a definite pattern of behavior emerges (Hersen and Barlow, 1976, p. 79). One situation or the other is necessary to provide a meaningful basis for the comparison of baseline and treatment phases. If good baseline stability occurs, changes in the treatment data-line can be more easily attributed to the treatment variable.

In this study, baseline data for all the subjects as a group were collected for 9 weeks, with subjects averaging 11 data points each. Variability ranged from 5 to 25 percent, indicating good to moderate stability.

All subjects with more than 5% variability displayed various patterns of behavior. Two subjects had scores consistently alternating up and down within a small range of scores. Three subjects exhibited similar alternating of scores but over a wider range. The final subject had scores varying over a wide range, with the last three data points very close together.

At this point, subjects were assigned the order, on a random basis, in which they would begin to receive treatment. Those subjects not yet receiving treatment continued under the baseline procedures. Treatment was initiated for each subject at one week intervals.

Treatment

Treatment consisted of instruction in reading comprehension using the technique of mapping. All instruction was given within the context of the subject's regular reading program. Trainers applied the technique of mapping to the reading materials normally used. Three trainers used a commercially available reading program and one used a basal series. All students in the subjects' reading groups received instruction in mapping and completed the independent passages. For the purpose of this study, however, only data on identified subjects were graphed.

All reading lessons were based on the teacher guidelines accompanying each program or basal series used. All followed the standard format of reading instruction, including pre-reading activities. Pre-reading activities covered introduction of new vocabulary, concept development, and introduction to the story. After each story was read, construction of a map was incorporated into the follow-up discussion. Events of the story were sequenced on the map as major strands, with relevant details, feelings and relationships marked in appropriate places. When completed, each map was summarized.

The lesson ended with comparison of the map and any comprehension questions. Students were shown how to locate information on the map and use it to answer questions. Students then answered comprehension questions independently, using the map for reference. See Appendices A and B for an example of a completed map and ten scaled questions.

Over time, the students were given more responsibility in constructing the maps. It was hoped map construction would become an independent skill, but that proved to be too difficult for most students. Trainers attempted to foster independence by, among other things:

1. Having a student lead the map-constructing discussion.

2. Providing only the major strands, with the students filling in details.
3. Providing only the first few strands with details and having the students complete the map.
4. Providing a skeleton of the map and having the students fill in the important ideas and details.

Instruction was given in daily periods approximately 45 minutes long, depending on the schedule of each class. The entire treatment procedure took from three to five days, subject to the length of each story and the number of pre-reading activities and comprehension questions. The format of daily, average-length classes and the use of typical, commercially available materials closely approximates the everyday instructional situation. This adds to the ability to generalize the results of the study.

At the completion of each instructional unit (pre-reading activities, reading the story, discussion and map construction, comprehension questions), all students in the subjects' reading group completed a reading passage. Students were encouraged to construct a map, or at least attempt one, but the reading, any map construction, and the scaled follow-up questions were done independently.

For each identified subject, the number of correct responses on the comprehension questions was used as a data point.

Data Collection and Recording

Data points for the baseline and treatment phases of the study were generated through the administration of reading passages with comprehension questions, separate from any treatment procedures or materials. During baseline, these passages were given twice weekly. During treatment, they were given at the end of each instructional unit. The passages were taken from the third, fifth and sixth grade levels of Holt Basic Reading (Holt, Rinehart and Winston, 1983) and HBJ Bookmark Reading Program, Eagle Edition (Harcourt Brace Jovanovich, 1983). None of the identified subjects had any experience with these series prior to the study. Subjects were given passages at the grade level corresponding to their reading level on the Reading Miscue Inventory, which indicates an instructional level of reading.

All of the passages were graded using the Fry Readability Scale. In addition, all were retyped for uniform presentation. They varied in length from one to two pages, but were designed to be completed in 30 to 45

minutes. The passages were prepared and presented as they were taken from the basal series. Most of the subjects completed most of the passages by the end of the study. Differences in passage completions stemmed from intermittent absences and class scheduling.

The scaled comprehension questions were all written by the researcher. An independent rater (a teaching colleague not acting as a trainer) read the questions to verify the accuracy of the question types. Adjustments in wording were made until agreement was reached that questions corresponded with the areas of association, categorization, seriation, integration and extension. If agreement could not be reached, a question was deleted. Two questions of each type were written for each passage. All questions were in short essay form, requiring at least a short phrase for a correct response.

All of the scaled comprehension questions for completed passages were scored by the researcher. Again, an independent rater (a teaching colleague not acting as a trainer) was used to verify the scores. The independent rater received the same instruction as the teachers acting as trainers, prior to the study. Half of the passages were scored only by the researcher. The other half were first scored by the researcher and then scored by the independent rater. After both sets of scores were completed,

they were compared for reliability. In all instances, the first and second total scores were within one point of each other, indicating good score reliability. All subjects were recorded on a graph, one for each research subject.

In addition to the multiple baseline procedure, a pre- and post-treatment measurement was taken for each subject using the Reading Miscue Inventory. Data were collected on the proportionate use of the graphophonic, syntactic and semantic cue systems and the percentage of comprehension loss, based on the type of reading errors made.

Data Processing and Analysis

The Reading Cluster of the Woodcock-Johnson Psycho-educational Battery and the Fullerton Language Test for Adolescents were given as pre-tests only, to establish the equivalency of the subjects. The Reading Miscue Inventory was given as both a pre-test and post-test, but no statistical analysis was done on the data. A descriptive analysis of change in comprehension loss, retelling ability and proportionate use of all three cue systems was completed for each subject. Because of the nature of the information generated by the Reading Miscue Inventory and the small sample size, these data were not conducive

to statistical analysis.

During the course of the study, it appeared that several patterns of response were emerging as the subjects completed reading passages after each instructional unit of the treatment phase. Data were collected to see if any given passage proved more or less difficult for the subjects as a group. Total scores on the scaled questions were compared across subjects for each passage. In conjunction with that, scores on the scaled comprehension questions were tallied by type of question. A comparison was made to provide information on the interactive effect of mapping and the specific type of question. Again, because of the small sample size, no statistical analysis was carried out.

Statistical Analysis

The issue of running a statistical analysis on data generated by use of a single case design is controversial. The primary point of difference is the definition of "significance" when evaluating the effect of treatment. Opponents of statistical analysis are looking for clinical significance; that is, a degree of behavior change that makes the subject socially and functionally acceptable. Statistical analysis can give credence to subtle changes that may have no real effect on the subject's daily life

(Hersen and Barlow, 1976, pp. 266-69). This is important in light of the fact that single case designs are utilized primarily in the field of behavioral sciences.

Those who advocate the use of statistics do so only in well-defined situations. If visual inspection of the different phases indicates clear stability and low variability with a marked degree of change, statistics are not needed. In cases where lack of stability, excess variability (a range of 50% or more; Hersen and Barlow, 1976, p. 75) or questionable effects are noted, statistics can be helpful. The researcher must be cautious in drawing conclusions, because it is possible that the analysis will grant significance to small effects of no clinical importance. The advantage is that reliable, though small, parts of the study have been identified and may be valuable leads to future studies (Hersen and Barlow, 1976, pp. 269-72).

The R_n statistic (Revusky, 1967) is recommended for use with multiple baseline designs when it is necessary to augment visual interpretation of the data. With this procedure, the scores of all the subjects are ranked (1 being the highest) each time treatment is initiated. Each ranking is considered a sub-experiment with the experimental subject (receiving treatment) being compared to "control" subjects (no treatment). Only the rank of the

experimental subject is recorded (see Table 2). The sum of the sub-experiment ranking equals the R_n statistic, which is then compared to a given table to determine its significance.

TABLE 2

	Week 1	Week 2	Week 3	Week 4
Subject 1	20C	30C	30C	65E
Subject 2	40C	60E		
Subject 3	60E			
Subject 4	45C	65C	80E	
Rank Outcome	1	2	1	1

Hypothetical data (percent of correct responses on comprehension questions following a given reading passage) illustrating the ranking procedure for each of 4 sub-experiments.

E = Experimental; C = Control.

Several points must be considered when using this procedure. First, it is assumed that the probability of each ranking across subjects is equal if the treatment has no effect. With this assumption, the initiation of the treatment must be in random order. Second, with each sub-experiment, previously ranked experimental subjects

are not used. Only the most recent experimental subject is compared to the "controls." The final consideration is the similarity of baseline data across subjects. If these raw scores differ greatly, they may not be comparable in terms of relative growth. Revusky (1967) provides and recommends a formula to transform raw scores so that comparisons are made on the basis of percent of change from the baseline.

Two conditions were present in this study which supported analysis of the treatment phase datalines by means of the R_n statistic. First, baseline data across subjects was not entirely similar. Raw scores needed to be converted to obtain a more reliable picture of relative growth. Second, not all subjects achieved an adequate level of stability in the treatment phase. Several exhibited performance that did not allow for clear visual interpretation of the data.

Summary

This chapter contains a full description of the research design and treatment procedures of this study. A single case experimental design; specifically, multiple baseline across subjects, was utilized to accommodate the conditions of a small sample size and the need to closely study the effect of matching a specific instructional

technique to a specific reading disability. Results from the multiple baseline will be augmented by a comparison of pre- and post-treatment scores on the Reading Miscue Inventory (Goodman and Burke, 1972).

Sample selection was completed through a three-step process. Six subjects from the seventh through tenth grades were identified. They were all in one of three special education classes, working under one of four trainers.

Baseline procedures lasted nine weeks, followed by the staggered initiation of treatment at regular intervals. Treatment consisted of the inclusion of mapping into each subject's regular reading program. Independent reading passages followed by ten scaled comprehension questions were administered at the end of each instructional unit. Scores from these passages served as data points in the baseline and treatment phases of the study.

The multiple baseline datalines were subjected to visual interpretation and statistical analysis, using the Rn statistic (Revusky, 1967). All other comparisons were given only a descriptive analysis.

CHAPTER IV

Analysis and Evaluation

This chapter covers the analysis and evaluation of data collected through the multiple baseline procedure plus the pre- and post-test scores of the Reading Miscue Inventory. Both descriptive and statistical analyses are offered. Under the multiple baseline procedure, the treatment of each subject is considered a sub-experiment. Each subject, and thus each sub-experiment, is identified by the numerical order in which treatment was initiated. The order was assigned on a random basis. Variability of data points in both baseline and treatment phases was determined by finding the percentage difference between the third and sixth data point of each phase.

Multiple Baseline Across Subjects

Sub-Experiment 1

S₁ was a ninth grade white male, who read at the sixth grade level (see Figure 3). Baseline lasted nine weeks, generating nine data points, which exhibited 10% variability. S₁ averaged a raw score of 7.3. The treatment phase for S₁ lasted 21 weeks, with 12 data points collected. Variability was 20%, with an average raw

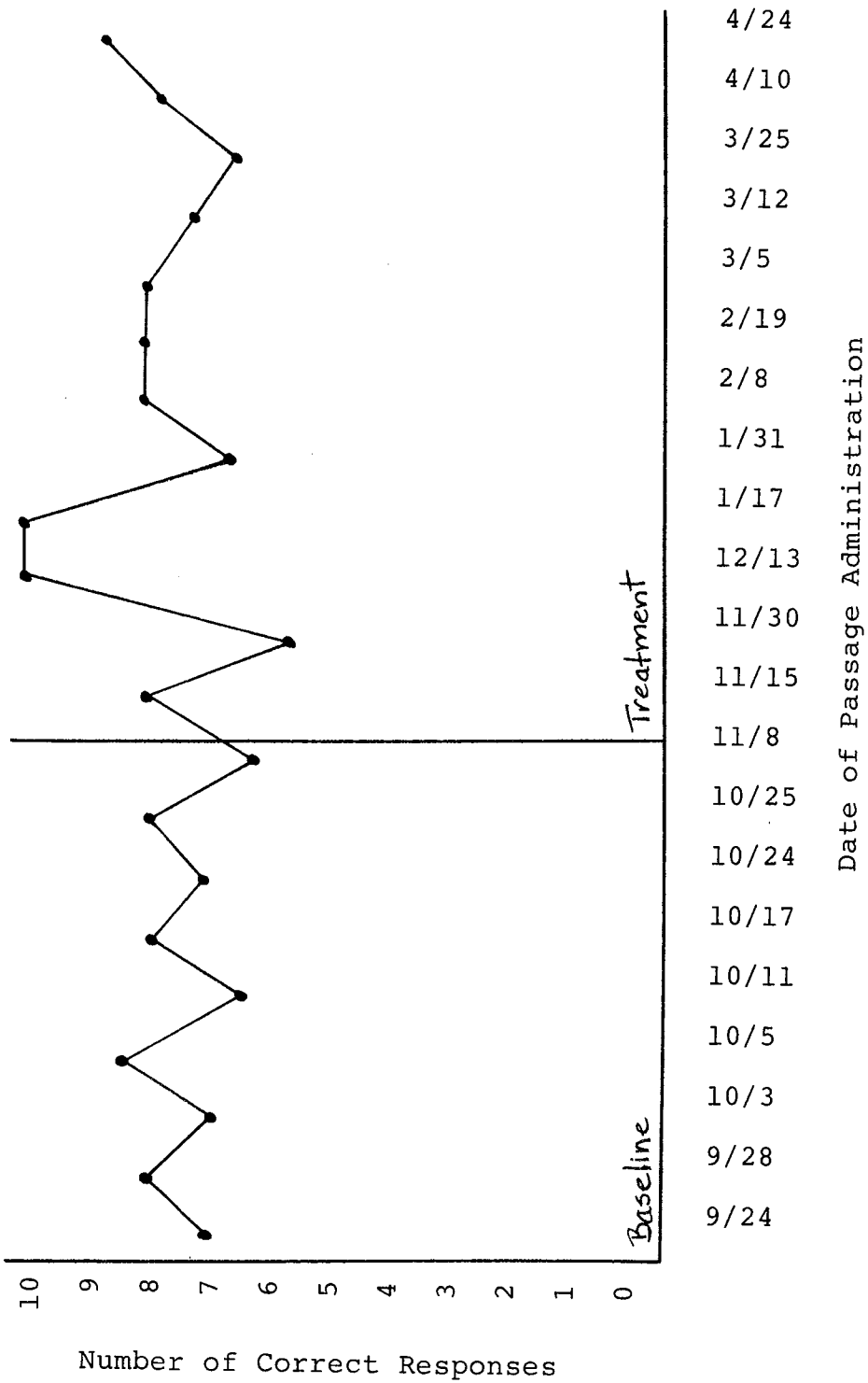


Figure 3
Subject No. 1

score of 7.8.

Visual interpretation of the graph indicates no real change, either positive or negative. S_1 received two perfect scores of 10 during the treatment phase, but all the other data points did not vary greatly from those of the baseline phase.

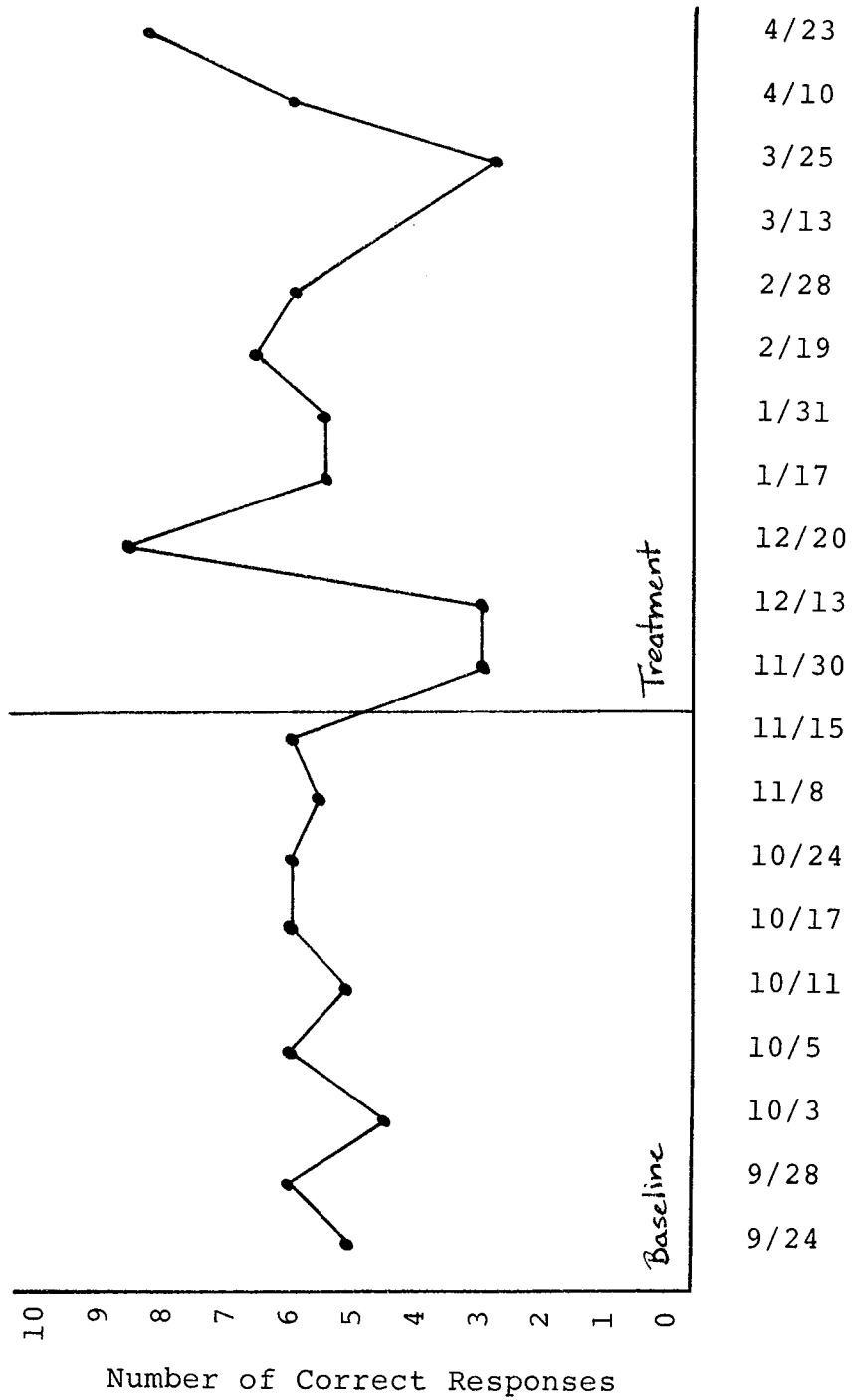
Sub-Experiment 2

S_2 was a ninth grade white female reading at the fifth grade level (see Figure 4). Baseline lasted nine weeks, generating nine data points, which showed 15% variability. During this phase, the average raw score was 5.6. The treatment phase lasted 20 weeks, with 11 data points collected. The average raw score was 5.3, with variability of 20%.

Visual interpretation of the graph does not support any positive change. Two data points were quite high, but the majority still were at the baseline level. Four points were quite low, especially in comparison to the baseline phase. These points corresponded with periods of refusal to complete assignments.

Sub-Experiment 3

S_3 was a seventh grade white male reading at the third grade level (see Figure 5). Baseline lasted 11 weeks with 11 data points collected. The average raw



Date of Passage Administration

Figure 4

Subject No. 2

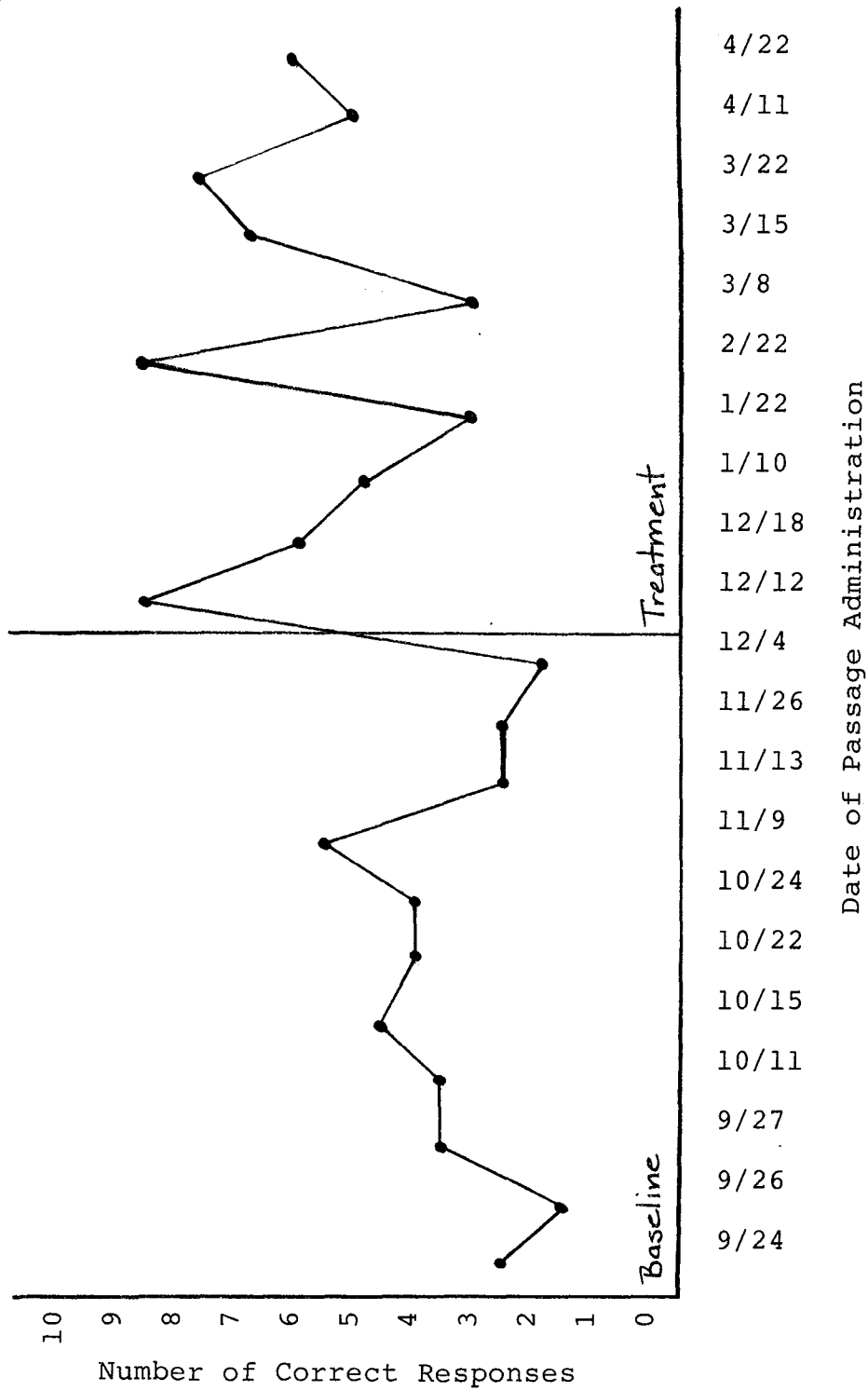


Figure 5
Subject No. 3

score was 3.3, with 5% variability. The treatment phase lasted 18 weeks, generating 10 data points. The average raw score was 6.0, with 15% variability.

Visual interpretation suggests greater variability than indicated by the above percentage (the percentage difference between the third and sixth data points of each phase). Overall comparison of the phases still supports positive change, however. Extremely low scores were eliminated and intermittent high scores were achieved.

Sub-Experiment 4

S₄ was a tenth grade white male reading at the third grade level (see Figure 6). The baseline lasted 12 weeks with ten data points collected. The average raw score was 5.8, with 10% variability. The treatment phase lasted 17 weeks, with 10 data points generated. The average raw score was 6.8, with 0% variability.

Visual interpretation clearly supports positive change during the treatment phase. The treatment data-line exhibits a definite and stable upward trend, with the exception of one data point.

Sub-Experiment 5

S₅ was a ninth grade white male who read at the third grade level (see Figure 7). Baseline lasted 12

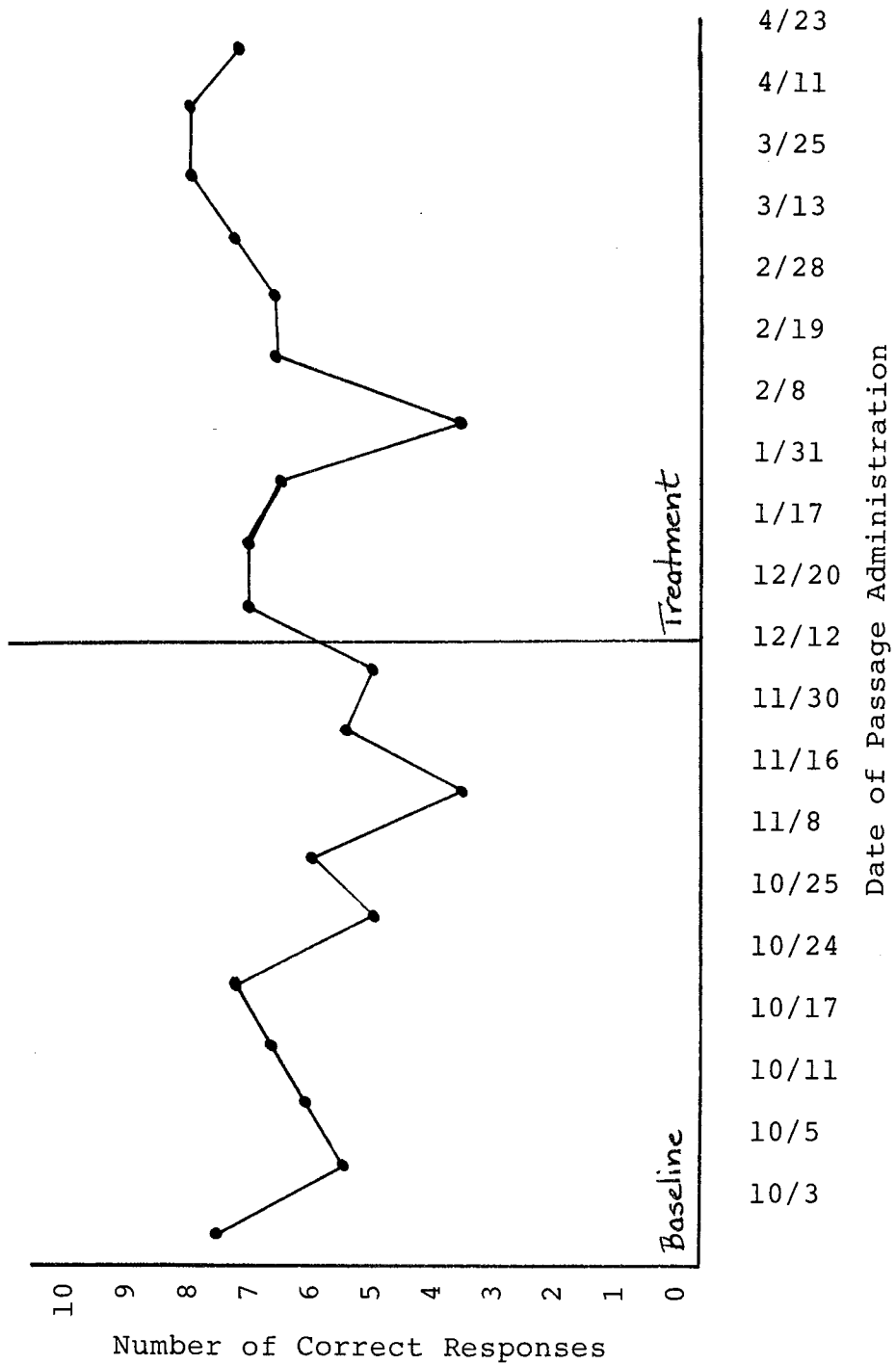


Figure 6
Subject No. 4

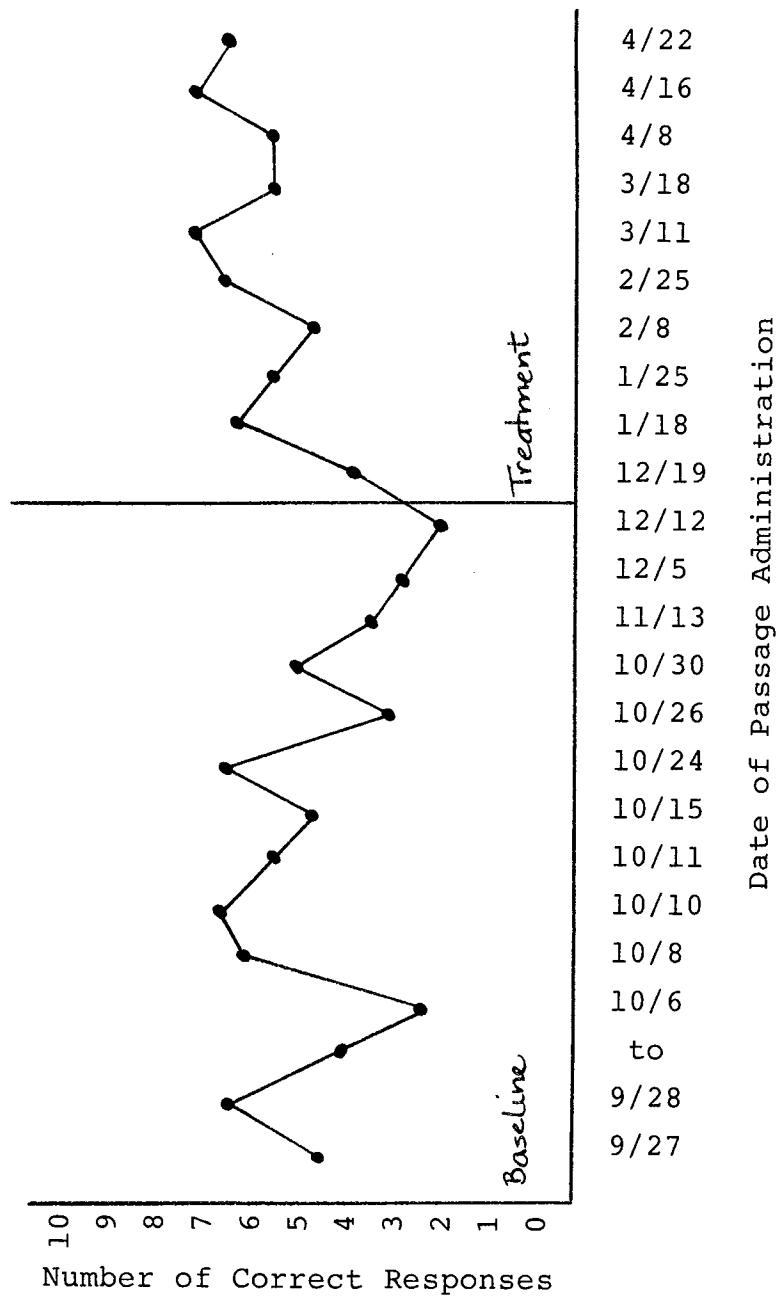


Figure 7
Subject No. 5

weeks, and 14 data points were collected. Variability was 25%, with an average raw score of 4.5. Treatment lasted 17 weeks, with 10 data points collected. Variability was 15%, with an average raw score of 6.3.

Visual interpretation supports positive change of a specific nature. The number of extremely low raw scores was decreased, thereby decreasing variability and increasing the average raw score. Overall comprehension was still weak, with no high scores, but had definitely improved.

Sub-Experiment 6

S₆ was a ninth grade white male, reading at the sixth grade level (see Figure 8). Baseline lasted 13 weeks, with 13 data points collected. The average raw score was 5.8, with variability of 15%. The treatment phase lasted 15 weeks, with 9 data points collected. The average raw score was 6.7, with variability of 25%.

Visual interpretation supports no real positive change. Variability had decreased in the initial weeks of treatment but was not maintained. Fewer data points were collected during the treatment phase because of poor attendance.

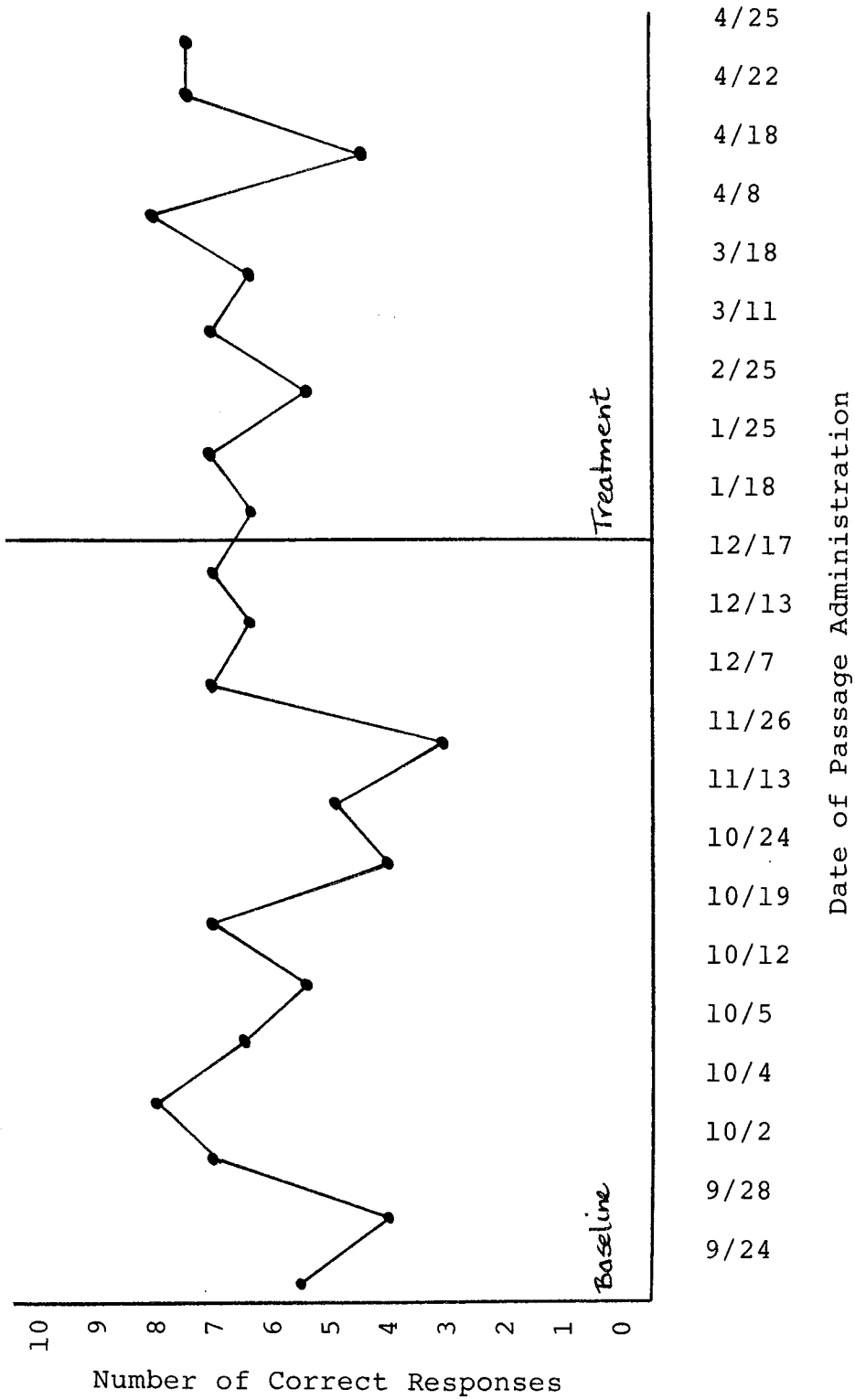


Figure 8
Subject No. 6

Percentage Score by Passage Type

During the course of the study, it became apparent that raw scores on the reading passages used for data points may have varied with the type of passage used. It is possible that the mapping procedure was more suitable for some passage types than others. Five passage types were used in the study: myths, general information, general fiction, biography and animal stories. There was an even assortment of passage types, just as might be found in any reading series or program.

No formal analysis of this data could be made because of the small number of subjects. Two informal comparisons were made at both the third and sixth grade reading levels. First, a comparison of percentage scores by passage across subjects was made. Second, percentage scores were ranked and compared across subjects. No comparison was made at the fifth grade level because there was only one subject reading at that level.

Data in Table 3 indicate no pattern of response in regard to percentage score by passage type at the sixth grade level. Twenty-one passages were completed by both subjects. Of these, both subjects scored less than 70% (generally accepted as average accuracy) in only four instances. Three of these passages were biographies and one was on computers. All were factual and dealt more

TABLE 3

Comparison of Passage Score (% Correct)Sixth Grade Level

Passage Number	Passage Type	Subject No. 1	Subject No. 6
101	Myth	70%	55%
102	Animal Story	80	40
103	Myth	70	70
104	General Fiction	85	80
105	Biography	80	65
106	Biography	65	55
107	Animal Story	80	70
108	General Fiction	70	70
109	Biography	60	50
110	General Information	100	65
111	Myth	65	70
112	Biography	80	40
113	Animal Story	100	70
114	General Information	55	30
118	General Information	70	70
120	Biography	80	80
121	General Information	80	65
122	General Information	80	55
125	Animal Story	85	45
126	Animal Story		75
127	Biography	60	65
128	General Information	75	75

with ideas than actions. One of the two subjects scored under 70% on nine passages, but this was consistently the same subject. Both subjects scored at least 70% on the remaining eight passages. In both of the last two instances, there was an even assortment of different kinds of passages. This seems to indicate that no one kind of passage was more or less compatible with the mapping procedure.

Data in Table 4, indicating the rank of percentage scores at the sixth grade level, suggest a trend in responses, but not enough to support a conclusive pattern. Both subjects had primarily high ranking scores for general fiction and animal stories. Neither subject had any high ranked scores for myths. This seemed to indicate that at the sixth grade level, general fiction and animal stories were easier to process while myths were more difficult.

Table 5 indicates a weak pattern of response in regard to percentage score by passage type at the third grade level. Overall, the three subjects at third grade level tended to receive lower scores than the subjects at sixth grade level. Of the 18 passages completed by all three subjects, scores were below 70% in 16 instances. Scores were evenly distributed across passage types, with the exception of myths. Six myths were presented,

TABLE 4

Ranking of Passages by ScoreSixth Grade Level

Rank	Subject 1	Subject 6
1	*General Information/100% Animal Story	General Information/80% Biography
2	General Fiction/85% Animal Story	Animal Story/75% General Information
3	Animal Story/80% Animal Story Biography Biography Biography General Information General Information	Myth/70% Animal Story General Fiction Myth Animal Story General Information
4	General Information/75%	Biography/65% General Information General Information Biography
5	Myth/70% Myth General Fiction General Information	Myth/55% Biography General Information
6	Biography/65% Myth	Biography/50%
7	Biography/60% Biography	Animal Story/45%
8	General Information/55%	Animal Story/40% Biography
9		General Information/30%

*Type of passage and percent correct

TABLE 5

Comparison of Passage Scores (% Correct)Third Grade Level

Passage Number	Passage Type	Subject No. 3	Subject No. 4	Subject No. 5
101	General Fiction	25%	80%	60%
102	Myth	15	65	45
103	General Information	35	75	65
104	Myth	35	55	40
105	Myth	45	60	25
106	Myth	40	65	65
107	Biography	40	70	45
108	Biography		50	55
109	Animal Story	50	60	65
110	Animal Story	55	35	50
111	General Information	25	55	30
112	General Fiction	25	50	35
113	Myth	85	65	30
114	Myth	20	70	20
116	General Information	50	65	65
117	Biography	35	35	45
118	General Fiction	60	70	40
119	General Information	30		55
120	General Fiction	65	80	70
121	General Fiction	85	70	65
122	Animal Story		75	65
124	Biography	75		55
125	Animal Story			55
126	General Fiction	60		70

and the subjects scored 50% or less on four of these. For this group, it appeared that myths were more difficult to use with the mapping procedure.

Data from Table 6, indicating the rank of percentage scores at the third grade level, showed a weak trend in that scores for biographies were ranked primarily in the middle to low range. All the other passage types received a fairly even distribution of rankings. It appeared that the biographies used at this level were more difficult to use with the mapping procedure.

Percentage Score by Question Type

Mapping is based on the organization and sequencing of superordinate and subordinate ideas with the appropriate placement of supporting details. With that kind of processing, it is possible that the treatment might have had a varied effect across the different types of scaled questions. This was not an original hypothesis but evolved as the study progressed. Again, no formal analysis could be done because of the small sample size.

Table 7 presents the percentage score of each question type for all six subjects. The scores are broken down for a baseline and treatment phase comparison. There were two questions in each category for each reading passage. A 25% change in either direction was

TABLE 6

Ranking of Passages by Score
Third Grade Level

Rank	Subject 3	Subject 4	Subject 5
1	*Myth/85% General Fiction	General Fiction/80% General Fiction	General Fiction/70% General Fiction
2	Biography/75%	General Information/75% Animal Story	Myth/65% Animal Story Animal Story General Information General Information General Fiction
3	General Fiction/65%	Biography/70% Myth General Fiction General Fiction	General Fiction/60%
4	General Fiction/60% General Fiction	Myth/65% Myth Myth General Information	Biography/55% General Information Biography Animal Story
5	Animal Story/55%	Animal Story/60% Myth	Animal Story/50%
6	Animal Story/50%	Myth/55% General Information	Myth/45% Biography Biography
7	Myth/45%	Biography/50% General Fiction	Myth/40% General Fiction
8	Myth/40% Biography	Animal Story/35% Biography	General Fiction/35%
9	General Information/35% Myth Biography		General Information/ 30% Myth
10	General Information/30%		Myth/25%
11	General Fiction/25% General Fiction General Information		Myth/20%
12	Myth/20%		
13	Myth/15%		

*Indicates type of passage and percent correct

TABLE 7

Average Score (% Correct) by Question Type

Type	S ₁		S ₂		S ₃		S ₄		S ₅		S ₆	
	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment
Recall (#1 and 2)	78%	93%	70%	85%	*28%	78%	73%	70%	*52%	80%	73%	70%
Categoriza- tion (#3 and 4)	72	64	47	43	*30	58	50	58	36	45	56	75
Seriation (#5 and 6)	86	71	59	50	45	53	55	63	56	48	62	50
Integration (#7 and 8)	67	68	67	50	*30	73	*43	75	*38	73	52	70
Extension (#9 and 10)	78	91	*11	45	20	40	65	73	47	45	64	72

*Increased by at least 25 percentage points.

considered substantial and thus warranted further discussion.

In comparing baseline and treatment phases for all subjects across all question types, percentage scores decreased in eight instances. All, however, decreased by less than 25 percentage points. They were not considered meaningful and thus not described individually.

Positive change in percentage scores was seen in seven instances. Two subjects, S_3 and S_5 , increased by at least 25% for recall questions. Three subjects, S_3 , S_4 and S_5 , all increased in the area of integration questions. One subject (S_3) increased in the area of categorization, and another (S_2) increased in the area of extension. No subjects evidenced any change in seriation questions. In looking at the subjects, there appeared to be no pattern across individuals or across reading grade levels.

Statistical Analysis

Table 8 presents the ranking procedure for the R_n statistic (Revusky, 1967). The scores for the experimental subjects and all the control subjects were ranked every time treatment was initiated. Scores represent the percent of change from each subject's mean baseline score. This transformation was made because of substantial differences between the subjects' initial raw

scores. Their mean baseline scores ranged from 3.3 to 7.3, out of 10 points possible.

TABLE 8

Rn Statistic (Revusky, 1967)

Sub- ject	Base- line \bar{x}	Sub-Experiments						
		1	2	3	4	5	6	
1	7.3	*+7E						
2	5.6	+4C	-26E					
3	3.3	-7C	-8C	+57E				
4	5.8	-23C	-3C	-8C	+12E			
5	4.5	-10C	No Score	-15C	-25C	-5E		
6	5.8	-8C	-28C	+12C	+7C	+12C	+7	
Rank Outcome		6	2	4	3	1	1	=17

*Percent of change from baseline \bar{x}
 E = Experimental
 C = Control

Subjects exhibiting the greatest positive change received the highest numerical rank. This occurred with

subjects S_1 , S_3 , S_4 , and S_6 . The R_n statistic is the sum of the rank outcomes, in this case 17. A minimum value of 19 (given six subjects) is necessary to achieve significance at the .05 level of significance. This indicates that the treatment effect is positive and approaches significance, but does not actually achieve it.

Reading Miscue Inventory

The Reading Miscue Inventory (Goodman and Burke, 1972) is a diagnostic tool designed to determine how well a reader uses all the cue systems and strategies available for comprehension. For effective and efficient reading the graphophonic, syntactic and semantic cue systems should be used on an interactive basis, as necessary. Emphasis should be on the use of the syntactic and semantic cue systems.

Table 9 gives a pre- and post-test comparison of all six research subjects on the Reading Miscue Inventory. The first column, "Full/Partial Comprehension Loss," refers to the amount of comprehension loss resulting from uncorrected miscues (reading errors). "Full/Partial Use of Graphophonics" refers to the amount of sound and graphic similarity between the text and a reader's miscue. This is interpreted in conjunction with the "Use of Syntax" score, which reflects how often grammatical

TABLE 9

Reading Miscue Inventory Pre-Test/Post-Test Comparison

Sub- ject	Grade Level	Full/Partial Comprehension Loss		Full/Partial Use of Graphophonics		Use of Syntax		Retelling Score		Effective Use of All Strategies	
		Pre-	Post-	Pre-	Post-	Pre-	Post	Pre-	Post-	Pre-	Post-
1	6.0	78%	40%	80%	65%	Weak	Partial strength	56	62	Some	High
2	5.0	48%	33%	60%	72%	Partial strength, close to weakness	Partial strength, close to full strength	50	58	Moderate	High
3	3.0	76%	48%	80%	91%	Weak, close to partial strength	Partial strength, close to full strength	40	57	Some	Moderate
4	3.0	63%	24%	75%	93%	Weak	Full strength	55	70	Some	High
5	3.0	77%	58%	80%	83%	Weak	Weak, close to partial strength	50	70	Some	Moderate
6	6.0	43%	45%	85%	80%	Partial strength, close to weakness	Partial strength, close to full strength	48	62	Some	Moderate

function and correctness are maintained in miscues. If the graphophonic score is high while the use of syntax score is low, it can be concluded that the reader is dependent on the graphophonic cue system. When a miscue occurs, sound and graphic integrity are attended to and maintained to the exclusion of syntactic and semantic acceptability. The writer's intended meaning is not reconstructed. An example of this can be seen in the sentence, "The ship is in the harbor." A reader dependent on graphophonic cues might read, "The sheep is in the harbor." A reader concerned with meaning, who attends to syntactic and semantic cues, might read, "The boat is in the harbor."

The fourth column, "Retelling Score," reflects how well a reader comprehends the overall text, including those parts where no miscues occur. The final column indicates how well a reader uses all available cue systems and strategies on an interactive basis. The preceding scores are compared to determine if the reader's use of strategies is highly effective, moderately effective, somewhat effective, or ineffective.

Pre-test scores on Table 9 indicate that S_1 , S_3 , S_4 , and S_5 show definite dependency on the graphophonic cue system. Graphophonic scores are high, while use of syntax is weak. All of their retelling scores (out of 100

points possible) are low enough to indicate comprehension loss even when miscues are not made.

On the pre-test, subjects S₂ and S₆ show at least partial dependency on the graphophonic cue system. They use the syntactic cue system to some degree, but not enough for truly efficient reading. Their retelling scores, especially for S₆, indicate that syntax and semantics are not attended to because comprehension is being lost even when no miscues occur.

The post-test scores listed in Table 9 indicate that all six subjects made at least some positive change. This indicates less dependency on the graphophonic cue system and increased use of the syntactical and semantic cue systems. Subject S₅ and S₆ went from somewhat to moderately effective readers, overall. S₃ showed the same overall change, but in addition, made greater improvement in "Full/Partial Comprehension Loss," going from 76% down to 48%. S₂ increased from a moderately effective to a highly effective reader. The most apparent change was exhibited by S₁ and S₄. Both of these subjects went from being somewhat effective, overall, to being highly effective. Also, their percentage of "Full/Partial Comprehension Loss" from uncorrected miscues was essentially cut in half.

Research Questions and Hypotheses

Three research questions and two hypotheses were proposed at the beginning of this study.

Research Questions

Research Question 1: What are the specific behaviors of readers characterized as word-callers in terms of proportional use of graphophonic, syntactic and semantic cue systems?

As indicated by the Reading Miscue Inventory pre-test, readers identified as exhibiting word-calling behavior were over-dependent on the use of the graphophonic cue system, to the exclusion of the syntactic and semantic systems.

Research Question 2: Of the strategies and activities in use in reading instruction, which ones would develop skill in the language processing task of concept formation, organization, and integration, and thus be beneficial to readers displaying word-calling behavior?

Various strategies and activities were described in the review of the literature. The literature supported mapping (Hanf, 1971; Cleland, 1981; Freedman and Reynolds, 1980) as focusing on language processing tasks and as being beneficial in the improvement of reading

comprehension.

Research Question 3: Does focusing directly on reading as a language based activity through the teaching of mapping during reading instruction result in improvement in reading comprehension?

As indicated by both measurements used in this study, mapping had at least some positive effect on the comprehension abilities of the subjects. All six subjects decreased their dependency on the graphophonic cue system and became more effective in the interactive use of all cue systems. Three of the subjects showed positive gains in the completion of independent reading passages with ten scaled follow-up questions.

Hypotheses

Hypothesis 1: Readers characterized as word-callers will be over-dependent on the use of the graphophonic cue system, thus under-using language processing skills in concept formation, organization and integration for comprehension.

The Reading Miscue Inventory pre-test supported this hypothesis without qualification. All six subjects scored high in the use of graphophonics and low in the use of syntax. All were low also in their retelling score, indicating comprehension loss even when miscues do not

occur. This indicated that these readers were not attending sufficiently to meaning-carrying cues. They orally read what looked and sounded like the text (e.g., called words) but did not incorporate syntactic and semantic cues in order to reconstruct meaning.

Hypothesis 2: Teaching the application of language processing skills to readers characterized as word-callers, through the instructional technique of mapping, will result in improved reading comprehension.

Descriptive data from the pre- and post-test comparison of the Reading Miscue Inventory supported this hypothesis. In considering overall effectiveness in the interactive use of cue systems, all subjects exhibited marked improvement. Retelling scores improved also, indicating attention to and use of meaningful cues.

Statistical data from the multiple baseline procedure did not support this hypothesis. Rank outcome for the R_n statistic approached but did not achieve significance at the .05 level of significance.

Discussion

The findings of this study allow for, at best, limited acceptance of mapping as a technique for improving comprehension in readers displaying word-calling behavior. The R_n statistic for the multiple baseline

approached but did not achieve significance. Three of the six subjects displayed substantial positive change under visual interpretation of the graphs. Change came in the form of decreased variability, a decrease in the number of very low scores, and thus higher average scores. It may be of importance that the three subjects who exhibited positive change were also the lowest functioning readers. This last point is in contrast to Galloway (1983), who found that the mapping technique benefited average readers more than high or low readers. This seems to indicate, however, that focus on language processing skills can benefit readers who are much less than proficient in reading comprehension skills.

Informal analysis of the independent reading passages showed that mapping, essentially, was equally applicable to different types of passages. Depending on the comparison made or the grade level, one or two passage types tended to produce higher or lower scores than the other types. At the sixth grade level, general fiction and animal stories tended to be ranked high, while myths and to some extent biographies were ranked lower. At both grade levels, the two different comparisons were inconsistent with one another. The only consistency was that myths tended to receive lower rankings at both the third and sixth grade reading levels.

Informal analysis of subject scores across the types of scaled questions revealed an interesting pattern. Average scores on recall and integration questions showed the greatest positive change. The improvement in the recall of details is in congruence with findings in previous studies (Rauch and Fillenworth, 1980; Davidson and Triplett, 1979; Vaughn, Stillman and Sabers, 1978). Score averages for categorization, seriation and extension questions displayed no real change.

Stronger support for mapping as an effective intervention came from analysis of the Reading Miscue Inventory. All six subjects made substantial gains in shifting from dependence on the graphophonic system to efficient, interactive use of all cue systems. Specific instruction in the active processing of information from the text resulted in improved reading comprehension. It appears that the subjects had been made aware of the need to read for meaning. In addition, they were given a tool to help organize, associate and integrate the information they had decoded.

Summary

This chapter covers an analysis and discussion of the statistical and descriptive data gathered during this study. The data supported some acceptance of mapping

as an effective strategy for improving reading comprehension with low-functioning difference model (word-calling) readers. The R_n statistic approached but did not reach significance. Comparison of pre- and post-test scores on the Reading Miscue Inventory indicated substantial gains in the increased and efficient use of the syntactic and semantic cue systems.

CHAPTER V

Summary, Conclusions and Recommendations

This study investigated the effectiveness of mapping as an instructional technique to improve the reading comprehension skills of difference model, or word-calling, readers. Chapter I was an overview and introduction to the study. Chapter II contained a review of the literature covering the reading process under a psycholinguistic framework, reading as a language processing task, and the instructional technique of mapping. Research called for the matching of specific reading disabilities to specific instruction. Difference model readers were selected as a distinct group and matched to the technique of mapping. It was hypothesized that directly addressing language processing skills, through mapping, would improve the comprehension of these readers.

Chapter III outlined the research design and treatment procedures of the study. A single case experimental design, specifically, multiple baseline across subjects, was utilized with six junior high and high school subjects. In addition, pre- and post-test scores

on the Reading Miscue Inventory were compared in order to measure changes in the interactive use of all available language cue systems. Statistical and descriptive analysis of all data collected was covered in Chapter IV. The Rn statistic for the multiple baseline procedure approached but did not achieve significance. Data from the Reading Miscue Inventory indicated substantial positive change in the subjects' ability to attend to and use meaningful cues from the syntactic and semantic systems. Reading to reconstruct meaning had become the subjects' reading priority, rather than just calling words.

Conclusions

The findings of this study give indications of the effectiveness of mapping in improving the reading comprehension of difference model readers. Under the multiple baseline procedure, subject ability in comprehension changed positively, but not to a significant degree. This change was seen in the decreasing variability and in the decreasing of extremely low scores of the lowest functioning readers. Analysis of data from the Reading Miscue Inventory gave full support to describing and defining difference model readers in psycholinguistic terms. All of the subjects made a substantial, positive shift toward the increased interactive use of available

cue systems. The Reading Miscue Inventory, however, was more a supplemental than integral part of the research design. For that reason, mapping cannot be conclusively named as the agent of change.

The difference between results with the Reading Miscue Inventory and the multiple baseline procedure seems to lie in the area of motivation. Those subjects who did not show positive gain on their graph tended to be those who balked at using the mapping procedure. These included subjects S_1 , S_2 and S_6 . S_1 was one of two subjects where lack of motivation was evident in his behavior. He did not interact well in group instruction and frequently refused to participate during the discussion and construction of maps. It was interesting to note, however, that after the study was completed, S_1 helped in constructing maps for most of the chapters of a short novel the class was reading. S_2 was the second subject where lack of motivation was evident in her behavior. She participated in discussions and map construction primarily as a follower, rather than as an active contributor. Independent activities, both regular assignments and the reading passages used for data points, frequently were not completed. Motivation as a negative factor was present with S_6 , but not to the degree of S_1 and S_2 . This subject would initially refuse

to participate at times, but could be coaxed into it. In effect, it appears that if subjects S_1 , S_2 and S_6 gained any real skill and understanding of mapping, it was through exposure or incidental learning.

Armbruster and Anderson (1980) also cited motivation and boredom as problems in their study on mapping. There, the difficulty appeared to be too complex a task. Here, the difficulty appeared to be subject attitude, presentation of the task, and the lack of systematic steps to foster independent use of mapping (see discussion below).

The problem of motivation carried over to another aspect of this study. Initially, it had been assumed that the subjects would develop some independent use of mapping during the instructional units and carry this over to the reading passages. All of the subjects consistently needed prompting from the trainer, or suggestions from group discussion, to produce usable maps. Only one student seriously attempted to construct maps for the reading passages. These tended to have events out of sequence and be cluttered with unnecessary details.

Two reasons are offered to explain this lack of effective independent use of maps. First, the steps for building a map were not broken down and presented adequately. All of the trainers agreed on and consistently

used a basic presentation format, but the procedure for shifting to independent use was not as controlled. Trainers selected suggested variations based on the age, skill level and individuality of their subjects. Second, the mapping technique was used only on a post-reading basis. Huard (1983) used only a post graphic organizer and also had difficulty reaching significance for the treatment variable. In order to foster more efficient and independent use of maps, perhaps the instructional unit should include pre-reading and concurrent reading steps.

Further conclusions center on the use of mapping in specific situations. Analysis of the different types of passages used indicated no strong pattern of any one type being more or less compatible with mapping. Several trends gave a preliminary suggestion that general fiction and animal stories may be more conducive to mapping while biographies and myths are not. Verification of this can only come through further research. It is possible that inherent features of the passage, such as subplots, figurative language, heavy use of inference or time flashbacks, may make mapping less feasible. Instructors may need to look at passage structure rather than passage type when considering mapping.

Another suggested area where it appears that mapping

is effective is in the answering of different types of questions. In this study, substantial improvement was seen in the answering of recall and integration questions. It seems that the structure of a map provides an organization for working detail into a conceptual whole. The reason for improvement in integration questions is not readily apparent. A possible connection is that increased recall of details plus organization of those details provides the necessary foundation for answering questions referring to implicit information.

Score averages for categorization, seriation, and extension questions displayed no real change. This could lie in the position that these questions all require specific processing tasks, such as comparing and contrasting (categorization) and applying information to another situation or oneself (extension). It may be that these question types need to be addressed more directly with examples and practice.

The findings of this study also support the conclusion that mapping aligns well with the psycholinguistic model of reading used in this study. It was possible to define difference model readers in psycholinguistic terms. These readers initially were dependent on the graphophonic cue system. Following administration of the treatment variable, the readers were substantially more

efficient in using syntactic and semantic cues to read for meaning. In psycholinguistic terms, they began to approach reading as a language processing task, becoming actively involved in the text in order to derive meaning.

A final conclusion centers on the applicability of mapping to a variety of settings and materials. A combination of grade levels, reading materials and trainers were used in this study. In addition, the time-span and format of the instructional unit closely adhered to the constraints of classroom teaching. This supports the conclusion that, with further verification and refinement, mapping could easily be integrated into most reading programs without great difficulty or expense.

Recommendations

The limitations of this study give rise to several recommendations for further investigation. A primary concern is the full verification of mapping as a significant and effective technique for improving reading comprehension. Improved use of a multiple baseline design, in terms of sample selection, randomization and measurement of the treatment variable, or the application of other designs sensitive to individual subjects may produce more conclusive results.

Additional concerns are motivating students to

develop map construction skills and independent use of maps. Both of these concerns could be addressed by developing more precise and systematic steps for teaching map construction. These procedural steps should cover both how a map is constructed and where it is included in an instructional unit. Using it on a post-reading basis only has not been sufficient. It is suggested that a skeleton map (core question and unmarked major strands) be included as a pre-reading activity. Concurrent activity could be the identification of key and subordinate ideas and details as the passage is read. The map itself could be constructed at this time. Students could re-read the passage silently, confirming the map, and then complete the follow-up questions.

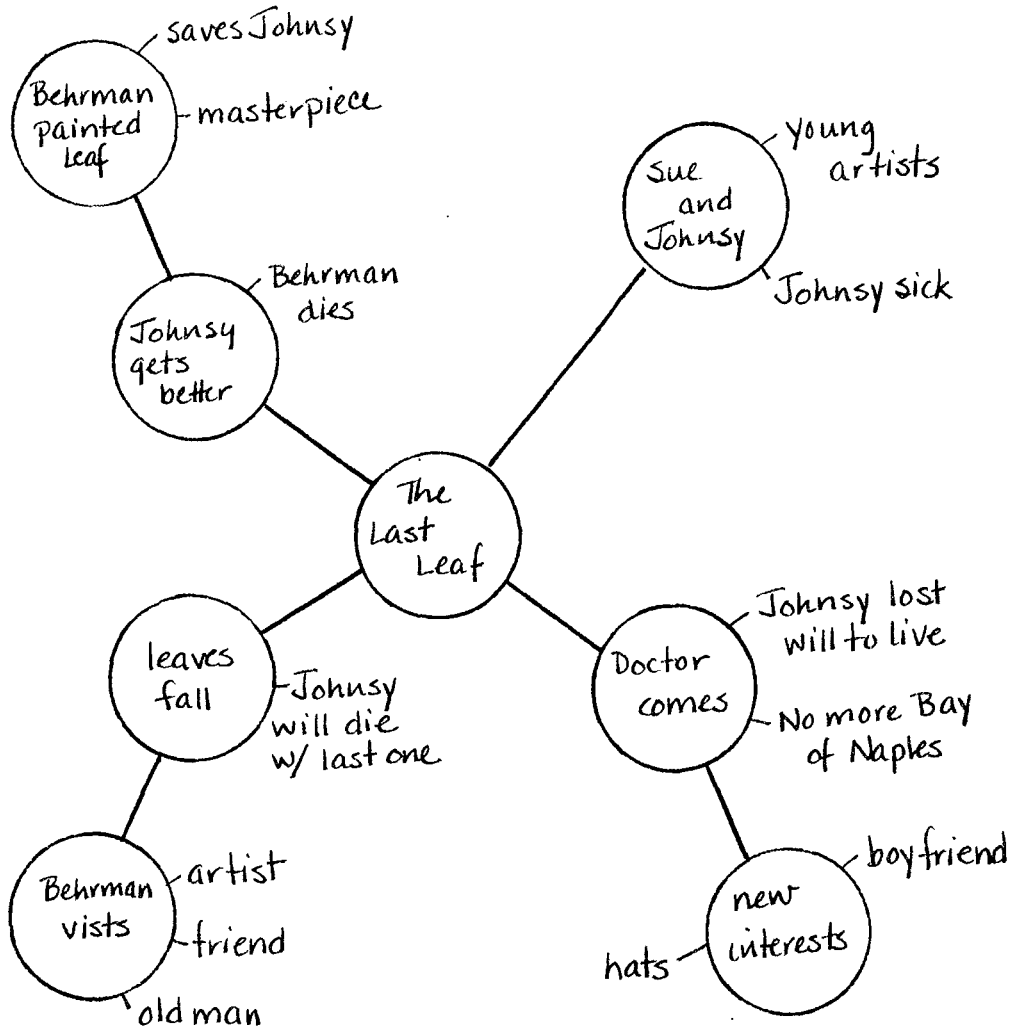
Results from the multiple baseline procedure give rise to two areas for future research. The first concerns the type of passage suitable for use with the mapping procedure. As stated, the structure of a passage may have more bearing on the efficacy of mapping than the passage type. If some structures are too complex for the simple procedure used here, then alternative techniques need to be developed. The second area of consideration is the interaction of mapping with the different types of questions used. No change in the

areas of categorization, seriation and extension suggests more than just the cognitive processes investigated here. It might be beneficial to study these question types in terms of linguistic processes, especially the encoding of language. This stems from the observation that subjects frequently verbalized correct responses to questions but were unable to write them down independently.

A final possible area for further research might be the positive change, in conjunction with increased variability, exhibited by several subjects. This could be a reflection of the theory of Piaget (Cowan, 1978), which holds that initially, new skills are not consistent over different tasks and situations. Although this study found no real preference or pattern in the passage used, more extensive study in this area might prove beneficial. Aligning major theories of development and learning could result in more efficient and effective instruction.

APPENDIX A

Example of a Completed Map



Map of "The Last Leaf," by O'Henry. Johnsy, a young girl, is ill and has lost her will to live. A doctor has seen her but an old friend, through a heroic act, is the one who provides a cure.

APPENDIX B

Sample Scaled Questions

Core question: What happens in the story?

Questions to be answered from map strands, following the format of Crowell and Hu-pei Au (1981):

Association: (recall detail from the story)

1. What did the doctor say about Johnsy?
2. What did Sue reply?

Categorization: (make a categorization based on information from the story)

3. What is the difference between what the doctor asked for and what Johnsy wants?

Seriation: (describe interrelationships among details, such as cause/effect and sequence of events)

4. What was going to happen when the last leaf fell?
5. What really happened after the last leaf fell?

Integration: (combine elements of the story that are not explicit; make interpretations)

6. Is Behrman a successful artist? Did he paint an important picture?

7. Which are better--the big things Johnsy wants or the little things the doctor mentions? Why?

8. Do you think Johnsy will realize her dream and paint the Bay of Naples?

Extension: (apply understanding of the story to other situations)

9. Are big things or little things more important to you? Why?

10. Tell about another story or real life happening where a person risked his life to save a friend.

APPENDIX C

Observation Checklist for Trainers

1. Are prereading activities (vocabulary, concepts) completed?
2. Does general group discussion follow the story, with students expressing personal opinions?
3. Does the teacher introduce the map's core questions and strands with leading information?
4. Does the teacher construct the map using verbatim student responses?
5. Does the teacher prompt open-ended questions?
6. Is the completed map thorough but not overly cluttered with detail?
7. Does the teacher guide in summarizing events and relationships in the completed map?
8. Does the teacher have each student make a copy of the map for personal and future use?
9. Does the teacher guide in the use of the map to answer follow-up questions?
10. Over time, does the teacher shift construction of the map to students?

All of the questions should be answered yes. If not, time will be allowed to discuss the correct procedure and make recommendations for change.

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