2000

The Current Structure of Intellect Remediation Lab as an Intervention for Deficient Readers in Grades 3, 4, and 5

Donna Turner Campbell

Andrews University

Follow this and additional works at: https://digitalcommons.andrews.edu/dissertations

Part of the Curriculum and Instruction Commons

Recommended Citation
https://digitalcommons.andrews.edu/dissertations/260

This Dissertation is brought to you for free and open access by the Graduate Research at Digital Commons @ Andrews University. It has been accepted for inclusion in Dissertations by an authorized administrator of Digital Commons @ Andrews University. For more information, please contact repository@andrews.edu.
Thank you for your interest in the

Andrews University Digital Library
of Dissertations and Theses.

Please honor the copyright of this document by not duplicating or distributing additional copies in any form without the author’s express written permission. Thanks for your cooperation.
INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

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

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

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

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

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

UMI®
THE CURRENT STRUCTURE OF INTELLECT REMEDIATION
LAB AS AN INTERVENTION FOR DEFICIENT
READERS IN GRADES 3, 4, AND 5

A Dissertation
Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
Donna Turner Campbell

June 2000
THE CURRENT STRUCTURE OF INTELLECT REMEDIATION
LAB AS AN INTERVENTION FOR DEFICIENT
READERS IN GRADES 3, 4, AND 5

A dissertation
presented in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

by

Donna Turner Campbell

APPROVAL BY THE COMMITTEE:

Chair: Donna J. Habenicht

Member: Wilfred Futcher

Member: Shirley Freed

External: Deborah Gray

Dean, School of Education
Karen Graham

Date approved: July 12, 2000

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
ABSTRACT

THE CURRENT STRUCTURE OF INTELLECT REMEDIATION
LAB AS AN INTERVENTION FOR DEFICIENT
READERS IN GRADES 3, 4, AND 5

by

Donna Turner Campbell

Chair: Donna J. Habenicht
ABSTRACT OF GRADUATE STUDENT RESEARCH

Dissertation

Andrews University
School of Education

Title: THE CURRENT STRUCTURE OF INTELLECT REMEDIATION LAB AS AN INTERVENTION FOR DEFICIENT READERS IN GRADES 3, 4, AND 5

Name of researcher: Donna Turner Campbell

Name and degree of faculty chair: Donna J. Habenicht, Ed.D.

Date completed: June 2000

Problem

Educational testing procedures focus on identification and classification of students rather than on remediation for their abilities. The Structure of Intellect (SOI) model proposes a multidimensional view of intelligence with a focus on remediation for underdeveloped or nonexistent abilities as they relate to school achievement.

Purpose

The purposes of this study were to determine if participation in the SOI remediation lab had a measurable effect on reading achievement with third-, fourth-, and fifth-grade students, and to describe SOI learning profiles of students with below grade reading skills.
Methodology

The subjects for this quasi-experimental study were third-, fourth-, and fifth-graders from two public schools. Eleven subtests from the SOI Learning Abilities Tests, Forms CR and L, purportedly related to reading, were used as pre- and post-test measures. ANCOVA was used to analyze data from these 11 subtests. The Burns & Roe Informal Reading Inventory was a pre/post measure of reading. Chi-square was used to analyze the proportions of students making gains in reading achievement. The SOI learning profiles were analyzed descriptively.

Findings and Conclusions

The results supported the SOI Intervention lab as a useful intervention for remedial reading. Students who participated in the SOI remediation lab showed significant increases in reading achievement. The 11 subtests proposed as prerequisite skills for reading and comprehension did not uniformly increase as did the reading levels. Gains were only noted on 4 of the 11 subtests. There were no discernable patterns of SOI learning profiles that predicted below grade level reading skills. It appears that the SOI remediation lab could serve as an effective intervention for students with deficient reading skills in grades three through five. The lack of discernable distinct learning profiles limits the Forms CR and L of the Structure of Intellect Learning Abilities tests as a possible option for identification.
TABLE OF CONTENTS

LIST OF TABLES ................................................................................................................................. vi

Chapter

I. INTRODUCTION .............................................................................................................................. 1

   Background ........................................................................................................................................ 1
   Purpose of Study ............................................................................................................................... 4
   Research Questions ............................................................................................................................ 4
   Hypotheses ......................................................................................................................................... 5
   Theoretical Framework ...................................................................................................................... 5
   Importance of the Study ..................................................................................................................... 7
   Delimitation of the Study .................................................................................................................... 7
   Limitations of the Study ...................................................................................................................... 8
   Definition of Terms ........................................................................................................................... 8
   Organization of the Study ................................................................................................................... 9

II. LITERATURE REVIEW .................................................................................................................. 11

   Introduction ....................................................................................................................................... 11
   Brief History of Intelligence Theories ............................................................................................... 11
   The SOI Model .................................................................................................................................. 13
   Structure of Intellect Validity Studies ............................................................................................... 16
   Informal Reading Inventories ............................................................................................................ 17
   Sensory Integration Related to Reading ............................................................................................ 20
   Vision Training ................................................................................................................................... 22
   Direct Instruction ............................................................................................................................... 24
   Summary ............................................................................................................................................ 27

III. METHODOLOGY ............................................................................................................................ 28

   Subjects ............................................................................................................................................ 28
   Instrumentation ................................................................................................................................. 30
   SOI .................................................................................................................................................... 30
       SOI Tests Form L and Form CR ................................................................................................. 30
   Research and Development .............................................................................................................. 30

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
LIST OF TABLES

1. Test-Retest Correlations and Alternate Form Correlation for Forms A and B ............ 36
2. Power for ANCOVA Tests ................................................................................................... 46
3. Sample Subgroup Frequencies ......................................................................................... 47
4. Form L–Descriptive Statistics, Grade 3 ........................................................................... 48
5. Form CR–Descriptive Statistics, Grade 4 ........................................................................ 49
6. Form CR–Descriptive Statistics, Grade 5 ........................................................................ 50
7. ANCOVA–CFU Subtest, Grade 3 .................................................................................... 51
8. ANOVA of Gain Scores–CFU ............................................................................................ 52
9. ANCOVA–CFU Subtest, Grades 4 and 5 ......................................................................... 53
10. ANCOVA–CFU Subtest T Scores, Grades 3, 4, and 5 .................................................. 54
11. ANCOVA–CFC Subtest, Grade 3 .................................................................................. 55
12. ANOVA of Gain Scores–CFC, Grade 3 .......................................................................... 55
13. ANCOVA–CFC Subtest, Grades 4 and 5 ....................................................................... 56
14. ANCOVA–CFC Subtest T Scores, Grades 3, 4, and 5 .................................................... 57
15. ANOVA of Gain Scores–CFC, Grades 3, 4, and 5 ......................................................... 58
16. ANCOVA–EFU Subtest, Grade 3 ................................................................................... 59
17. ANCOVA–EFU Subtest, Grades 4 and 5 ...................................................................... 60
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>ANOVA EFU Subtest T Scores, Grades 3, 4, and 5</td>
<td>60</td>
</tr>
<tr>
<td>19</td>
<td>ANOVA of Gain Scores–EFU Subtest, Grades 3, 4, and 5</td>
<td>61</td>
</tr>
<tr>
<td>20</td>
<td>ANCOVA CMUr Subtest, Grade 3</td>
<td>62</td>
</tr>
<tr>
<td>21</td>
<td>ANOVA of Gain Scores–CFU Subtest, Grade 3</td>
<td>62</td>
</tr>
<tr>
<td>22</td>
<td>ANCOVA CMUr Subtest, Grades 4 and 5</td>
<td>63</td>
</tr>
<tr>
<td>23</td>
<td>ANCOVA CMUr Subtest T Scores, Grades 3, 4, and 5</td>
<td>64</td>
</tr>
<tr>
<td>24</td>
<td>ANCOVA CMR Subtest, Grade 3</td>
<td>65</td>
</tr>
<tr>
<td>25</td>
<td>ANCOVA CMR Subtest, Grades 4 and 5</td>
<td>66</td>
</tr>
<tr>
<td>26</td>
<td>ANCOVA CMR Subtest T Scores, Grades 3, 4, and 5</td>
<td>67</td>
</tr>
<tr>
<td>27</td>
<td>ANCOVA CMS Subtest, Grade 3</td>
<td>67</td>
</tr>
<tr>
<td>28</td>
<td>ANCOVA CMS Subtest, Grades 4 and 5</td>
<td>68</td>
</tr>
<tr>
<td>29</td>
<td>ANOVA CMS Subtest T Scores, Grades 3, 4, and 5</td>
<td>69</td>
</tr>
<tr>
<td>30</td>
<td>ANCOVA MFU Subtest, Grade 3</td>
<td>70</td>
</tr>
<tr>
<td>31</td>
<td>ANCOVA MFU Subtest, Grades 4 and 5</td>
<td>71</td>
</tr>
<tr>
<td>32</td>
<td>ANCOVA MFU Subtest T Scores, Grades 3, 4, and 5</td>
<td>71</td>
</tr>
<tr>
<td>33</td>
<td>ANCOVA NST Subtest, Grade 3</td>
<td>72</td>
</tr>
<tr>
<td>34</td>
<td>ANCOVA NST Subtest, Grades 4 and 5</td>
<td>73</td>
</tr>
<tr>
<td>35</td>
<td>ANCOVA NST Subtest T Scores, Grades 3, 4, and 5</td>
<td>74</td>
</tr>
<tr>
<td>36</td>
<td>ANCOVA EFC Subtest, Grades 4 and 5</td>
<td>75</td>
</tr>
<tr>
<td>37</td>
<td>ANCOVA MSUV Subtest, Grades 4 and 5</td>
<td>76</td>
</tr>
<tr>
<td>38</td>
<td>ANCOVA MSSV Subtest, Grades 4 and 5</td>
<td>77</td>
</tr>
</tbody>
</table>
39. Chi-Square Analysis of Reading Gains ................................................................. 77
40. Expanded Chi-Square Analysis of Reading Level Gains ................................. 78
41. Chi-Square Analysis of Gains in Experimental Groups ................................. 79
CHAPTER I

INTRODUCTION

Background

School psychologists face unique challenges. The field was virtually non-existent before the turn of the century. The specific discipline of school psychology dates from 1904, when the Minister of Public Instruction in Paris named a commission to develop placement tests that would ensure two things: that no child should be placed in a class for the mentally defective until tested and that mentally deficient children would receive an adequate education. Binet was asked to take on this work (and is often referred to as the "Father of IQ tests"); he solicited the help of a colleague, Simon. The first published Binet-Simon scales appeared in 1905 (Sternberg, 1990).

The objective of the first Binet scale was to discriminate between normal and mentally deficient children (Binet & Simon, 1905), and was the forerunner of the work of educational psychologists as we know it today. Binet claimed intelligence was multi-dimensional and studied functions such as abstraction, ideation, imagination, imagery, thoughts, attention, reaction time, and memory. Specifically, Binet proposed 30 different tests to measure intelligence (Guilford, 1967).

The use of intelligence testing became widespread almost instantly. In the United States, a number of authors thought that by improving the conditions of children's lives and increasing their educational level, many socioeconomic problems could be overcome.
(Cohen, Craven, Cremin, & Cubberly, as cited in Fagan and Wise, 1994). Special education services continued to evolve, as did the specificity of intelligence scales. Although now more focused, the general goals of intelligence testing have remained the same: determining eligibility for special education or gifted programs and prediction of future academic performance (Reschly, 1997).

Charles Spearman pioneered reducing intelligence to a single factor called "g" for "general factor" that would represent several factors. He argued that the "monarchic" view of a unitary thing called intelligence was popular as far back as the 15th century (Spearman, 1927). Although most psychologists today will argue that intelligence is multidimensional, they still report and use the information as if it were, in fact, a monarchic view of a unitary thing as first described by Spearman.

Among the earliest theorists advocating multidimensional models are Thurstone (1924, Theory of Primary Mental Abilities), Gardner (1983, Multiple Intelligences), and Sternberg (1985, Triarchic Theory). Guilford's concept of a multidimensional idea of intelligence emerged in 1945. He proclaimed that intelligence could no longer be thought of as a "one-dimensional affair" (Guilford, 1967) and offered his Structure of Intellect model. In the new millennium, school psychologists are still proclaiming, and theorists are still fighting over, the particular multidimensional aspects of intelligence.

Although it seemed that Carroll had no theory of his own, his major contribution consisted of his extensive synthesis of literature on multifactorial psychometrics of intelligence testing (Carroll, 1993). However, all these theories lacked pragmatic substance for the practitioner. Gardner (1983) offered nothing more than some new teaching styles with the belief that we are smart in many ways; but these ways are not
really measurable and are more like gifts or talents. Sternberg's (1985) model and Carroll's (1993) descriptions of the "strata" of various models offered strong theoretical validation, but neither provides the school psychologist with usable testing protocols for multidimensional cognitive functioning. Additionally, these measures do not extend information that can be used for substantive academic interventions.

Thus with the growing body of knowledge on cognitive functioning, I believe it is crucial that K-12 educational institutions take their direction from a more multidimensional view of intelligence. In my own work, it had become increasingly apparent that children do not come to school with the cognitive prerequisites that educators assume are in place. Education has traditionally been guided by methods of teaching and learning conceptual material (M & M Systems, 1996), not teaching and learning cognition. Even in education beyond the elementary-school level, there is the implicit, but faulty, assumption that if students are provided with concepts and facts, they will be able to use them. "That computer between the ears must be given programs for action as well as being fed information. Intellectual functions involve operations as well as information, and operations other than cognition and memory" ( Guilford, 1979a, p. 40).

Mary Meeker, along with her husband, sought to change the notion that intelligence is measurable, but not changeable. They believe cognitive abilities beyond those measured by traditional intelligence testing could be improved. Many theorists had proposed a fluid, not static, intelligence; however, none had offered an intervention model that is feasible for widespread use in schools. Since the mid-60s, the Meekers have further developed Guilford's Structure of Intellectual theory (SI) into a pragmatic intervention specifically designed for use in schools, called the Structure of Intellect.
(SOI) model for learning (Guilford, 1981). Their assumption is that most learning failures occur because the learner is not prepared to learn. The SOI model focuses on the learner. Assessment procedures identify abilities, skills, and competencies expected for success in general education curricula. Remediation is provided for expected abilities, skills, and competencies not yet developed.

**Purpose of the Study**

The purpose of this study was to (1) determine if Structure of Intellect (SOI) remediation yields a measurable effect on reading achievement with third-, fourth-, and fifth-grade students; and (2) describe the Structure of Intellect learning profiles of these students related to their instructional needs.

**Research Questions**

This study attempted to answer the following questions:

1. Is there a difference in scores on the Structure of Intellect-Learning Abilities (SOI-LA) pre- and posttest for students receiving (a) a combination of SOI and Science Research Associates (SRA) direct reading instruction as an intervention method (group 1, SOI Plus) and (b) SOI instruction only as an intervention method (group 2, SOI Alone), and (c) neither of the two intervention methods (control group).

2. Is there a difference in reading achievement levels pre- and posttest for students receiving (a) a combination of SOI and SRA instruction as an intervention method and (b) SOI instruction only as an intervention method, and (c) neither of the two intervention methods.
3. Do students with deficient reading skills share similarities in SOI learning profiles that would indicate specific instructional needs?

**Hypotheses**

The hypotheses for this study are as follows:

1. Only children having both the SOI intervention and SRA reading instruction will show significant posttest gains on the SOI-LA test.

2. Only children having both the SOI intervention and SRA reading instruction will show significant gains on an informal reading inventory.

3. Children who demonstrate deficits in reading will have similar SOI learning profiles.

**Theoretical Framework**

The Structure of Intellect (SI) is a theory of intelligence that was developed from 1945 to 1965 by Guilford and his colleagues at the University of Southern California. Dr. Mary Meeker researched Guilford's model and validated its relevance to education. Her book, *The Structure of Intellect: Its Interpretation and Its Uses* (1969), provided the foundation for applying Guilford's theory to the educational realm. Dr. Mary Meeker began her work as early as 1963 with Guilford, in a researcher-student relationship and refined the theory over the years (1963, 1974, 1989). The current Structure of Intellect theory and intervention was later developed and commercialized by Dr. Mary Meeker and her husband, Dr. Robert Meeker.

In general, the SOI theory defines intelligence as a systematic collection of abilities or functions for processing different kinds of information in various ways.
Intelligence is concerned with both the kinds of information and the types of operations performed.

Though some had criticized the lack of validation of the Structure of Intellect (SI) model (Bachelor & Bachelor, 1989; Bachelor, Michael & Kim, 1995; Horn & Knapp, 1973; Pearce, 1983), no scholarly articles have been published to confirm or criticize the outcomes of the intervention research regarding the application of the SOI model to education. The SOI model offers education a viable option to the "single number" approach to represent a level of intelligence now known to be multidimensional. The SOI application offers school psychologists an opportunity to do more than merely predict a student's success in school, or confirm the student's need for curricular accommodations. Guilford's SI model, adapted by Meeker and Meeker, offers teachers a prescriptive strategy for building learning abilities, self-control, and concentration ability in students with these deficits.

The building of specific learning abilities takes place through paper and pencil activities referred to as modules. Concentration and self-regulation are taught through a series of sensorimotor exercises, consisting of balance activities on balance boards and trampoline exercises with specific directions.

Reading has many aspects. A multiplicity of texts have been published about the process. However, the behavioral aspects of reading have not been adequately addressed. Most texts currently are "brain-based" with a focus on which areas of the brain are needed for which portion of reading. Until we can get a child's brain engaged in the process of reading, the activity of the brain will never happen. The SOI Intervention Lab focuses on the abilities built for reading through the SOI theoretical paradigm.
I do not think we can overestimate the impact that the sensorimotor and self-regulation activities have on the behavioral aspect of reading. This theoretical framework is based on the assumption that the training of the mind will lead to engagement that is more profound and enhanced reading achievement. Not only will children sharpen their skills for decoding and fluency, but also, most importantly, they will sit and engage their brains in a concentrated manner for a specific period.

Importance of the Study

This research is important for several reasons. In a general sense, it is important to know if the current SOI model provides statistically significant improvements in reading, and can, therefore, be viewed as a viable option for the school district. Data provided by SOI marketing support gains in overall achievement. However, achievement is measured by comparing group results on standardized tests. My intent was to examine the reading and thinking abilities of individual children in detail.

If a specific SOI learning profile can be identified and matched with preferred reading instruction, the countless hours of trial-and-error reading instruction may be avoided, and this time made more valuable. It was expected that this research would lead to the matching of a specific reading approach to a child with a given SOI profile.

Delimitation of the Study

The study was delimited to general education students in Grades 3, 4, and 5 in two schools in Northern Indiana. These two schools are part of a school system that has little ethnic diversity, but great economic diversity. Generalizability is therefore restricted to schools with similar demographic characteristics.
Limitations of the Study

First, as with any school-based research, extraneous variables such as attrition rate, maturation, effects of testing, and simultaneous interventions of others were unavoidable. Second, selection for inclusion in the project is not random; all third, fourth, and fifth graders currently enrolled at the elementary school chosen were included. Finally, as with any educational field project, interventions had to be included in the total program of the school.

Definition of Terms

Several terms are used throughout the dissertation that may need a brief explanation.

Informal Reading Inventory (IRI) is an instrument used to measure reading achievement in this study. Such instruments are referred to as IRIs and can aid in the discovery of fluency and comprehension levels (Burns & Roe, 1993).

Learning Profile refers to one of three content dimensions suggested by M & M Systems (1996). These content dimensions bear a special relationship to reading methodologies. The learning profile can be Figural, Symbolic, or Semantic.

Figural Learners like to deal with concrete information that one can see, hear, and touch. Figural learners learn to read best through gestalt methods using memory and representations of the words.

Symbolic Learners prefer information in notational form. In contrast to Figural information which is concrete, Symbolic information is abstract. Symbolic learners learn to read best by a notation or phonetic system.
Semantic Learners prefer concepts and ideas. Semantic learners learn to read best through the whole-word and contextual approach. (Meeker and Meeker suggest that the lack of development of these semantic abilities is the seed germ of the learning disabled.)

SI refers to the Structure of Intellect theory developed by Guilford (1967) that suggests up to 126 structures or faces of intellect.

SOI refers to the revised theory of Structure of Intellect by Meeker (1969), offering 26 identifiable structures of intellect related specifically to school achievement.

SR-I refers to the specific Direct Reading Instruction program by Science Research Associates used in this study, titled the Reading Mastery Series. By using the SRA Reading Mastery program, the teacher controls the students' vocabulary, paces the instruction appropriately, and focuses on fluency and comprehension of the short stories.

Organization of the Study

Five chapters are contained in this dissertation. Chapter 1 includes the introduction, statement of the problem, purpose of the study, research questions and hypotheses, theoretical framework and background, importance of the study, delimitation of the study, definition of terms, and organization of the study.

Chapter 2 introduces intelligence testing as it relates to the field of education, outlines a review of the literature on the Structure of Intellect theory, including sensory integration: Direct Instruction as an instructional method, concentrating on the SRA Reading Mastery Program; Informal Reading Inventories, and training the visual system.

Chapter 3 describes the research design, sampling procedures, the instruments, data collection, hypotheses, and statistical analyses.

Chapter 4 outlines the findings and interprets results.
Chapter 5 presents a summary of the study, discussion of results, conclusions, implications of the findings, and recommendations for further research.
CHAPTER II

LITERATURE REVIEW

Introduction

The following literature review covers a brief history of intelligence theories as it relates to the field of education and outlines a review of the literature on the Structure of Intellect (SOI) theory. Particular attention is paid to informal reading inventories, as this was the second instrument used for measurement. Sensory integration related to reading, and vision system training are an integral part of the current SOI remediation lab; therefore information is included in this review. Direct Instruction was the instructional method used for reading.

The following databases were searched: PsycHeliit, ERIC, Social Sciences Index, Dissertation Abstracts, and Books in Print. The Meekers also publish a compendium of articles. This compendium cites periodicals, books, and informal pieces. However, only a select few citations are used in this literature review, as most are unpublished, incomplete, or lack adequate references for citation.

Brief History of Intelligence Theories

There is little more agreement today among psychologists regarding the matter of intelligence than there has been among philosophers for the past 3,000 years (Sternberg, 1990). As early as the 6th century BCE. Homer recognized intelligence as distinct from...
other skills. Willhelm Wundt, although published exclusively in German during the late 1800s, is considered the father of the new science of psychology (Schultz & Schultz, 1996). Titchener, an English psychologist, brought these new science ideas to America and translated them into what we now know as Structuralism. Titchener, for a brief time, had as his student a young man named J.P. Guilford. It was Titchener who influenced Guilford to conduct research in the area of intelligence (Guilford, 1988). The global and unitary conception of human intelligence as a general ‘mental energy’ exploded in 1956 with the advent of Guilford’s Structure of Intellect theory (Feldman, 1970). As cited by Martin (1999). Guilford’s book, Psychometric Methods (1936/1954), expanded the reach of experimental methods into all areas of psychology.

Although the field of school psychology really began as early as 1904 when Binet was commissioned to design tests to aid in the education of all children, it was not until the 1973 Section 504 of the Rehabilitation Act and 1975 PL94-142 were enacted that the field of psychology became crucial to the American educational system. Educational psychology came into its own, and lent the major impetus to the development of screening and testing instruments.

Public policy dictated an increasing need for instruments to measure intelligence in the schools. Although the initial use for these instruments was for identification of children who would need instruction outside the mainstream, these tests quickly became the norm for categorizing all students.

There are currently a multiplicity of tests that purport to measure intelligence for the purposes of prediction of future academic performance, selection of students for programs, and identification of special abilities and learning problems. Many
professionals raised doubts about the usefulness of mere intelligence testing in the schools and wanted, instead, an increase in assessment techniques that had direct links to effective intervention (Reschly, 1997).

The SOI Model

Mary Meeker played a large role in this era in educational history. She developed Guilford's Structure of Intellect theory further by applying the Structure of Intellect model to educational planning. Her first book was published in 1969, and her theory began to take hold in the early 1970s.

At one time, Guilford had identified over 100 different types of intelligence (Guilford & Hoepfner, 1969) and published approximately 25 articles on the validation of the factor analyses used to determine his multiple structures. However, his model in its final form identified only 26 different factors of intellect (M & M Systems, 1996).

Guilford's protégé, Mary Meeker, quickly saw the relevance of his SI theory to the field of education. Specifically, Meeker, a school psychologist at the time, found it a valuable tool for diagnosing learning difficulties. Between 1962 and 1974, Mary and her husband Robert gathered data and developed what is known today as the Structure of Intellect theoretical model. The Meekers defined 26 learning abilities that they believed were directly linked to reading, reading comprehension, arithmetic, math, creativity, and problem solving (Meeker, 1989; M & M System, 1996). Much of the Meekers' work is unpublished, making it difficult to ascertain the factor analytic validity of the specific 26 abilities. Reliability and validity issues are discussed in chapter 3.
There have been approximately 300 books and articles (excluding textbooks) published with at least a reference to the subject of the Structure of Intellect. Only 11 of those have been published in the last decade. Of these 11, two have to do with the construct validity of Guilford's original SI model (Chen & Michael, 1993; Clapham, 1996). Five of the articles relate only to education of the gifted (Cooper, 1991; Guillory & Kher, 1995; Maker & Nielson, 1995; Michael & Bachelor, 1992; Shaughnessy, 1995). Just three of these articles are related to academic achievement in general. Only one of the three was published in a research journal (LeGagnoux, Michael, Hocevar, & Maxwell, 1990). The two remaining articles (Imison, 1994; Meeker, 1990) are primarily conceptual arguments referenced in the SOI Systems Compendium. Neither of these two articles had adequate information for citation. They primarily offered conceptual arguments for learning abilities and vision skills needed for reading.

According to M & M Systems, the intellectual property owners of the SOI program (1996), numerous field studies have been conducted within the last decade validating the efficacy of the current SOI intervention model. However, these studies have not been published in research journals. Results have primarily been used as marketing tools for Intellectual Development Systems, the financial force behind the program. The current SOI intervention program is marketed under the trademark name of Bridges learning lab. Some of these field studies are referenced through the SOI Systems Compendium, but are incomplete.

M & M Systems and Intellectual Development Systems provide a 13-page overview of the history of the research about SOI intervention. The literature references range from Guilford's work in 1956 to recent marketing materials in 1998. Guilford's
and Meeker’s work are the only citations that are published in research journals. All these citations are more than two decades old. In addition, there are four evaluations of the current remediation lab that are of particular interest, one of which is published only as an ERIC document. These are published primarily as marketing tools of M & M Systems and Intellectual Development Systems.

Stock and DiSalvo (1998) offer the most recent and comprehensive program evaluation of the current remediation lab. They evaluated the first year of the program and found lab participants made considerable gains on most of the SOI subtests. There was also evidence of improvement in Stanford Achievement Test mathematics scores. However, there were no discernable effects of the intervention lab on the Stanford Achievement Test reading scores or on the Cognitive Abilities Test verbal, quantitative, or nonverbal scores.

In 1997, Bradfield and Slocumb compared math and reading performance of students in five schools completing 1 year of the SOI Intervention Lab to that of student groups from comparable schools in Rosenberg, Texas. In this study they found that the schools completing 1 year of the SOI Intervention Lab showed significantly greater year-to-year gains on the Texas Academic Achievement Scores (TAAS) in math and reading tests.

Sisk (1998) evaluated the SOI Intervention Lab in rural schools in Paris, Texas. She found significant increases in achievement on standardized test scores for Grades 2 through 12. A majority of the students showed year-to-year improvements in both math and reading on the Texas standardized tests.
R. Meeker (1999) summarized the first 15 years of the SOI Intervention. He found that children who completed their programs were judged successful by classroom teachers according to the criterion of having developed the ability to keep pace with mainstream instruction.

In summary, most of the substantive literature on SOI intervention, as it currently exists, is commercially oriented. There are few academic studies of selected factors and usages.

**Structure of Intellect Validity Studies**

Although not within the last 10 years, between 1979 and the present, a number of research articles were published discussing the validity of Structure of Intellect factors. In 1979 Sternberg examined construct validity of several aptitude tests including the SOI and questioned the specific factors Guilford identified. In the 1980s, factors of the SOI theory were examined repeatedly (Bachelor, 1987; Daniels, 1986; Harmel, 1980; Khattab & Michael, 1986; Khattab, Michael, & Hocevar, 1982; Landis & Michael, 1981; Mehrens & Clarizio, 1985; Roid, 1984; Thompson & Andersson, 1983) with different statistical rotations including the oblique model by Kelderman (1981). Guilford's factors were supported.

Three of the authors, Khattab and Michael (1986), and Roid (1984), examined the construct validity of the Figural, Symbolic, and Semantic factors, and found factorial validity. These three factors are referred to in M & M Systems (1996) as specific learning profiles, although there is no supporting research presented to link factorial validity to reading achievement.
Examination of the construct validity of factors related to creativity was the focus of the two studies published in the early 1990s. Cooper (1991) and Bachelor and Michael (1991) found substantial support for the higher-order factor models related to creativity. Chen and Michael (1993) reanalyzed Guilford's higher-order factors and proposed a pyramidal, hierarchical structure rather than the cube Guilford proposed. Clapham's (1996) research, conducted with college students, supported the types of products the SOI model supported.

Regardless of the amount of formal research that has been conducted, educators opt for pragmatic intervention. The SOI remediation lab is now installed in approximately 100 schools nation-wide.

**Informal Reading Inventories**

This section discusses the value of standardized testing versus informal reading testing published in the literature. The informal reading inventory is a type of informal reading test designed to provide teachers with diagnostic information regarding a child's reading capabilities. Informal reading inventories can help teachers understand at which level children can read: independent, instructional or frustration. The independent reading level is the level at which the student can read easily and without assistance. Various educators have tried to quantify the levels by attaching expected percentages for word recognition and comprehension. Many educators agree that the reader must have 99% or better word recognition and 90% or better comprehension in order to be labeled as being at an independent level. The instructional reading level is the level at which the student can read and understand with assistance. The reader must have 95% or better
word recognition and 75% or better comprehension. The frustration level is the level at which the student is unable to read and understand alone because the material is too difficult. The reader recognizes less than 90% of the words and has less than 75% comprehension.

The emphasis is not upon comparing the performance of a student who is taking an informal reading inventory with others who have taken such an inventory; instead, it is on learning about the skills, abilities, and needs of the student in order to better plan a program of reading instruction that will allow a maximum rate of progress (Johnson. Kress. & Pikulski. 1987. p. 2).

Originally, informal reading inventories (IRIs) were all teacher-made. However, according to Barr, Sadow, and Blachowicz (1990), commercial informal reading inventories have many advantages. Among the most popular of the many inventories discussed in the literature are the Burns and Roe Informal Reading Inventory (1993), Qualitative Reading Inventory-II (1995), Analytical Reading Inventory (1995), Keefe Inventory for Silent Reading (1993), Ekwall Reading Inventory (1986), Adams Informal Reading Inventory (1985), and the JAT (Joels. Anderson. and Thompson) Reading Inventory for Classrooms (1998).

Robertson, 1993; Shearer & Homan, 1994; Stasko, 1991; Zakaluk, 1991). Within the last decade, secondary and adult populations have also been a topic of interest for researchers using informal reading inventories (Camperell et al., 1995; Conlon et al., 1995; Cross et al., 1991; Giordano, 1996; Hinton, 1992; Rupley & Longnion, 1990; Siedow, 1991).

Various authors have examined the value of different informal reading inventories. Duffelmeyer, Robinson, and Squier (1989) questioned the validity of the vocabulary, and Duffelmeyer and Duffelmeyer (1989) questioned the main idea comprehension questions for the Analytical Reading Inventory, Basic Reading Inventory, and Information Reading Inventory. Arno (1990) found the Burns and Roe Informal Reading Inventory a popular and valuable tool to study, evaluate, or diagnose reading behaviors. Tulley and Farr (1987) and Bristow and others (1983) compared five methods of determining instructional reading levels and found that each method, because of high percentages of agreement, yielded similar information. Using the inventories for an alternative diagnosis and remediation is acceptable (Barr, Blachowicz, & Wogman-Sadow, 1995; Crawley & Merritt, 1996; Gunning, 1998; Miller, 1995).

Amoriell (1981) conducted a study to provide insight into the consistency of reading achievement scores from four standardized reading tests, assessing the accuracy of grade equivalents or instructional reading levels obtained on them. The four tests examined were the Iowa Tests of Basic Skills, Stanford Achievement Test, Gates-MacGinitie Reading Test, and the Metropolitan Achievement Test. The resulting grade levels revealed significant discrepancies across the different tests. The results did not support the use of standardized test scores as adequate measures of reading achievement or as a substitute for individually administered informal reading inventories. While not
including informal reading inventories specifically, Ramos (1996) explored the
computation, interpretation, and limits of grade equivalent scores from group
administered standardized achievement tests. Ramos concluded that grade-equivalent
scores are not consistent across tests and these scores should not be used to make
comparisons of grade-equivalent performances. There is a relatively poor match between
current reading theory and existing standardized tests of reading (Linn & Valencia.
1986).

Despite the fact that the IRIs are considered informal, they lend themselves
appropriately to identifying students' instructional levels for reading. In fact, there is no
substitute for individually administered IRIs for obtaining information about a child's
reading level. This is most likely why so many dissertations in the last decade have used
IRIs as the main assessment tool for reading (Bilhener. 1992; Boulware. 1994; Bunker.
1997; Carter. 1996; Cleveland. 1990; Crouchet. 1998; Dubert. 1992; Dugan. 1996;
1990).

**Sensory Integration Related to Reading**

The SOI Remediation Lab includes a sensory integration component. Sensory
Integration (SI) is theorized to have an effect on academic skills (Law. Miller. &
Polatajko. 1991). The effectiveness of SI as an intervention has been the subject of a
great debate (Arendt. MacLean. & Baumeister. 1988; Clark & Pierce. 1988; Schaeffer.
1984). Ottenbacher (1982) performed a meta-analysis of eight studies and concluded that
empirical support exists for SI therapy. The results of studies examining the effectiveness of sensory integration therapy were reviewed, using quantitative methods that treat the literature review process as a unique type of research. Three hundred and seventeen subjects were studied. The average overall performance of subjects receiving SI was better than 78.8% of the subjects' control groups. The effect was largest when measures of motor or reflex performance were used to evaluate improvement, where the SI subjects' performance was better than 84.8% of the control subjects.

In Parham's 1998 study evaluating sensory integration, at younger ages there was no significant association between concurrent reading achievement, but there was 4 years later. Cummings (1999) examined the relationship between sensory integration training, spelling, and reading performance. Students were divided into two groups: those with partial training (3.4 months or less) and those with full training of 8.5 months or more. Older students tended to improve more than those in the second grade did, supporting Parham's findings.

Wilson, Kaplan, Fellowes, Gruchy, and Faris (1992) and Wilson and Kaplan (1994) compared the efficacy of sensory integration training and tutoring, and followed up 2 years later. At the end of the experimental sessions, tutoring was found as effective as sensory integration training, while even the students tutored showed improvement in motor functioning. Two years later there was a significant difference in the gross motor performance of the students receiving sensory integration training. However, there was no difference between the groups on measures of reading skills. Kaplan, Polatajko, Wilson, and Faris (1993) re-examined the efficacy of SI by combining data from a study
of 96 Canadian children. Their results showed that the therapeutic effect of SI is not
greater than other more traditional methods of intervention.

Not only is SI and academic achievement a source of debate, even the instruments
used for SI intervention have been questioned by Meyers and Schkade (1992). They
found the Belgau Calibrated Variable-Difficulty Balance Platform not effective in the
remediation of learning problems (including reading) of junior-high-school students.

Morrison and Sublett (1986) also found SI as an ineffective treatment for reading
disabilities. The SI therapy improved nystagmus duration from a depressed to a more
normal level; there was no change over time in equilibrium reactions or visual integration
in either group.

While the debate continues, there is mounting evidence that academic
achievement can be significantly improved with sensory integration training added to the
intervention repertoire.

**Vision Training**

The SOI Remediation Lab also includes a vision training component. “The idea
that there is a causal relationship between visual or visual processes and learning
disabilities is one of the oldest and most controversial in our field” (Keogh & Pelland.
1985, p. 228). Tinker (as cited in Lynch. 1987) reviewed the research on eye movements
and commented negatively on what he considers the “mistaken notion” that training eye
movements is an effective way to improve reading. An extensive body of research does
not exist on the subject. Research on vision system training has slowed during the last
decade. I had to include three decades of search to retrieve only a handful of studies.
examining vision training and its effect on reading. Vision and learning disabilities may be discussed, but not used in conjunction with remediation effects on reading. For instance, Christenson, Griffin, and Wesson (1990) described visual direction, visual form perception, intersensory integration, and eye-hand coordination, binocular vision, accommodation, tracking, and convergence as all relevant for reading. Optometric vision training is proposed, but not measured along with reading. Keys and Silver (1990) examined the relationship between learning disabilities and vision problems. They advocate for vision therapy, treatments of colored lenses and applied kinesiology to improve reading.

Variations of traditional vision therapy have been examined. Blaskey and colleagues (1990) compared traditional vision therapy with Irlen Filters and reading performance. Pre- and posttesting revealed that subjects in both treatment groups were more comfortable after treatment, that only the vision therapy group showed improved visual functioning. The Irlen Filter group did not show significant gains in reading. The ReadFast computer program was also analyzed. At the end of the regular vision therapy program there was an average improvement in reading speed of 45%. whereas after completing ReadFast an average improvement of 73% in reading speed was measured. Other significant changes occurred in number of regressions and reading comprehension. Vision therapy alone improved comprehension by only 6%, while adding ReadFast improved it by 12%.

Lynch (1987) offers the most thorough review of the literature as well as original research. This work is currently not published in a research journal; it exists in Master’s thesis form and is over a decade old. She suggested from the outcomes of her research
that a more efficient visual system could have a positive effect on the reading achievement of the fifth-grade students in her study. There are clear results indicating significant improvement in the ocular-motor and visual-motor skills of the experimental groups and also a significant gain in the reading performance of those same students.

Vision therapy as it relates to reading improvement is a debatable issue between behavioral and medical disciplines. The medical field generally accepts that there is improvement in ocular-motor skills, but the relationship to reading has not been established. Educators tend to be more behavioral in practice. They are in teaching in order to make a change, even if the links have not yet been verified.

**Direct Instruction**

Part of the intervention for this study included reading instruction. The Reading Mastery and Corrective Reading series (SRA) was used as the method of instruction. Since this is considered a direct instruction method, an overview of direct instruction is provided.

The term *direct instruction* is used in different ways in the literature. In the most pure sense, Direct Instruction is a system of teaching that attempts to control all the variables that make a difference in the performance of children. This instructional system assumes that children can be placed into a Direct Instruction program and acquire content (reading in this case) at a reasonable rate (Adams & Engelmann, 1996).

The most common confusion in terminology is that Direct Instruction is "simply teacher-directed instruction, the opposite of so-called 'child-centered' approaches (such as the open classroom or discovery method) in which the teacher is supposed to act as a
facilitator for students” (Adams & Engelmann. 1996, p. 1). Siegfried Engelmann and colleagues originated the concept of Direct Instruction in 1964. Originally the approach was referred to as direct verbal instruction (Bereiter & Engelmann. 1966).

The approach became more programmatic and was called the Direct Instruction System for Teaching Arithmetic and Reading (DISTAR), that in turn evolved into several programs, one of which is the SRA series. The SRA series has followed the same controlled, scripted style.

During the last three decades, direct instruction has been shown effective for reading instruction. In their latest publication (1996), Adams and Engelmann offer the most thorough review of related research supporting Engelmann’s Direct Instruction model. It seems to be one of the oldest reading instructional approaches in existence with a substantial amount of research. Within the last two decades a number of studies have confirmed efficacy of direct instruction in general for children in the primary grades (Becker. 1977; Becker & Gerston. 1982; Davis. 1996; Meyer. 1984; Rawl & O‘Tuel. 1982; Sexton. 1989; Snider. 1990; Traweek & Berninger. 1997; Umbach. Darch. & Halpin. 1989). The research examining direct instruction with secondary students is not as abundant or affirming. Most recently, Mosley’s (1997) results indicated that students taught using Direct Instruction as opposed to students taught in the regular classroom had no statistically significant difference on reading scores. He attributes non-significant findings to the fact that previous findings suggest that Direct Instruction should be taught for at least 2 years before significant results are produced.

Much research has also been done on the special education population, primarily children with learning disabilities. O’Connor. Jenkins. Cole. and Mills (1992. 1993), the
Cantalian Center (1982), Woltz (1981), Marston, Deno, Dim, Diment, and Rogers (1995), and Gersten and Maggs (1982) all found similarly positive results, thus validating direct instruction as a valid instructional model for special education children both mainstreamed and nonmainstreamed.

However, Kuder's (1990) study offered contradictory findings for children with learning disabilities. He compared reading achievement of students with learning disabilities who received reading instruction through DISTAR to those who received reading instruction through basal reading material. The overall reading scores of the groups were not significantly different following 1 and 2 years of instruction, although students in the DISTAR program had somewhat better word attack skills.

Spector (1995) and Morgan (1995) (as cited in Mosley, 1997) think that direct instruction is not as effective as portrayed. Spector specifically argues that learning how to read in an alphabetic system requires children to understand the complex relationship between print and speech and believes that the direct instruction program does not offer these things.

Perhaps the most dramatically documented study was Project Follow Through (Meyers, Gersten, & Gutkin, 1983) demonstrating that even students from disadvantaged areas can match the academic accomplishments of middle-class peers. The project began in 1968 using DISTAR (Direct Instruction System for Teaching Arithmetic and Reading) direct instructional programs that included a consistent focus on academic objectives, high allocation of time to small-group instruction in reading, language, and math, teacher training, and a comprehensive system for monitoring both the rate of students' progress and their mastery of the materials covered.
Some believe that the method is shallow, and does not offer children the opportunity to learn the complexities of language required for reading. While direct reading instruction has probably the strongest research base of any program, there are those who do not believe the regimen is appropriate in certain settings.

Summary

In summary, research on the current SOI intervention model (Bridges learning lab) is greatly needed. While Guilford's SI model has been psychometrically substantiated, scholarly research is sporadic on the Meekers' curriculum, and practically nonexistent on the current model that is a hybrid of the Meekers' model and sensory integration and vision system therapy. Sensory integration appears consistently to improve motor functioning. However, its impact on reading and academic achievement remains debatable. This same notion holds true for vision system training. Applied fields seem to agree on the efficacy of optometric training but the link to reading and achievement is still under exploration. Direct reading instruction has probably the strongest research base of any remedial program, yet there are those who are not willing to accept the regimen in certain settings. The value of IRIs has been substantiated for identifying a child's instructional reading level and is more appropriate than interpreting grade-equivalence on a standardized instrument.
CHAPTER III

METHODOLOGY

This study is a quasi-experimental field study in which pre- and posttests were compared for gains on SOI abilities and reading achievement for two experimental groups and a control group.

Subjects

The subjects for this study included third-, fourth-, and fifth-grade students from two schools in a Northern Indiana School District. Both School A and School B had similar enrollments of approximately 350. Both schools had similar socioeconomic levels, determined by their entitlement for Title I services. The district School Board requested that all students in School A be assigned to the experimental group; therefore, a second school, which matched School A in Title I criteria, was needed for a control group. Two schools met the selection criteria, but only the principal in School B was willing to have his school participate in the study. The Human Subjects Review Board of Andrews University and the principals at both schools approved the study (Appendix A).

Grade 3, 4, and 5 students from both schools were screened through administration of the Burns and Roe Informal Reading Inventory (Burns & Roe, 1993) and through examination of standardized reading test scores from the previous year. Students in Grade 4 in both schools had been tested by the Indiana State Wide Test of
Educational Proficiency (ISTEP) and the Terra Nova reading subtest scores were used for Grades 3 and 5. Students are tested every year, alternating these two tests so that 1 year the students will have the ISTEP, and the next Terra Nova.

Fifty-five general education students with reading scores at or below the 16th percentile on the ISTEP or the Terra Nova or who were reading at least two instructional levels behind their actual placement (according to the Informal Reading Inventory) were selected to participate in the study. Three children did not choose to participate. The data on another three children were not included because they were labeled with a learning disability during the course of the program, four children moved mid-year, and another student had data missing from a subtest of the SOI posttest. Thus 44 students remained in the study.

Reading levels were identified as the level of reading at the Instructional Level. The Instructional Level for Grade 3 and above is defined by Burns and Roe (1993) as at least word recognition of 95% and 80% or higher comprehension. (See appendix B for full explanation of criteria used for determination of Instructional Level.) Criteria were the same for both the control and experimental groups.

A letter of invitation to participate was sent to the parents of each of the selected students (Appendix C). Parents indicated their permission by signing and returning the letters.

Once permission was granted, students from School A were assigned through stratified random sampling (by grade and gender) into two experimental groups, SOI Plus and SOI Alone. Students from School B served as the control group.
Instrumentation

Three measurement instruments were used in this study: SOI Form L for Grade 3, SOI-CR for Grades 4 and 5, and the Burns and Roe Informal Reading Inventory for all three grades.

SOI

SOI Tests Form L and Form CR


Instead of providing a single IQ score, these subtests offer a detailed profile of learning abilities by assessing as many as 26 separate abilities. These tests may be either individually or group administered and take approximately 2 1/2 to 3 hours.

Research and Development

The basic forms of the SOI-LA were published in late 1975, following 13 years of development. The tests are based on Guilford’s (1959) model of intelligence. Guilford’s laboratory research and the subsequent development of the current SOI-LA tests grew from an extended tradition of factor-based testing. M. Meeker (1969) mapped the origin of numerous tests for each of the Structure of Intellect factors from sources such as the reasoning tests of Adkins and Lyerly (1951), the visual memory studies of Christal (1958), the cognitive factor tests of French, Ekstrom, and Price (1963), the aptitude
measure of Fleishman, Roberts, and Friedman (1958), the studies of auditory function by Karlin (1942), the memory ability factor analyses of Kelley (1964), and the studies of perceptual factors by Thurstone (1944). Because the tests used in the majority of these studies and those of Guilford and his associates were intended for an adult population, the format, content, and response mode were scaled down to a level appropriate for elementary-school students.

**Description of Tests**

Both versions of the SOI test are published by SOI Systems in Vida, Oregon. SOI Form L holds a 1993 copyright date, while the most recent version for the SOI-CR test is 1991. Robert and Mary Meeker author both test forms. Currently, the SOI tests use grade norms for children of school age.

The following subtests are common to both the SOI form L and the SOI-CR tests.

**CFU (Cognition of Figural Units) subtest**

The CFU subtest is related to visual closure. This subtest requires that the respondent name a partially drawn figure, similar to the format of Gestalt closure. One point is scored for each item answered correctly. Maximum possible score is 14 for Form L and 16 for Form CR.

**CFC (Cognition of Figural Classes) subtest**

The CFC subtest is related to visual conceptualization. This subtest requires that the respondent match an abstract object with its appropriate grouping of other objects. One point is scored for each item answered correctly. Maximum possible score is 17 for Form L and 9 for Form CR.
EFU (Evaluation of Figural Units) subtest

The EFU subtest measures visual discrimination. This subtest requires that the respondent match identical figures in a multiple choice format. One point is scored for each item answered correctly. Maximum possible score is 20 for Form L and 26 for Form CR.

CMUr (Cognition of Semantic Units) subtest

The CMUr subtest measures the ability to understand vocabulary. This subtest, in a multiple-choice format, requires that the respondent choose a synonym for the word provided. One point is scored for each item answered correctly. Maximum possible score is 20 for Form L and 30 for Form CR.

CMR (Cognition of Semantic Relations) subtest

The CMR subtest measures the ability to understand verbal relations. This multiple-choice subtest requires that the respondent choose the event or idea that comes between the two prompts provided. One point is scored for each item answered correctly. Maximum possible score is 19 for Form L and 25 for Form CR.

CMS (Cognition of Semantic Systems) subtest

The CMS subtest measures the comprehension of extended information. This multiple-choice subtest requires that the respondent choose series of shapes that are described by sentences. One point is scored for each item answered correctly. Maximum possible score is 20 for Form L and 25 for Form CR.
MFU (Memory for Figural Units) subtest

The MFU subtest measures the visual memory for details. This subtest requires that the respondents mark all the figures they remember from the testing protocol. One point is scored for each item circled correctly and 1 point deducted for each item circled incorrectly. Maximum possible score is 20 for Form L and 26 for Form CR.

NST (Convergent Production of Symbolic Transformations) subtest

The NST subtest measures the speed of word recognition. This subtest requires that the respondent scan the sentences and words provided to find “hidden” words: there are no spaces or punctuation provided. One point is scored for each word identified correctly on all three sections of Form L. Four points are scored for each word circled correctly in the first section; 1 point is scored for each correct word in the second section on Form CR. Maximum possible score is 200 for Form L and 128 for Form CR.

The following subtests were administered only to Grades 4 and 5. Form L did not have these subtests.

EFC (Evaluation of Figural Classes) subtest

The EFC subtest measures the ability to judge similarity of concepts. This subtest requires that the respondent match a figure to the one most like the example in a multiple-choice format. The individual scores 1 point for each item answered correctly. Maximum possible score is 17.
MSUv (Memory for Symbolic Units-visual) subtest

The MSUv measures the ability to recall visually presented numbers. This subtest requires that the respondent write a series of numbers from visual short-term memory in an open recall format. One point is given for each item answered correctly. Maximum possible score is 18.

MSSv (Memory for Symbolic Systems-visual) subtest

MSSv measures the ability to sequence visually. This subtest requires that the respondent write a series of numbers in reverse order from visual short-term memory in an open recall format. One point is given for each item answered correctly. Maximum possible score is 18.

Reliability of SOI Tests

Several types of reliability have been calculated on the SOI-LA tests, particularly for Forms A and B. The difficulty, however, is in acquiring these forms for administration. Currently for all school projects, M & M Systems recommend forms CR for Grades 4 and higher and Form L for Grades 3 and lower (M & M Systems, personal communication. August 1998). As it turns out, Form CR is, in fact, Form A reported in the technical manual (1985 ed.). There are no data for Form L in this technical manual. Dr. Robert Meeker (personal communication. June 1999) assured me that Form L was actually Form P. Form P data are listed in the most recent version of the technical manual (Meeker et al., 1985). However, when I began to run the statistical portion for Form L, the stanines and means did not match the Form P data provided. I telephoned...
Dr. Robert Meeker to request the means and standard deviations for the actual Form L. Although the test has a 1993 copyright date, nothing has been published to date on Form L. Dr. Robert Meeker did not send means and standard deviations, but instead sent the entire norming sample for me to calculate norms and standard deviations.

Four types of reliability estimate have been calculated for the Form CR: Interrater Reliability for Divergent production subtest, test-retest, alternative forms, and decision-consistency reliability. (Form CR is referred to as Form A in the 1985 technical manual [Meeker et al., 1985].)

Interrater reliability

Thompson and Andersson (1983) investigated the interrater reliability of the DFU, DMU, and DSR subtests. None of these subtests were examined in this study.

Test-retest reliability

Test-retest reliability coefficients were calculated for each test form and grade level during the normative study of Forms A and B. The subjects were retested within a 2- to 4-week interval. The test-retest correlations are based on the samples of boys and girls across grade levels. “One noteworthy trend is a gradual increase in test-retest reliability coefficients from the individual subtests to the general ability scores” (Meeker et al., 1985, p. 89). However, general ability scores were not used in this study.

Alternate forms reliability

Some students in the normative sample were given both Forms A and B (Form A = Form CR) 2 to 4 weeks apart. Half the students were given Form A followed by Form
B. while the other half were given Form B followed by Form A. Table 1 presents test-retest correlations and alternate form correlations for Form CR.

Table 1

*Test-Retest Correlations and Alternate Form Correlation for Forms A and B*

<table>
<thead>
<tr>
<th>SOI-LA Measure</th>
<th>Test-Retest Correlation</th>
<th>Alternate Form Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Form A</td>
<td>Form B</td>
</tr>
<tr>
<td>CFU</td>
<td>.81</td>
<td>.75</td>
</tr>
<tr>
<td>CFC</td>
<td>.51</td>
<td>.36</td>
</tr>
<tr>
<td>EFU</td>
<td>.66</td>
<td>.72</td>
</tr>
<tr>
<td>CMUr</td>
<td>.72</td>
<td>.70</td>
</tr>
<tr>
<td>CMR</td>
<td>.78</td>
<td>.79</td>
</tr>
<tr>
<td>CMS</td>
<td>.73</td>
<td>.73</td>
</tr>
<tr>
<td>MFU</td>
<td>.49</td>
<td>.38</td>
</tr>
<tr>
<td>NST</td>
<td>.88</td>
<td>.83</td>
</tr>
<tr>
<td>EFC</td>
<td>.35</td>
<td>.34</td>
</tr>
<tr>
<td>MSUv</td>
<td>.49</td>
<td>.49</td>
</tr>
<tr>
<td>MSSv</td>
<td>.47</td>
<td>.51</td>
</tr>
</tbody>
</table>

Decision-consistency reliability

Estimates of decision-consistency reliability are presented. This information pertains to the stability of gifted selection decisions based on subtest scores. This type of reliability was examined in detail (Meeker et al., 1985). Since this instrument was not used to identify the gifted population in this study, these estimates are not discussed.

A number of authors give evidence of content, criterion, construct, concurrent, and predictive validity.
Content validity


Criterion validity

Three facets for criterion validity are reviewed in the Technical Manual (1985): (1) Diagnostic utility for important criteria such as giftedness, (2) concurrent validity with other tests, and (3) predictive utility with school achievement and teacher ratings. A number of studies offered diagnostic utility for specific populations, such as the gifted (M. Meeker, 1978; Pearce, 1983), Hispanic and American Indians (M. Meeker, 1978), junior-high-school students (Gore, 1980), and senior-high-school students (Meeker et al., 1985). None of these populations was used in this study, therefore the studies are not discussed.

Kent (1981) studied differences in subtests for highly skilled first-grade readers versus non-readers. The expected higher scores for the skilled readers on SOI subtests DMU (verbal fluency), CMU (vocabulary), and NST (speed of word recognition) were all consistent with the superior pattern of standardized reading test scores from the
Metropolitan Achievement Tests. The groups did not differ on DFU (spatial figural) and CRU (visual perception) which relate to figural units rather than semantic information.

Concurrent validity

Nine of the SOI subtests are hypothesized to be related to reading, and 11 are hypothesized to be related to arithmetic achievement. Studies by Thompson, Alston, Cunningham, and Wakefield (1978) showed the highest correlations for reading were for the subtests CMR, NSS, ESC, and CMS. Only two of these subtests are said to be related to reading achievement, CMR and CMS. Thompson and colleagues found even higher correlations between the subtests of ESS, ESC, NSI, and CMR and arithmetic achievement.

Johnson (1979) studied learning disabled and emotionally disturbed seventh, eighth, and ninth graders. He found significant correlations between 22 subtests and the Peabody Individual Achievement Test. The reading recognition and reading comprehension scores reported are relevant to this study. The highest correlations were among the subtests: CPU, CMU, MSSv, DFU, CMU, MSI, EFC, and NST.

Pearce (1983) and Stenson (1982) reported correlations between the SOI Gifted Forms and the WISC-R. Gore (1980) found that the difference between gifted and nongifted students on the Ross Test of Higher Cognitive Processes paralleled the differences in the SOI Divergent Production scores.

Predictive validity

Crosslin (1978) reported a predictive study of reading achievement for gifted first-grade students. Meeker et al. (1985) consider Crosslin's study encouraging because
of the restriction of range present in such high-functioning groups. Cunningham, Thompson, Alston, and Wakefield (1978) published a predictive study of relationships between SOI tests scores and teacher ratings.

Construct validity

Thompson and Andersson (1983) conducted a construct validity study of the Divergent Production subtests. The size of the factor adequacy coefficients found by Thompson and Andersson provides evidence for the construct validity of the Divergent Production factors. None of the Divergent Production subtests, however, was used in this study.

Maxwell (1984) conducted a confirmatory factor analysis of these memory and Figural subtests: MSUv, MSUa, MSSv, MSSa, MSI, CFS, and CFT. The MSUv, MSUa, MSS, MSSa, and MSI subtests were found to have significant factor loadings on their respective factors, with all t-ratios for the factor loadings exceeding 1.96, thus confirming the existence of each memory factor.

Roid (1984) conducted another confirmatory factor analysis of all 26 subtests to verify the Figural, Symbolic, and Semantic content dimensions. All nine of nine subtests hypothesized to load on the Figural factor were confirmed. For the Symbolic factor, 10 of the 13 subtests were confirmed, and for the Semantic factor, three of four subtests were confirmed.

Informal Reading Inventory

There are many versions of informal reading inventories. Informal reading inventories are a type of informal reading test designed to provide teachers with a variety
of information to help guide further reading instruction. One of the most popular of the informal reading inventories (IRI) is the Burns and Roe (1993). The fourth edition was used for this study. The IRI is aided by a series of guidelines for its construction, administration, and scoring.

When constructing the passages for the reading inventories, passages of between 60 and 220 words were chosen from each grade level from the basal reading series published by Houghton Mifflin, Rand McNally, and Scott Foresman. The passages were checked for readability level using the Spache Readability Formula for pre-primer through Grade 3 and the Fry Readability graph for Grades 4 through 12. A mix of fiction and nonfiction selections was included because students are exposed to both in their school and recreational reading activities. Any necessary background information was included in the introductory statements that precede each passage.

The comprehension questions that accompany the reading are of six types: main idea, details, sequence, cause and effect, inference, and vocabulary. The guidelines for writing informal reading inventory questions set forth by Valmont (1972) were followed in constructing the questions. The fourth edition IRI was field-tested on students in Grades 1 through 12.

There are four forms of graded passages for the IRI. Form A was administered for pretests and Form C for posttests. The student is told what to expect during the assessment process and given any background information necessary for comprehension of the inventory passage. The student is then asked to read orally from the passage and told that she or he will be asked questions at the end of the passage. Fluency miscues are recorded as well as responses to the comprehension questions. When the student has met
the criteria for both word recognition and comprehension, the instructional level is recorded. See Appendix B for additional administration details.

**Direct Instruction--SRA**

The direct instruction techniques developed by Bereiter and Engelmann (1966) consist of two types: 1) Direct Instruction techniques and sequences that set standards (by documenting what students can achieve) and 2) commercial Direct Instruction sequences and materials that are designed for use by people who have not been trained directly by Engelmann and his colleagues" (Adams & Engelmann, 1996, p. 2). The SRA series is the latest Direct Instruction method developed by Engelmann.

The SRA series was used for this study. This series offers scripted presentations that "guide the teacher and simultaneously teach the students" (Adams & Engelmann, 1996, p. 3). Each level is divided into daily lessons that are presented as a core program. Students are taught everything that is required for that and subsequent lessons. Skill development is cumulative and the difficulty of the material gradually increases.

**Research Procedures**

**Pretest**

Four certified and two paraprofessional individuals were recruited to collect data for this study. Certified personnel included the school psychologist (the researcher), a general education teacher, and two elementary-school principals. The two paraprofessionals were Title I aides who had worked in the school system for at least 5 years. The four certified personnel were also trained on administration of the SOI abilities tests by Meeker-licensed trainers.
The SOI pretest, Form L and Form CR, was administered to children in small
groups. Exceptions were made for students who needed individual testing.

The Burns and Roe IRIs were administered individually to all students.
Administration and scoring guidelines were presented in a training session prior to the
project. Guidelines are found in Appendix B.

Intervention

A trained technician conducted the SOI remediation, consisting of the activities
specified by IDS and M & M Systems as the "learning lab." Meeker-licensed trainers
and the school psychologist trained this technician. Title I paraprofessionals were
responsible for direct reading instruction for the SOI Plus group, using the SRA Reading
Mastery Series. An inservice education session on the SRA Reading Mastery Series was
provided for Title I paraprofessionals before they were asked to deliver instruction. The
school psychologist closely monitored all SOI remediation and direct reading instruction.

Students in both the experimental groups received 2. 45-minute sessions per week
in the SOI remediation lab, from September to May, an average of 46 sessions. Students
engaged in three sets of activities during each 45-minute session. Students in the Control
group received no additional instruction outside the normal general education curriculum.

Activities for the lab included SOI learning modules, sensori-motor integration,
and vision system treatment. The SOI learning modules are in workbook form. These
activities are intended to improve memory and recall, and comparison (contrast thinking,
contextual comprehension, etc.). Sensori-motor integration included activities such as
body movement sequences done on a mini-trampoline or balancing on a Belgau board.
while engaging in a simultaneous activity. Vision system activities included eye-focusing exercises, near and far, and saccadic eye movements.

Students in the SOI Plus group received 30 minutes of the SRA scripted reading instruction at least 4 days per week, for an average of 27 weeks. Students in the SOI Alone group and Control group received no reading instruction other than from the general education curriculum.

Posttest

The SOI posttest, Form L and Form CR, was administered to children in small groups. Exceptions were made for students who needed individual testing. The Burns and Roe IRIs were administered individually to all students. Administration and scoring guidelines were presented in a training session prior to the project. The same group of people who administered pretests administered the posttest.

Hypotheses and Methods of Analysis

The research hypotheses were stated in chapter 1. In order to test the first two research hypotheses, 11 null hypotheses were derived on subtests of specific factors. The hypotheses relate to mean posttest scores when adjusted for the pretest means. The three groups are SOI Plus (SOI plus direct reading instruction), SOI Alone (SOI remediation without direct reading instruction), and the Control group.

Hypothesis 1. There is no significant difference among the adjusted posttest means of the three groups on the CFU subtest.

Hypothesis 2. There is no significant difference among the adjusted posttest means of the three groups on the CFC subtest.
Hypothesis 3. There is no significant difference among the adjusted posttest means of the three groups on the EFU subtest.

Hypothesis 4. There is no significant difference among the adjusted posttest means of the three groups on the CMUr subtest.

Hypothesis 5. There is no significant difference among the adjusted posttest means of the three groups on the CMR subtest.

Hypothesis 6. There is no significant difference among the adjusted posttest means of the three groups on the CMS subtest.

Hypothesis 7. There is no significant difference among the adjusted posttest means of the three groups on the MFU subtest.

Hypothesis 8. There is no significant difference among the adjusted posttest means of the three groups on the NST subtest.

Hypothesis 9. There is no significant difference among the adjusted posttest means of the three groups on the EFC subtest.

Hypothesis 10. There is no significant difference among the adjusted posttest means of the three groups on the MSUv subtest.

Hypothesis 11. There is no significant difference among the adjusted posttest means of the three groups on the MSSv subtest.

Hypotheses 1 to 11 were tested using analysis of covariance, with the posttest as criterion and the pretest as covariate. The first eight hypotheses were tested three times using raw scores for Grade 3, raw scores for Grades 4 and 5 combined, and T scores for all three grades combined. The remaining three hypotheses were tested only once using
raw scores for Grades 4 and 5 combined. The subtests of EFC, MSUv. and MSSv were not common to both tests.

Raw scores cannot be used for the three groups together, as Grade 3 was tested with a different instrument from that used in Grades 4 and 5. However, for the sake of increased sample size, all three groups were combined using T scores.

The last hypothesis to be tested was derived from the second general hypothesis statement. Please refer to chapter 1.

Hypothesis 12. There is no significant difference among the proportions in each of the three groups who make an improvement of at least one grade level on the Informal Reading Inventory. This hypothesis was tested by chi-square analysis.

Hypothesis 12a. There is no significant difference among the proportions for the three groups who will make a gain of more than one grade level in reading.

Hypothesis 12b. There is no significant difference among the proportions for the two experimental groups who make an improvement of more than one grade level in reading.

The remaining research question was taken from the third general hypothesis. This question was addressed descriptively. SOI learning profiles were examined separately for males and females. SOI learning profiles were examined individually and in relation to reading achievement.

Power Analysis for the ANCOVA

Power analysis was undertaken assuming 24 students per class, the maximum that could logically be expected. Thus with three treatment groups, each class may possibly supply as many as 8 subjects per treatment group. All three classes together would thus
supply 24 subjects per group. Grades 4 and 5 would together supply 16 subjects per group. Grade 3 alone would supply 8 subjects per group.

The Power analysis was initially undertaken with the alpha set at .05. for moderate effect size ($f^2 = .25$) and for large effect size ($f^2 = .40$), using Cohen's (1969) Table 8.3 (pp. 306-307). The resulting values of power are given in the left-hand half of Table 2. As these figures are so low, an alpha level of .10 was decided upon instead. The resulting power values from Cohen's Table 8.3 (pp. 328-329) are given in the right-hand half of Table 2. While still below .50 for two of the six conditions, they are somewhat improved and give some hope of identifying departures from a false null hypothesis under the remaining conditions.

All hypotheses were tested with an alpha set at .10. Even so, there is still little probability of rejecting a false null hypothesis with medium effect size.

As it turned out, the distribution among grades was not as evenly distributed as expected. With few in each grade, the Power was even lower than indicated in Table 2.

Table 2

Power for ANCOVA Tests

<table>
<thead>
<tr>
<th>$n$ per group</th>
<th>Alpha = .05</th>
<th></th>
<th>Alpha = .10</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate</td>
<td></td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effect</td>
<td></td>
<td>Effect</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>.45</td>
<td></td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>.31</td>
<td></td>
<td>.44</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>.16</td>
<td></td>
<td>.27</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Moderate effect = .25; Large effect = .40.
CHAPTER IV

DATA ANALYSIS

Chapter 4 presents data on the sample and instruments, and concludes with a report of the results of testing the null hypotheses.

Sample Description

The research sample consisted of 44 students from Grades 3, 4, and 5. The students were selected from two schools in the same Northern Indiana school district. Table 3 shows the distribution of the research sample by grade, gender, and group. The groups are not distributed evenly among grades due to the selection criteria. All students who met selection criteria were asked to participate in the study.

Table 3

Sample Subgroup Frequencies

<table>
<thead>
<tr>
<th>Grade</th>
<th>SOI Plus</th>
<th></th>
<th>SOI Alone</th>
<th></th>
<th>Control</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

Total 24 20 44

Note. M = male; F = female.
Descriptive Data on the Instruments

Table 4 presents descriptive data for the 16 Grade 3 sample students on the eight subtests of Form L.

The majority of variables in Grade 3 cover a reasonable proportion of the possible range with the exception of the scores on the NST and CMS subtest. The pretest research sample means are below the normative sample means on all eight subtests. This might be expected for students who are reading at no more than the first-grade level.

Table 4

Form L—Descriptive Statistics, Grade 3

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Mean Normative Sample</th>
<th>Mean Research Sample Pre</th>
<th>Mean Research Sample Post</th>
<th>Possible Range</th>
<th>Possible Range Pre</th>
<th>Possible Range Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFU</td>
<td>9.39</td>
<td>8.44</td>
<td>11.50</td>
<td>0-14</td>
<td>4-13</td>
<td>5-13</td>
</tr>
<tr>
<td>CFC</td>
<td>12.94</td>
<td>11.00</td>
<td>13.31</td>
<td>0-17</td>
<td>3-15</td>
<td>4-14</td>
</tr>
<tr>
<td>EFU</td>
<td>16.10</td>
<td>13.25</td>
<td>15.31</td>
<td>0-20</td>
<td>9-18</td>
<td>11-19</td>
</tr>
<tr>
<td>CMUr</td>
<td>17.98</td>
<td>17.13</td>
<td>18.19</td>
<td>0-20</td>
<td>14-19</td>
<td>15-20</td>
</tr>
<tr>
<td>CMR</td>
<td>13.97</td>
<td>11.69</td>
<td>14.13</td>
<td>0-19</td>
<td>8-16</td>
<td>11-16</td>
</tr>
<tr>
<td>CMS</td>
<td>11.98</td>
<td>9.25</td>
<td>11.81</td>
<td>0-20</td>
<td>5-12</td>
<td>7-19</td>
</tr>
<tr>
<td>MFU</td>
<td>12.41</td>
<td>9.31</td>
<td>12.19</td>
<td>0-20</td>
<td>0-17</td>
<td>6-19</td>
</tr>
<tr>
<td>NST</td>
<td>132.39</td>
<td>73.00</td>
<td>123.13</td>
<td>0-200</td>
<td>33-106</td>
<td>34-200</td>
</tr>
</tbody>
</table>

Note. CFU = Cognition of Figural Units; CFC = Cognition of Figural Classes; EFU = Evaluation of Figural Units; CMUr = Cognition of Semantic Units; CMR = Cognition of Semantic Relations; CMS = Cognition of Semantic Systems; MFU = Memory for Figural Units; NST = Convergent Production of Symbolic Transformations

Table 5 presents descriptive data for the 14 Grade 4 sample students on the 11 subtests of Form CR. The NST subtest means for the research sample are considerably

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
lower than the normative sample means. A large number of students in the research sample performed poorly on at least one section of vision screening. Poor performance indicates poor eye movement or tracking skills, or both. Poor tracking skills heavily affect the NST subtest. It is not known if the normative sample had the same vision system issues.

Table 5

*Form CR—Descriptive Statistics, Grade 4*

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Mean Normative Sample</th>
<th>Mean Research Sample Pre</th>
<th>Mean Research Sample Post</th>
<th>Possible Range</th>
<th>Range Pre</th>
<th>Range Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFU</td>
<td>8.80</td>
<td>4.75</td>
<td>6.31</td>
<td>0-16</td>
<td>2-9</td>
<td>3-9</td>
</tr>
<tr>
<td>CFC</td>
<td>5.35</td>
<td>5.25</td>
<td>5.44</td>
<td>0-9</td>
<td>2-8</td>
<td>0-8</td>
</tr>
<tr>
<td>EFU</td>
<td>13.54</td>
<td>14.06</td>
<td>13.69</td>
<td>0-26</td>
<td>10-17</td>
<td>10-18</td>
</tr>
<tr>
<td>CMUr</td>
<td>12.12</td>
<td>10.19</td>
<td>12.38</td>
<td>0-30</td>
<td>4-18</td>
<td>7-17</td>
</tr>
<tr>
<td>CMR</td>
<td>15.36</td>
<td>13.69</td>
<td>17.00</td>
<td>0-25</td>
<td>8-19</td>
<td>9-22</td>
</tr>
<tr>
<td>CMS</td>
<td>11.57</td>
<td>8.69</td>
<td>11.44</td>
<td>0-25</td>
<td>4-13</td>
<td>7-16</td>
</tr>
<tr>
<td>MFU</td>
<td>12.56</td>
<td>11.19</td>
<td>12.06</td>
<td>0-26</td>
<td>4-17</td>
<td>7-21</td>
</tr>
<tr>
<td>NST</td>
<td>94.01</td>
<td>20.63</td>
<td>33.19</td>
<td>0-128</td>
<td>1-45</td>
<td>16-58</td>
</tr>
<tr>
<td>EFC</td>
<td>8.09</td>
<td>9.25</td>
<td>9.06</td>
<td>0-17</td>
<td>7-12</td>
<td>6-11</td>
</tr>
<tr>
<td>MSUv</td>
<td>15.16</td>
<td>13.75</td>
<td>14.94</td>
<td>0-18</td>
<td>7-18</td>
<td>7-18</td>
</tr>
<tr>
<td>MSSv</td>
<td>4.82</td>
<td>3.94</td>
<td>4.25</td>
<td>0-18</td>
<td>0-13</td>
<td>0-12</td>
</tr>
</tbody>
</table>

*Note.* CFU = Cognition of Figural Units; CFC = Cognition of Figural Classes; EFU = Evaluation of Figural Units; CMUr = Cognition of Semantic Units; CMR = Cognition of Semantic Relations; CMS = Cognition of Semantic Systems; MFU = Memory for Figural Units; NST = Convergent Production of Symbolic Transformations; EFC = Evaluation of Figural Classes; MSUv = Memory for Symbolic Units-visual; MSSv = Memory for Symbolic Systems-visual.

Table 6 presents descriptive data for the 14 Grade 5 sample students on the 11 subtests of Form CR. Approximately half of the variables in Grade 5 cover a reasonable proportion of the possible range. Students in Grade 5 showed a decline on three subtests.
CFC, MFU, and MSSv. As for the Grade 4 students, NST subtest means for the research sample are lower than the normative sample means. A large number of students in the research sample performed poorly on at least one section of vision screening. Poor performance indicates poor eye movement or tracking skills, or both. Poor tracking skills heavily affect the NST subtest. Again, it is not known if the normative sample had the same vision system defects.

Table 6

*Form CR—Descriptive Statistics, Grade 5*

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Mean Research Sample</th>
<th>Mean Research Sample</th>
<th>Possible Range Pre</th>
<th>Possible Range Post</th>
<th>Range Pre</th>
<th>Range Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFU</td>
<td>9.93</td>
<td>6.33</td>
<td>7.58</td>
<td>0-16</td>
<td>4-11</td>
<td>4-12</td>
</tr>
<tr>
<td>CFC</td>
<td>5.75</td>
<td>5.08</td>
<td>4.83</td>
<td>0-9</td>
<td>4-8</td>
<td>0-8</td>
</tr>
<tr>
<td>EFU</td>
<td>14.40</td>
<td>13.00</td>
<td>14.42</td>
<td>0-26</td>
<td>9-16</td>
<td>12-18</td>
</tr>
<tr>
<td>CMUr</td>
<td>13.77</td>
<td>10.67</td>
<td>12.92</td>
<td>0-30</td>
<td>0-16</td>
<td>9-16</td>
</tr>
<tr>
<td>CMR</td>
<td>17.78</td>
<td>13.83</td>
<td>16.83</td>
<td>0-25</td>
<td>9-20</td>
<td>13-23</td>
</tr>
<tr>
<td>CMS</td>
<td>14.12</td>
<td>10.58</td>
<td>11.58</td>
<td>0-25</td>
<td>7-15</td>
<td>8-15</td>
</tr>
<tr>
<td>MFU</td>
<td>14.20</td>
<td>10.00</td>
<td>9.50</td>
<td>0-26</td>
<td>1-21</td>
<td>3-15</td>
</tr>
<tr>
<td>NST</td>
<td>115.69</td>
<td>28.92</td>
<td>40.17</td>
<td>0-128</td>
<td>6-62</td>
<td>15-67</td>
</tr>
<tr>
<td>EFC</td>
<td>8.65</td>
<td>8.17</td>
<td>8.83</td>
<td>0-17</td>
<td>5-13</td>
<td>6-13</td>
</tr>
<tr>
<td>MSUv</td>
<td>16.15</td>
<td>14.25</td>
<td>15.92</td>
<td>0-18</td>
<td>7-18</td>
<td>11-18</td>
</tr>
<tr>
<td>MSSv</td>
<td>4.54</td>
<td>6.08</td>
<td>4.33</td>
<td>0-18</td>
<td>0-18</td>
<td>0-12</td>
</tr>
</tbody>
</table>

**Testing the Hypotheses**

The analyses of the 12 null hypotheses listed in chapter 3 are presented in the following sections. Each of the first 11 hypotheses was tested by ANCOVA. For each of the first 8 hypotheses, three separate analyses were carried out.
1. Pre- and posttest raw scores for Grade 3 alone, as Grade 3 used a different test form.

2. Pre- and posttest raw scores for grades 4 and 5 combined.

3. Pre- and posttest $T$ scores for all three grades together.

The subtests analyzed under hypotheses 9-11 were administered only to Grades 4 and 5, as the form of the tests used for Grade 3 did not include these subtests. Therefore, only the raw score analysis was computed. As mentioned in chapter 3, in order to obtain somewhat improved Power, Alpha level of .10 was used to test all hypotheses.

Hypothesis 1

There is no significant difference among the adjusted posttest means of the three groups on the CFU subtest.

Grade 3 raw scores

Table 7 presents the sample size, and pretest, posttest, and adjusted posttest means for the three groups. The ANCOVA yielded an $F$ ratio of 4.91 with 2 and 12 Degrees of Freedom and $p = .028$.

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>7</td>
<td>8.429</td>
<td>12.429</td>
<td>12.431</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>5</td>
<td>8.800</td>
<td>12.000</td>
<td>11.891</td>
</tr>
<tr>
<td>Control</td>
<td>4</td>
<td>8.000</td>
<td>9.250</td>
<td>9.381</td>
</tr>
</tbody>
</table>
Data indicate a significant difference among adjusted posttest means and suggest the null hypothesis should be rejected. However, the important assumption of homogeneity of regression was not supported for this test. It is therefore unwise to place value on or interpret the ANCOVA results. The recommended procedure in this situation is to block on pretest scores, which was not possible with such a small sample. I then analyzed the less reliable gain scores from pretest to posttest means by ANOVA. The mean pretest to posttest gains were 4.000 for SOI Plus, 3.200 for SOI Alone, and 1.250 for the Control group. Table 8 presents the results of the ANOVA.

Table 8

ANOVA of Gain Scores – CFU

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>19.388</td>
<td>2</td>
<td>9.694</td>
<td>1.92</td>
<td>.186</td>
</tr>
<tr>
<td>Error</td>
<td>65.550</td>
<td>13</td>
<td>5.042</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data indicate that the F ratio is not significant. This hypothesis is retained for gain scores. There is no significant difference among the three treatment groups with respect to gain scores on the CFU subtest.

Grades 4 and 5 raw scores

Table 9 presents the sample size and pretest, posttest, and adjusted posttest means. ANCOVA analysis indicated that assumption of homogeneity was supported for this
subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 3.9 with 2 and 24 Degrees of Freedom and $p = .034$.

Table 9

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>5.556</td>
<td>6.778</td>
<td>6.709</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>6.000</td>
<td>8.333</td>
<td>8.026</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>4.800</td>
<td>5.600</td>
<td>5.939</td>
</tr>
</tbody>
</table>

Data indicate a significant difference among adjusted posttest means. Therefore the null hypothesis is rejected. The comparison of all three pairs of means indicates that the SOI mean is significantly greater than both the SOI Plus mean and the Control mean. There is no significant difference between the SOI Plus and Control means.

Grades 3, 4, and 5 $T$ scores

Table 10 presents the sample size and pretest, posttest, and adjusted posttest means of the three groups. ANCOVA analysis indicated that assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 4.04 with 2 and 40 Degrees of Freedom and $p = .025$.

Data indicate a significant difference among adjusted posttest means. Therefore the null hypothesis is rejected. The comparison of all three pairs of means indicated that both the SOI Plus and SOI Alone group means were significantly greater than the Control
group mean. There was no significant difference between SOI Plus and SOI Alone group means.

Table 10

\textit{ANCOVA--CFU Subtest T Scores, Grades 3, 4, and 5}

<table>
<thead>
<tr>
<th>Group</th>
<th>(n)</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>39.779</td>
<td>50.028</td>
<td>48.916</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>40.660</td>
<td>51.757</td>
<td>49.986</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>34.228</td>
<td>38.156</td>
<td>41.201</td>
</tr>
</tbody>
</table>

Hypothesis 2

There is no significant difference among the adjusted posttest means of the three groups on the CFC subtest.

Grade 3 raw scores

Table 11 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. The ANCOVA yielded an \(F\) ratio of 2.84 with 2 and 12 Degrees of Freedom and \(p = .098\).
Table 11

**ANCOVA—CFC Subtest, Grade 3**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>7</td>
<td>10.143</td>
<td>11.429</td>
<td>11.856</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>5</td>
<td>11.400</td>
<td>15.400</td>
<td>15.201</td>
</tr>
<tr>
<td>Control</td>
<td>4</td>
<td>12.000</td>
<td>14.000</td>
<td>13.502</td>
</tr>
</tbody>
</table>

Data indicate a significant difference among adjusted posttest means. The null hypothesis should be rejected. However, the important assumption of homogeneity of regression was not supported for this test. Therefore, it is unwise to place value on or interpret ANCOVA results. The recommended procedure in this situation is to block on pretest scores. However, this was not possible with such a small sample. I therefore decided to analyze the less reliable gain scores from pretest to posttest by ANOVA. The mean pretest to posttest gains were 1.280 for SOI Plus, 4.000 for SOI Alone, and 2.000 for the control group. Table 12 presents the results of the ANOVA.

Table 12

**ANOVA of Gain Scores—CFC, Grade 3**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>22.009</td>
<td>2</td>
<td>11.004</td>
<td>1.31</td>
<td>.304</td>
</tr>
<tr>
<td>Error</td>
<td>109.429</td>
<td>13</td>
<td>8.418</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data indicate that the $F$ ratio is not significant. This hypothesis is retained for gain scores. There is no significant difference among the three treatment groups with respect to gain scores on the CFC subtest.

Grades 4 and 5 raw scores

Table 13 presents the sample size and pretest, posttest, and adjusted posttest means. ANCOVA analysis indicated that assumption of homogeneity was supported for this subtest, therefore. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 3.15 with 2 and 24 Degrees of Freedom and $p = .061$.

Data indicate a significant difference among adjusted posttest means. The null hypothesis is rejected. The comparison of all three pairs of means indicates that both SOI Plus and SOI Alone significantly differ from the Control group. There is no significant difference between the SOI Plus and SOI Alone means.

Table 13

*ANCOVA--CFC Subtest, Grades 4 and 5*

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>5.111</td>
<td>5.889</td>
<td>5.913</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>4.333</td>
<td>5.889</td>
<td>6.185</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>6.000</td>
<td>3.900</td>
<td>3.612</td>
</tr>
</tbody>
</table>
Grades 3, 4, and 5 T scores

Table 14 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. The ANCOVA yielded an $F$ ratio of 4.03 with 2 and 40 Degrees of Freedom and $p = .026$.

Table 14

*ANCOVA--CFC Subtest T Scores. Grades 3, 4, and 5*

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>44.496</td>
<td>48.847</td>
<td>49.603</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>44.102</td>
<td>54.561</td>
<td>55.481</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>50.612</td>
<td>44.729</td>
<td>42.944</td>
</tr>
</tbody>
</table>

Data indicate a significant difference among adjusted posttest means. The null hypothesis should be rejected. However, the important assumption of homogeneity of regression was not supported for this test. Therefore, it is unwise to place value on or interpret ANCOVA results. The recommended procedure in this situation is to block on pretest scores, which was not possible with such a small sample. I therefore analyzed the less reliable gain scores from pretest to posttest by ANOVA. The mean pretest to posttest gains were 4.351 for SOI Plus, 10.459 for SOI Alone, and -5.883 for the Control group. Table 15 presents the results of the ANOVA.
Table 15

ANOVA of Gain Scores--CFC, Grades 3, 4, and 5

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1912.758</td>
<td>2</td>
<td>956.379</td>
<td>6.10</td>
<td>.005</td>
</tr>
<tr>
<td>Error</td>
<td>6427.416</td>
<td>41</td>
<td>156.766</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data indicate that the $F$ ratio is significant. This hypothesis is rejected for gain scores. Both SOI Plus and SOI Alone have significantly greater means than the Control group. There is no significant difference between the SOI Plus group means and the SOI Alone group means.

Hypothesis 3

There is no significant difference among the adjusted posttest means of the three groups on the EFU subtest.

Grade 3 raw scores

Table 16 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .45 with 2 and 12 Degrees of Freedom and $p = .648$. 

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 16

**ANCOVA--EFU Subtest, Grade 3**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>7</td>
<td>14.286</td>
<td>16.286</td>
<td>15.792</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>5</td>
<td>13.000</td>
<td>14.600</td>
<td>14.719</td>
</tr>
<tr>
<td>Control</td>
<td>4</td>
<td>11.750</td>
<td>14.500</td>
<td>15.215</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained. The comparison of all three pairs of means indicates no significant difference between the means achieved by any of the three groups.

**Grades 4 and 5 raw scores**

Table 17 presents the sample size and pretest, posttest, and adjusted posttest means. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .20 with 2 and 24 Degrees of Freedom and $p = .819$.

The data do not indicate a significant difference among adjusted posttest means. Therefore the null hypothesis is retained.
Table 17

**ANCOVA—EFU Subtest, Grades 4 and 5**

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>14.778</td>
<td>14.000</td>
<td>13.613</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>12.444</td>
<td>14.000</td>
<td>14.384</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>13.600</td>
<td>14.000</td>
<td>14.002</td>
</tr>
</tbody>
</table>

Grades 3, 4, and 5 T scores

Table 18 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. The ANCOVA yielded an F ratio of .08 with 2 and 40 Degrees of Freedom and $p = .921$.

Table 18

**ANCOVA—EFU Subtest T Scores, Grades 3, 4, and 5**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>48.822</td>
<td>50.765</td>
<td>49.607</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>43.585</td>
<td>48.160</td>
<td>49.082</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>44.897</td>
<td>48.236</td>
<td>48.637</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis should be retained. However, the important assumption of homogeneity of regression was not supported for this test. Therefore, it is unwise to place value on or interpret ANCOVA results. The recommended procedure in this
situation is to block on pretest scores, which was not possible with such a small sample. I then decided to analyze the less reliable gain scores from pretest to posttest by ANOVA. The mean pretest to posttests gains were 1.943 for SOI Plus, 4.574 for SOI Alone, and 3.339 for the Control group. Table 19 presents the results of the ANOVA.

Table 19

ANOVA of Gain Scores—EFU Subtest. Grades 3, 4, and 5

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>51.931</td>
<td>2</td>
<td>25.966</td>
<td>.370</td>
<td>.696</td>
</tr>
<tr>
<td>Error</td>
<td>2911.261</td>
<td>41</td>
<td>71.006</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data indicate that the F ratio is not significant. This hypothesis is retained for gain scores. There is no significant difference among the three treatment groups with respect to gain scores on the EFU subtest.

Hypothesis 4

There is no significant difference among the adjusted posttest means of the three groups on the CMUr subtest.

Grade 3 raw scores

Table 20 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. The ANCOVA yielded an F ratio of 1.17 with 2 and 12 Degrees of Freedom and p = .344.
Table 20

**ANCOVA--CMUr Subtest, Grade 3**

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16.857</td>
<td>18.429</td>
<td>18.313</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>17.400</td>
<td>18.400</td>
<td>18.519</td>
</tr>
<tr>
<td>Control</td>
<td>17.250</td>
<td>17.500</td>
<td>17.554</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis should be retained. However, the important assumption of homogeneity of regression was not supported for this test. Therefore, it is unwise to place value on or interpret ANCOVA results. The recommended procedure in this situation is to block on pretest scores, which was not possible with such a small sample. I then analyzed the less reliable gain scores from pretest and posttest means by ANOVA. The pretest to posttest gains were 1.571 for SOI Plus, 1.000 for SOI Alone, and .250 for the control group. Table 21 presents the results of the ANOVA.

Table 21

**ANOVA of Gain Scores--CFU Subtest, Grade 3**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>4.473</td>
<td>2</td>
<td>2.237</td>
<td>.500</td>
<td>.619</td>
</tr>
<tr>
<td>Error</td>
<td>58.464</td>
<td>13</td>
<td>4.497</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The data indicate that the $F$ ratio is not significant. This hypothesis is retained for gain scores. There is no significant difference among the three treatment groups with respect to gain scores on the CMUr subtest.

Grades 4 and 5 raw scores

Table 22 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that assumption of homogeneity was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.91 with 2 and 24 Degrees of Freedom and $p = .169$.

Table 22

<table>
<thead>
<tr>
<th>Grade</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>10.111</td>
<td>12.667</td>
<td>12.706</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>11.000</td>
<td>13.667</td>
<td>13.583</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>10.100</td>
<td>11.600</td>
<td>11.640</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained. The comparison of all three pairs of means indicated there is no significant difference between the two experimental groups.
Grades 3, 4, and 5 T scores

Table 23 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity was supported for this subtest, therefore ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 4.19 with 2 and 40 Degrees of Freedom and $p = .022$.

Table 23

*ANCOVA--CMUr Subtest T Scores, Grades 3, 4, and 5*

<table>
<thead>
<tr>
<th>Grade</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>42.470</td>
<td>51.161</td>
<td>51.205</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>45.398</td>
<td>52.859</td>
<td>52.731</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>41.931</td>
<td>45.759</td>
<td>45.836</td>
</tr>
</tbody>
</table>

The data indicate a significant difference among adjusted posttest means. The null hypothesis is rejected. The comparison of all three pairs of means indicated that both the experimental group means are significantly greater than the Control group mean. There was no significant difference between SOI Plus and SOI Alone group means.

Hypothesis 5

There is no significant difference among the adjusted posttest means of the three groups on the CMR subtest.
Grade 3 raw scores

Table 24 presents the sample size and pretest, posttest, and adjusted posttest means for the three experimental groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .23 with 2 and 12 Degrees of Freedom and $p = .800$.

Table 24

<table>
<thead>
<tr>
<th>ANCOVA--CMR Subtest. Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>SOI Plus</td>
</tr>
<tr>
<td>SOI Alone</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Grades 4 and 5 raw scores

Table 25 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .76 with 2 and 24 Degrees of Freedom and $p = .477$.  

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 25

*ANCOVA--CMR Subtest, Grades 4 and 5*

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>14.333</td>
<td>17.111</td>
<td>16.759</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>14.333</td>
<td>18.222</td>
<td>17.870</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>12.700</td>
<td>15.600</td>
<td>16.234</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Grades 3, 4, and 5 T scores

Table 26 presents the sample size and pretest, posttest, and adjusted posttest means of the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.18 with 2 and 40 Degrees of Freedom and $p = .318$.

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.
Hypothesis 6

There is no significant difference among the adjusted posttest means of the three groups on the CMS subtest.

Grade 3 raw scores

Table 27 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an F ratio of .73 with 2 and 12 Degrees of Freedom and \( p = .501 \).

Table 27

**ANCOVA--CMS Subtest, Grade 3**

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>7</td>
<td>9.714</td>
<td>12.857</td>
<td>12.780</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>5</td>
<td>8.400</td>
<td>11.400</td>
<td>11.541</td>
</tr>
<tr>
<td>Control</td>
<td>4</td>
<td>9.500</td>
<td>10.500</td>
<td>10.458</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Grades 4 and 5 raw scores

Table 28 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .67 with 2 and 24 Degrees of Freedom and $p = .519$.

Table 28

*ANCOVA--CMS Subtest, Grades 4 and 5*

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>9.222</td>
<td>11.222</td>
<td>11.298</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>10.222</td>
<td>12.444</td>
<td>12.247</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>9.100</td>
<td>10.900</td>
<td>11.010</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Grades 3, 4, and 5 $T$ scores

Table 29 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results
can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.45 with 2 and 40 Degrees of Freedom and $p = .248$.

Table 29

*ANCOVA*—CMS Subtest T scores, Grades 3, 4, and 5

<table>
<thead>
<tr>
<th>Grade</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>42.334</td>
<td>49.274</td>
<td>49.084</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>42.548</td>
<td>49.439</td>
<td>49.181</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>40.227</td>
<td>44.499</td>
<td>44.973</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Hypothesis 7

There is no significant difference among the adjusted posttest means of the three groups on the MFU subtest.

Grade 3 raw scores

Table 30 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .22 with 2 and 12 Degrees of Freedom and $p = .804$. 

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
The data do not indicate a significant difference among adjusted posttest means.

The null hypothesis is retained.

Table 30

*ANCOVA--MFU Subtest, Grade 3*

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>7</td>
<td>7.714</td>
<td>11.286</td>
<td>11.702</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>5</td>
<td>11.600</td>
<td>13.600</td>
<td>13.003</td>
</tr>
<tr>
<td>Control</td>
<td>4</td>
<td>9.250</td>
<td>12.000</td>
<td>12.016</td>
</tr>
</tbody>
</table>

Grades 4 and 5 raw scores

Table 31 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 3.94 with 2 and 24 Degrees of Freedom and $p = .033$.

The data indicate a significant difference among adjusted posttest means. The null hypothesis is rejected. The comparison of all three pairs of means indicated that SOI Plus means were significantly greater than both the SOI Alone means and the Control means. There was no significant difference between the adjusted means of SOI Alone and the Control group.
Table 31

**ANCOVA—MFU Subtest, Grades 4 and 5**

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>7.444</td>
<td>13.333</td>
<td>13.636</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>13.111</td>
<td>10.889</td>
<td>10.458</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>11.200</td>
<td>9.100</td>
<td>9.015</td>
</tr>
</tbody>
</table>

Grades 3, 4, and 5 T scores

Table 32 presents the sample size and pretest, posttest, and adjusted posttest means for the three experimental groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an F ratio of 2.94 with 2 and 40 Degrees of Freedom and $p = .065$.

Table 32

**ANCOVA—MFU Subtest T Scores, Grades 3, 4, and 5**

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>36.938</td>
<td>48.695</td>
<td>50.012</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>49.648</td>
<td>47.628</td>
<td>46.216</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>43.508</td>
<td>41.929</td>
<td>41.832</td>
</tr>
</tbody>
</table>

The data indicate a significant difference among adjusted posttest means. The null hypothesis is rejected. The comparison of all three pairs of means indicated that both
the SOI Plus and SOI Alone group means were significantly greater than the Control group means. There was no significant difference between SOI plus and SOI Alone group means.

Hypothesis 8

There is no significant difference among the adjusted posttest means of the three groups on the NST subtest.

Grade 3 raw scores

Table 33 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. Therefore, ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.12 with 2 and 12 Degrees of Freedom and $p = .360$.

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

Table 33

<table>
<thead>
<tr>
<th>ANCOVA--NST Subtest, Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>SOI Plus</td>
</tr>
<tr>
<td>SOI Alone</td>
</tr>
<tr>
<td>Control</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Grades 4 and 5 raw scores

Table 34 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.58 with 2 and 24 Degrees of Freedom and $p = .227$.

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.

### Table 34

**ANCOVA—NST Subtest. Grades 4 and 5**

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>25.444</td>
<td>30.889</td>
<td>30.239</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>22.444</td>
<td>38.556</td>
<td>39.446</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>24.600</td>
<td>38.800</td>
<td>38.584</td>
</tr>
</tbody>
</table>

Grades 3, 4, and 5 $T$ scores

Table 35 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of 1.43 with 2 and 40 Degrees of Freedom and $p = .252$. 

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 35

ANCOVA--NST Subtest T-Scores. Grades 3, 4, and 5

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>16</td>
<td>28.851</td>
<td>34.247</td>
<td>32.594</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>14</td>
<td>26.990</td>
<td>36.001</td>
<td>36.550</td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>26.321</td>
<td>31.616</td>
<td>32.956</td>
</tr>
</tbody>
</table>

The data do not indicate a significant difference among adjusted posttest means.
The null hypothesis is retained.

Hypothesis 9

There is no significant difference among the adjusted posttest means of the three groups on the EFC subtest.

Grades 4 and 5 raw scores

Table 36 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an F ratio of .92 with 2 and 24 Degrees of Freedom and \( p = .412 \).

The data do not indicate a significant difference among adjusted posttest means.
The null hypothesis is retained.
Table 36

*ANCOVA—EFC Subtest, Grades 4 and 5*

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>9.222</td>
<td>8.778</td>
<td>8.784</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>9.444</td>
<td>9.667</td>
<td>9.677</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>7.800</td>
<td>8.500</td>
<td>8.485</td>
</tr>
</tbody>
</table>

Hypothesis 10

There is no significant difference among the adjusted posttest means of the three groups on the MSUv subtest.

Grades 4 and 5 raw scores

Table 37 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .85 with 2 and 24 Degrees of Freedom and $p = .441$.

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.
Table 37

*ANCOVA—MSUv Subtest. Grades 4 and 5*

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>13.889</td>
<td>15.889</td>
<td>15.896</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>14.889</td>
<td>16.100</td>
<td>15.914</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>13.200</td>
<td>14.300</td>
<td>14.371</td>
</tr>
</tbody>
</table>

**Hypothesis 11**

There is no significant difference among the adjusted posttest means of the three groups on the MSS subtest.

**Grades 4 and 5 raw scores**

Table 38 presents the sample size and pretest, posttest, and adjusted posttest means for the three groups. ANCOVA analysis indicated that the assumption of homogeneity of regression was supported for this subtest. ANCOVA results can be interpreted with confidence. The ANCOVA yielded an $F$ ratio of .02 with 2 and 24 Degrees of Freedom and $p = .980$.

The data do not indicate a significant difference among adjusted posttest means. The null hypothesis is retained.
Table 38

\textit{ANCOVA--MSS\textsubscript{v} Subtest, Grades 4 and 5}

<table>
<thead>
<tr>
<th>Grade</th>
<th>n</th>
<th>Pretest Mean</th>
<th>Posttest Mean</th>
<th>Adjusted Posttest Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOI Plus</td>
<td>9</td>
<td>2.111</td>
<td>3.889</td>
<td>4.093</td>
</tr>
<tr>
<td>SOI Alone</td>
<td>9</td>
<td>5.444</td>
<td>4.333</td>
<td>4.290</td>
</tr>
<tr>
<td>Control</td>
<td>10</td>
<td>6.800</td>
<td>4.600</td>
<td>4.455</td>
</tr>
</tbody>
</table>

Hypothesis 12

There is no significant difference among the proportions in each of the three experimental groups who will make an improvement of at least one grade level on the Informal Reading Inventory.

This hypothesis was tested by chi-square analysis for all three grades together, as separate analyses involved a high proportion of small expected frequencies. Table 39 is the contingency table relating to this hypothesis.

Table 39

\textit{Chi-Square Analysis of Reading Gains}

<table>
<thead>
<tr>
<th></th>
<th>SOI Plus</th>
<th>SOI Alone</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>No Gain</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Gain</td>
<td>16</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
The value of chi-square was 27.731 with 2 Degrees of Freedom and $p < .00005$. The null hypothesis is rejected. There is a significant difference among the proportions of the three groups making a gain of at least one grade level in reading. A significantly lower proportion of the control group than of the two experimental groups made the hypothesized growth.

As it would be expected that a student would gain at least one grade level in reading in a school year, I expanded hypothesis 12 as follows.

Hypothesis 12a

There is no significant difference among the proportions for the three groups making a gain of more than one grade level in reading.

Table 40

*Expanded Chi-Square Analysis of Reading Level Gains*

<table>
<thead>
<tr>
<th></th>
<th>SOI Plus Subjects</th>
<th>SOI Alone Subjects</th>
<th>Control Subjects</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Gain</td>
<td>0 0</td>
<td>0 0</td>
<td>10 71.4</td>
<td>10</td>
</tr>
<tr>
<td>1 Year Gain</td>
<td>5 31.3</td>
<td>2 14.3</td>
<td>1 7.1</td>
<td>8</td>
</tr>
<tr>
<td>More Than 1 Year Gain</td>
<td>11 68.7</td>
<td>12 85.7</td>
<td>3 21.4</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>16 100</td>
<td>14 100</td>
<td>14 100</td>
<td>44</td>
</tr>
</tbody>
</table>

For these data, the value of chi-square was 29.279 with 4 Degrees of Freedom and $p < .0005$. The null hypothesis is rejected. There is a significant difference among the proportions of the three groups making a gain of at least one grade level in reading. A
significantly lower proportion of the control group than of the two experimental groups made the hypothesized growth.

Hypothesis 12b

There is no significant difference among the proportions for the two experimental groups who make an improvement of one or more grade levels in reading.

Table 41

*Chi-Square Analysis of Gains in Experimental Groups*

<table>
<thead>
<tr>
<th></th>
<th>SOI Plus</th>
<th></th>
<th>SOI Alone</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subjects</td>
<td>%</td>
<td>Subjects</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>1 Year</td>
<td>5</td>
<td>71.4</td>
<td>2</td>
<td>47.8</td>
<td>7</td>
</tr>
<tr>
<td>More than 1 Year</td>
<td>11</td>
<td>28.6</td>
<td>12</td>
<td>52.2</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100</td>
<td>14</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

As the smallest expected frequency in this 2 x 2 table was less than 5, Yates Correction was used. This yielded chi-square = 0.440, with $p = .5071$. The null hypothesis is retained. There is no significant difference between the proportions of the SOI Plus group and the SOI Alone group making gains of one or more year-levels in reading.

**SOI Learning Profiles**

The remaining research question was taken from the third general hypothesis. SOI Learning Profiles are examined and discussed descriptively. The question was: "Do
students with deficient reading skills share similarities in SOI learning profiles that would indicate specific instructional needs?" The Meekers posit the following for each profile.

Figural learners

These learners have the ability to work with shapes, objects, and spatial relationships. Students who are figural learners score high on most of the Figural subtests and do poorly on the Semantic subtests. Figural learners are often nonconceptual and may have difficulty with reading comprehension. They believe that if a child's learning abilities are predominantly Figural, he/she will probably not learn to read.

Students with average (or above) Figural abilities and below average Semantic abilities equaled 11% (2 females and 1 male) of the research group.

Symbolic learners

These learners have the ability to work with numbers, letters, and musical notes. Students who are symbolic learners will score higher on the Symbolic subtests than on the Semantic subtests. These students may have good auditory memories, are also nonconceptual, and thus have difficulty with reading comprehension. They should respond well to notational systems such as phonics.

This implies that if a child is average or above in Symbolic abilities, then he/she will read fluently, but have difficulty with the conceptual nature of the text, or comprehension. Students with average (or above) Symbolic abilities, below average Figural abilities, and either average or below Semantic abilities equaled 25% (3 females and 8 males) of the research groups.
Semantic learners

These learners have the ability to work with words and ideas. They are highly conceptual and visual. They score high on the Semantic subtests and many of the Figural subtests. Semantic learners are good at processing the conceptual content of language, which gives them an advantage for learning.

This implies that students with Semantic learning abilities will do well in school and not be deficient readers. Students with average (or above) Semantic abilities equaled 52% (9 females and 14 males) of the research group. An additional, but unstated, assumption is that if a student scores in the average or above average ranges on all Figural, Symbolic, and Semantic subtests, then he/she should possess the abilities to succeed in school, specifically reading. However, 36% of the research group attained these scores in contradiction to the theory for deficient readers.

Both experimental groups made significantly larger gains in reading achievement than the control group. Thus, the difference between the two groups warrants examination of the SOI learning profiles and their relationship to reading achievement. The experimental and control groups varied on only two learning profiles: students scoring average or above in Figural, Symbolic, and Semantic abilities and those students scoring below average in all three. Forty percent of the students from the experimental groups scored average or above in Figural, Symbolic, and Semantic abilities, while only 29% of the students from the control group scored average or above in all three. Only 10% of the students from the experimental groups scored below average in Figural, Symbolic, and Semantic abilities, while 36% of the control group scored below average in all three.
With the implied assumptions by the Meekers, it would be expected that students with average or above average Semantic abilities would not have reading or comprehension difficulties. The logical assumption then would be that if they did have average or above average Semantic abilities, they should be the students to make the most gains in reading given intervention. This assumption was proven by showing that 41% of the students from the experimental groups showed at least 2 years' gain in reading achievement. Seventeen percent of the students with below average Figural and Semantic abilities, but average to above average Symbolic abilities, made at least 2 years' gain in reading achievement. The third group making significant reading gains (10%) had an SOI learning profile which consisted of below average abilities in all Figural, Symbolic, and Semantic subtests.

Results indicate that specific learning profile patterns for poor readers do not exist for this particular group of students.
CHAPTER V

SUMMARY. CONCLUSIONS. AND RECOMMENDATIONS

This chapter is divided into three sections: The first section summarizes the research problem, literature, and procedures. The second section presents findings, discusses the findings in relation to the research questions, and offers conclusions. The third section offers recommendations for practice and further research.

Summary

Problem and Purpose

The purpose of this study was to determine if participation in the Structure of Intellect (SOI) remediation lab has a measurable effect on reading achievement with third-, fourth-, and fifth-grade students. Additionally, this study sought to describe Structure of Intellect (SOI) learning profiles of students with below-grade-level reading skills. M & M Systems, the publisher of the SOI curriculum, suggest that students with low Figural and high Symbolic and Semantic learning abilities will be proficient readers and have the ability to comprehend what they read. Subsequently, since this study examined students who read below grade level, it would be assumed that the deficient readers would be lacking in Semantic and Symbolic abilities.

This research is important for several reasons. In a general sense, it is important to know if the current SOI intervention model leads to statistically significant improvement in reading and, therefore, can be viewed as a viable practical intervention
procedure. If, in fact, a specific SOI learning profile can be identified and matched with a preferred reading instructional method, the countless hours of trial and error may be avoided.

**Literature Review**

In order truly to appreciate this study, one must have a brief understanding of the history of intelligence and how it relates to education. As cited by Sternberg (1990), there is little more agreement today about intelligence than in the past 3,000 years. While Guilford's Structure of Intellect (SI) theory is not presently accepted by scholars, the SI theory was predominant in the literature for at least the first half of the 1990s. Guilford helped expand the reach of experimental methods to all areas of psychology. Other theorists, in some way, used Guilford's SI theory as a springboard for their own theories.

Not only did Guilford's SI theory help expand experimental methods, it also challenged us to reconsider our ideas about the stability and malleability of one's intelligence. His graduate student, Mary Meeker, and later her husband, Robert Meeker, helped to bring the SI theory to the present by expanding its reaches into educational practice and further refining the theory to what is now called the Structure of Intellect theory (SOI).

The Meekers have dedicated their lives to changing the intelligence paradigm in education, trying to convince educators that intelligence can be taught and is not a static concept. While there is an enormous amount of literature on Guilford's SI theory, the scholarly research on Meeker's SOI theory is sparse. Additionally, the SOI intervention lab, as it currently exists, is not well referenced in scholarly publications. There was one article obtained through the ERIC database (Stock & DiSalvo, 1998) which examined the
current SOI intervention lab related to academic achievement in general. This study investigated SOI subtest gains along with reading and math achievement. Gains were noted in most subtests and in mathematics, but not in reading. Some additional field studies (Bradfield & Slocumb, 1997; Sisk, 1998) examined the current SOI intervention model. They examined reading and math achievement on a larger scale and found significant improvement in both math and reading.

Regardless of the amount of formal research on the current SOI model for intervention, it seems to fit the school environment well. Educators seem to opt for pragmatic intervention over theoretically based models. The fact that the Meekers have succeeded in changing the paradigm for intelligence in some systems is a victory. The SOI intervention lab was installed in approximately 100 schools nationwide at the time of this research project. It deserves attention that is more scholarly.

Research Procedures

This study was a quasi-experimental field study in which pretests and posttests were compared for gains on SOI abilities and reading achievement for two experimental groups and a control group. The students in the experimental group were all selected from School A. They were assigned to groups by stratified random sampling (grade and gender). The SOI Plus group received the SOI remediation lab along with direct reading instruction. The SOI Alone group received only the SOI remediation lab as intervention.

The population for the study consisted of 44 students. Grades 3 through 5 from two schools in a Northern Indiana School District. Fifty-five students met the selection criteria. Due to attrition, 44 students completed the study.
Four certified and two paraprofessional individuals were recruited to collect data for this study. Certified personnel included the school psychologist (the researcher), a general education teacher, and two elementary school principals. The two paraprofessional individuals were Title I aides who had worked in the school system for at least 5 years. The four certified personnel were also trained on administration of the SOI abilities tests by Meeker-licensed trainers.

Pretest

The SOI pretest, Form L and Form CR, were administered to children in small groups by an individual trained in the administration of the test by the Meekers. The Burns and Roe Informal Reading Inventories (IRIs) were administered individually to all students. Administration and scoring guidelines for the IRIs were presented in a training session prior to the project. Guidelines can be found in Appendix A.

Intervention

A trained technician conducted the SOI remediation. Meeker-licensed trainers and the school psychologist trained this technician. Title I paraprofessional individuals were responsible for direct reading instruction for the SOI Plus group, using the SRA Reading Mastery Series. Inservice education was provided for Title I teachers on the SRA Reading Mastery Series before they were asked to deliver instruction. The school psychologist closely monitored all SOI remediation and direct reading instruction.

Students in both experimental groups received two, 45-minute sessions per week in the SOI remediation lab. Students engaged in three sets of activities during each 45-minute session. Activities included sensory integration, vision system training, and SOI
learning modules in the workbook forms. Students in the Control group received no additional instruction outside the normal general education curriculum.

Students in the SOI Plus group received 30 minutes of direct reading instruction at least 4 days per week. Students in the SOI Alone group and Control group received no reading instruction other than from the general education curriculum.

Posttest

The SOI posttest, Form L and Form CR, was administered to children in small groups. The Burns and Roe IRIs were administered individually to all students. Administration and scoring guidelines were presented in a training session prior to the project. The same group of people who administered pretests also administered the posttests.

Instrumentation

Students were tested with the SOI tests and an informal reading inventory (IRI). Two forms of the SOI test were used to accommodate students of different grades. Students in Grade 3 were tested using SOI Form L. Students in Grades 4 and 5 were tested using SOI Form CR. All 44 students were tested with the Burns and Roe Informal Reading Inventory.

The SOI tests were used to assess the abilities that the Meekers suggest are associated with reading. For all grades, eight subtests were administered, common to both forms: CFU, CFC, EFU, CMUr, CMR, CMS, MFU, and NST. An additional three subtests were administered to Grades 4 and 5: EFC, MSUv, and MSSv.
There was some difficulty with the SOI testing and analysis procedures. The literature refers to the group of SOI tests as the SOI-LA test. There are several versions of the SOI-LA tests listed in the latest technical manual (Meeker et al., 1985). However, none of them listed are Forms CR or P, which were the forms used for this study. The Meekers, through M & M Systems, recommended these forms. Through personal correspondence with Dr. Robert Meeker, I discovered that Form A was really Form CR and Form P was really Form L. (Technical data for Form CR (A) are in the 1985 technical manual Meeker et al., 1985). However, the technical data in the manual for Form P do not match information for Form L. Further data for Form L was requested from Dr. Robert Meeker. Form CR was copyrighted in 1991 and Form L in 1993, but norming information with updates made to the tests has not been published since 1985.

The Burns and Roe IRI was administered to all 44 students as pre- and posttests. Pretest and Posttest reading levels were defined as reading at the instructional level. Students were asked to read and answer comprehension questions on several inventories until the criteria for the instructional level were met. Instructional level is defined by Burns and Roe as the level that should be used for teacher reading strategies, "the level a student should be placed for 'reading class' " (Burns & Roe, 1993, p. 3). See Appendix B for percentages needed for instructional levels.

**Findings**

Findings are summarized in relation to each of the 12 null hypotheses. The first 11 hypotheses were tested by Analysis of Covariance, with posttest scores as criterion and pretest scores as covariates. For the first 8, 3 analyses were run. In the cases where the assumption of homogeneity of regression was not supported, a one-way ANOVA was
used to compare gain scores. Three separate analyses were run: (1) raw scores pre- and posttest for Grade 3 alone, (2) raw scores for Grades 4 and 5 combined, (3) \( T \) scores pre- and posttest to analyze all three grades together. Null hypotheses 9 to 11 analyzed only Grades 4 and 5 because those subtests were unique to the Form CR used with these grades. The remaining three hypotheses, 12, 12a, and 12b, addressed growth in reading levels by chi-square analysis.

**Hypothesis 1.** There is no significant difference among the adjusted posttest means of the three groups on the CFU subtest. For Grade 3, gain scores had to be used. The null hypothesis was retained. For Grades 4 and 5, the ANCOVA yielded a significant difference; thus, the null hypothesis was rejected. SOI Alone adjusted means were significantly greater than the means of the SOI Plus or Control groups. There was no significant difference between SOI Plus and Control group means.

For the combined groups there was a significant difference among \( T \) score means, thus the null hypothesis was rejected. The adjusted means of both the SOI Plus and SOI Alone were greater than that of the control group. There was no significant difference between the SOI Plus and SOI Alone group means.

**Hypothesis 2.** There is no significant difference among the adjusted posttest means of the three groups on the CFC subtest. For Grade 3, gain scores had to be used. The null hypothesis was retained. For Grades 4 and 5, the ANCOVA yielded a significant difference; thus, the null hypothesis was rejected. Both SOI Plus and SOI Alone adjusted means were significantly greater than the means of the SOI Plus or Control groups. There was no significant difference between SOI Plus and SOI Alone group means.
For the combined groups there appeared to be a significant difference among $T$ score means; however, gain scores had to be used. The null hypothesis was rejected for gain scores. Both SOI Plus and SOI Alone showed significantly greater adjusted means than the Control group.

**Hypothesis 3.** There is no significant difference among the adjusted posttest means of the three groups on the EFU subtest. For Grade 3, there was no significant difference among adjusted posttest means, hence the null hypothesis was retained. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.

For the combined groups gain scores had to be used to examine $T$ score means. There was not a significant difference, thus the null hypothesis was retained.

**Hypothesis 4.** There is no significant difference among the adjusted posttest means of the three groups on the CMUr subtest. For Grade 3, gain scores had to be used. The null hypothesis was retained. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.

For the combined groups there was a significant difference among $T$ score means, thus the null hypothesis was rejected. The adjusted means of both the SOI Plus and SOI Alone were greater than that of the control group. There was no significant difference between the SOI Plus and SOI Alone group means.

**Hypothesis 5.** There is no significant difference among the adjusted posttest means of the three groups on the CMR subtest. For Grade 3, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.
For the combined group there was no significant difference among $T$ score means. thus the null hypothesis was retained.

*Hypothesis 6.* There is no significant difference among the adjusted posttest means of the three groups on the CMS subtest. For Grade 3, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.

For the combined group there was no significant difference among $T$ score means, thus the null hypothesis was retained.

*Hypothesis 7.* There is no significant difference among the adjusted posttest means of the three groups on the MFU subtest. For Grade 3, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained. For Grades 4 and 5, the ANCOVA yielded a significant difference, thus the null hypothesis was rejected. SOI Plus adjusted means were significantly greater than both the SOI Alone and Control group means. There was no significant difference between the adjusted means of SOI Alone and the Control group.

For the combined groups there was a significant difference among $T$ score means, thus the null hypothesis was rejected. The adjusted means of both the SOI Plus and SOI Alone were greater than those of the Control group. There was no significant difference between the SOI Plus and SOI Alone group means.

*Hypothesis 8.* There is no significant difference among the adjusted posttest means of the three groups on the NST subtest. For Grade 3, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained. For Grades 4 and 5, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained.
For the combined group there was no significant difference among $T$ score means. Thus the null hypothesis was retained.

**Hypothesis 9.** There is no significant difference among the adjusted posttest means of the three groups on the EFC subtest. Grade 3 was not administered the EFC subtest. For Grades 4 and 5, the ANCOVA did not yield a significant difference; thus, the null hypothesis was retained.

**Hypothesis 10.** There is no significant difference among the adjusted posttest means of the three groups on the MSUv subtest. Grade 3 was not administered the MSUv subtest. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.

**Hypothesis 11.** There is no significant difference among the adjusted posttest means of the three groups on the MSSv subtest. Grade 3 was not administered the MSSv subtest. For Grades 4 and 5, the ANCOVA did not yield a significant difference, thus the null hypothesis was retained.

**Hypothesis 12.** There is no significant difference among the proportions in each of the three groups who make an improvement of at least one grade level in reading. The chi-square was significant, hence the null hypothesis was rejected. While 100% of the two experimental groups made at least 1 year's growth in reading, only 29% of the Control group did so.

**Hypothesis 12a.** There is no significant difference among the proportions in each of the three groups who will make an improvement of one or more grade levels. The chi-square was significant, hence the null hypothesis was rejected. Only 21% of the Control
group made an improvement of more than 1 year's growth in reading, while 86% of the SOI Alone group and 69% of the SOI Plus group did so.

*Hypothesis 12b.* There is no significant difference among the proportions in each of the two experimental groups who make an improvement of one or more grade levels in reading. This hypothesis was tested as a follow-up to hypothesis 12a because of a difference between the experimental and control groups. The chi-square was not significant; hence the null hypothesis was retained. No significant difference exists between the proportions of the two experimental groups.

The third research question asked "Do students with deficient reading skills share similarities in SOI learning profiles that would indicate specific instructional needs?" The Meekers posit the following for each profile.

**Figural learners**

These learners have the ability to work with shapes, objects, and spatial relationships. Students who are Figural learners score high on most of the Figural subtests and do poorly on the Semantic subtests. Figural learners are often nonconceptual and may have difficulty with reading comprehension. The Meekers believe that if a child's learning abilities are predominantly Figural, he/she probably will not learn to read.

Students with average (or above) Figural abilities and below average Semantic abilities equaled 11% (4 females and 1 male) of the research group.
Symbolic learners

These learners have the ability to work with numbers, letters, and musical notes. Students who are Symbolic learners will score higher on the Symbolic subtests than on the Semantic subtests. These students may have good auditory memories and are also nonconceptual, thus having difficulty with reading comprehension. They should respond well to notational systems such as phonics.

This implies that if a child is average or above in Symbolic abilities, then he/she will read fluently, but have difficulty with the conceptual nature of the text or comprehension. Students with average (or above) Symbolic abilities, below average Figural abilities, and either average or below in Semantic abilities equaled 25% (3 females and 8 males) of the research groups.

Semantic learners

These learners have the ability to work with words and ideas. They are highly conceptual and visual. They score high on the Semantic subtests and many of the Figural subtests. Semantic learners are good at processing the conceptual content of language, which gives them an advantage for learning.

This implies that students with Semantic learning abilities will do well in school, thus not be deficient readers. Students with average (or above) Semantic abilities equaled 52% (9 females and 14 males) of the research group. An additional, but unstated, assumption is that if a student scores in the average or above average ranges on all Figural, Symbolic, and Semantic subtests, then he/she should possess the abilities to succeed in school, specifically reading. However, 36% of the research group attained these scores in contradiction to the theory for deficient readers.
Discussion

I originally embarked on this research study for two reasons. First, because school psychologists are asked to test and place students without real hope for educational change. I subscribe to the notion that intelligence is a changeable, not static, multi-dimensional concept and not a single number. It is one thing to subscribe to an idea, and another to find a way to impact students with those ideas.

Second, effective and affordable reading intervention is always an educator's dream. When planning the implementation of this program for the school, it made sense to examine reading achievement. In asking the question, "Can the SOI intervention model offer children the opportunity for significant improvement in reading?" I discovered that the literature did not provide a clear picture of what this remediation procedure was all about. I was surprised, when I was trained by the staff at M & M systems and IDS, that the SOI remediation lab had only a small portion of remediation associated with what the literature described as the SOI curriculum. The lab integrated the SOI curriculum, sensory integration, focusing skills, and vision system therapy. All of these offer controversial results related to reading or general academic gain.

The research study appeared to be inviting on the surface. However, as is common with field studies in general and this one specifically, numerous extraneous variables and unanswered questions surfaced. In retrospect, I might have also asked the question, "Does the combination of sensory integration, focusing skills, vision system training, and SOI curriculum produce gains in reading achievement and intelligence quotients?"
While controlling the extraneous variables in any research study is a challenge, controlling them in a field study is even more of a challenge. For example, getting the students into the lab and into reading instruction on a daily basis was a challenge. There are holidays, snow days, and substitute teachers. Though this research project had the support of the administration, teachers and staff were not easily convinced. The teacher might argue that it was more important for the student to stay in class for an art project or a particular activity. Additionally, the Title I teachers did not easily engage in the direct reading instruction program. They had been accustomed to doing crafty, “fun” type math, reading, or spelling activities with the students, but with no specific scope or sequence. To get them to maintain the 30 minutes of reading instruction outlined by the program took a great deal of effort. They were trained. I observed them on unannounced occasions, and they observed each other. Still, they often wanted to vary from the curriculum to do math or spelling or an art activity with the children.

Field studies have to be implemented with administrative support and in keeping with the already existent climate as much as possible. For this reason, IRIs were used as the reading measures for this project. The principal used them to measure individual student growth as well as to offer the teacher valuable feedback for instruction throughout the year. While I know that the IRIs administered for this study were done in a systematic way, it would have been ideal to add a standardized component. It would have been better if a standardized reading assessment and an intelligence measure, perhaps the WISC-III, could have been administered alongside the IRIs. However, in this field study, it was not possible. The biggest impediment lay in finding someone outside the school personnel qualified to administer these tests. All school personnel were
already teaching or responsible for administering the SOI tests or the IRIs. Additional personnel would have to be paid; there was no additional money. Another factor was the amount of time the children were missing from their classrooms for testing with the IRIs and SOI tests. The pre- and posttesting occurred at the beginning and ending of the year, which is a very difficult time for scheduling.

I hoped that the SOI learning profiles would yield some predictive results for deficient readers. Analysis of the profiles suggested no particular pattern for understanding the abilities, or lack of abilities, of deficient readers. Had a particular profile emerged, the predictive value for reading remediation would have been increased.

The most perplexing portion of this study was the analysis of why the learning abilities subtests did not rise uniformly as did the students’ reading scores. The SOI theory is based on the assumption that, as the learning abilities are increased, so will the child’s ability to learn, in this case, read. While both the experimental groups showed tremendous gains in reading, only four of the abilities measured that were associated with reading showed improvement. Three of the four subtests were measures of Figural abilities. Fifty-two percent of all subjects scored average or above on the Figural dimension on the pretest; this is not a disproportionate number. The experimental groups showed significant growth on these subtests (CFU, CFC, MFU, and CMU) compared to the control group. The percentages of students in the experimental and control groups scoring average or above on Figural abilities were examined. The experimental groups had only a slightly higher percentage of students (56%) than the control group (44%). It is possible that the students in the experimental groups may have received incidental instruction in Figural areas from their general education classrooms. While there is no
clear reason why the groups did better primarily on the Figural subtests. I believe it was
due directly to the instruction in the lab, as it is clear that the control group did not make
as much progress. It is possible that the difference occurred primarily because of the
difference in participants from each school, though schools were matched as closely as
possible.

The groups showed no gains in any of the remaining 7 subtests (EFU, CMR,
CMS, NST, EC, MSU, MSS). The Symbolic subtests of NST, MSU, and MSS showed
the most surprising results, especially because 68% of the subjects scored high on the
Figural pretest. These subtests dealt specifically with speed of word recognition, visual
attending, and concentration. Students engaged in activities for these proposed abilities
(i.e., visual tracking and speed of word recognition) each time that they visited the SOI
remediation lab. This makes one wonder about the efficacy of visual therapy and sensory
integration as an academic intervention. Without research on individual activities of the
lab, we cannot be sure.

Conclusions

The conclusions are organized in relation to the research questions.

1. Is there a difference in scores on the Structure of Intellect-Learning Abilities
(SOI-LA) pre- and posttests for students receiving (a) a combination of SOI and Science
Research Associates (SRA) direct reading instruction as an intervention method (SOI
Plus) and (b) SOI instruction only as an intervention method (SOI Alone) and (c) neither
of the two intervention methods (control group).

The results from this study indicate a difference in scores on only 4 of the 11
subtests: CFU, CFC, CMU, and MFU. These subtests measure visual closure, visual
conceptualization, vocabulary understanding, and visual memory for details. For each of these subtests, both experimental groups made significantly larger gains than the control group.

2. Is there a difference in reading achievement levels pre- and posttest for students receiving (a) a combination of SOI and SRA instruction as an intervention method and (b) SOI instruction only as an intervention method, and (c) neither of the two intervention methods.

The SOI remediation lab was supported as a viable intervention for reading for students with below-grade-level reading skills in Grades 3, 4, and 5. These data show that all the students in the SOI Plus group and the SOI Alone group gained at least 1 year in reading, while only 28.6% of the control group showed at least 1 year’s reading growth. In fact, post hoc analysis showed that 43% of the experimental groups increased reading levels to match their current grades.

3. Do students with deficient reading skills share similarities in SOI learning profiles that would indicate specific instructional needs?

A specific profile that might describe or predict deficient readers did not emerge. To use the SOI Learning Abilities tests (Forms CR and L) for testing and identification purposes alone would not have been prudent for this sample. A reading test had to be administered to determine reading levels. The SOI Learning Abilities Tests (Forms CR and L) offer information for remediation, but their usefulness as a test for multidimensional intelligence and prediction needs further examination.

Regardless of the current research situation, educators tend to choose pragmatic interventions. While there are limitations to this field study, the conclusions are
Students engaged in the SOI remediation lab made significant gains in reading achievement. There were no significant differences between those students participating in the lab alone and those receiving daily direct reading instruction also. The results suggest that money spent to implement the lab is money well spent. The findings of this study question the efficacy of direct reading instruction alone.

**Implications for Practice**

1. Although we do not know which portion of the lab was responsible for helping children in reading, the intervention as a model proved to be effective for students in this sample. Grades 3, 4, and 5.

2. School psychologists and educators will need to continue their search for a multidimensional test of intelligence. While the SOI Learning Abilities Tests (Forms CR and L) proved useful to guide remediation, their usefulness as a single test of measured abilities needs further examination.

3. The SOI lab may also serve to bolster students' opinions of themselves. My experience was that regardless of reading gain, students attending the lab talked about themselves as more capable learners. While it needs further investigation, this aspect alone may be worthwhile for students.

**Recommendations for Further Research**

1. The possibilities for further research with the SOI remediation lab are endless. There is only one publication, on the ERIC database, which examines the SOI remediation lab as it currently exists (called *Bridges* learning lab).
2. Research is needed to examine each component of the remediation lab independently: the vision training component, the SOI model curriculum, and sensory integration. Measuring each component in relation to reading, math, and IQ gains would be useful.

3. This research study should be repeated with a larger sample size. It would be advantageous to select both experimental and control subjects from the same school. It was not possible in this case.

4. While the direct reading instruction used here is substantiated by research, many other programs do as well, thus replicating this study with another reading method would also be useful.

5. Examination of reading gains for different groups of children should be done. Subjects separated by types of reading errors may be useful, such as those with poor fluency and decoding, poor comprehension, and so on.

6. Examination of students' perceptions of their learning abilities is another area of interest for further study.

7. While not discussed in the text, an unexpected qualitative finding is worth mentioning. Lab activities appeared to help students gain bodily control and increase attentional capacities in the classroom. Further examination in this area is warranted.
APPENDIX A

HUMAN SUBJECTS REVIEW BOARD APPROVAL
November 5, 1998

Donna Campbell
2258 Invicta
Niles, MI 49120

Dear Donna:

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS

On behalf of the Human Subjects Review Board (HSRB) I want to advise you that your proposal has been reviewed and approved. You have been given clearance to proceed with your research plans.

All changes made to the study design and/or consent form after initiation of the project require prior approval from the HSRB before such changes are implemented. Feel free to contact our office if you have any questions.

The duration of the present approval is for one year. If your research is going to take more than one year, you must apply for an extension of your approval in order to be authorized to continue with this project.

Some proposal and research designs may be of such a nature that participation in the project may involve certain risks to human subjects. If your project is one of this nature and in the implementation of your project an incidence occurs which results in a research-related adverse reaction and/or physical injury, such an occurrence must be reported immediately in writing to the Human Subjects Review Board. Any project-related physical injury must also be reported immediately to the University physician, Dr. Loren Hamel, by calling (616) 473-2222.

We wish you success as you implement the research project as outlined in the approved protocol.

Sincerely,

James R. Fisher

Human Subjects Review Board

c: Donna Habenicht

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
APPENDIX B

IRI ADMINISTRATION GUIDELINES
IRI Criteria

<table>
<thead>
<tr>
<th>Level</th>
<th>Word Recognition</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional</td>
<td>gr 1-2 85% or higher and 75% or higher</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gr 3-5 95% or higher and 80% or higher</td>
<td></td>
</tr>
</tbody>
</table>

The Instructional reading level is the level at which a person can read with understanding with the teacher's assistance. The reader has 85% or better word recognition (misses no more than fifteen words in a hundred) as a first or second grader or 95% or better word recognition (misses no more than five words in a hundred) as a third grader or above, and he or she has 75% or better comprehension (misses no more than two questions out of eight).

Material at a student's instructional level should be used for teaching reading strategies. This is the level at which the student should be placed for reading.

One particular area that is often misunderstood is the set of percentages given for the levels. What level should be assigned if a student makes a word recognition score of 90 to 95 percent and scores between 50 and 75 percent on comprehension?

To answer this question, which comes up frequently, the teacher should study all of the data gathered. The appropriate decision is sometimes that it is a "questionable instructional level" and sometimes that it is a "questionable frustration level."

A few examples will illustrate how the examiner must use personal judgment in deciding the level at which a student should be ranked.

**Student A:**
- word recognition: 94%
- comprehension: 100%

Since the word recognition score is so close to the Instructional level criterion, and since comprehension is perfect, this could be accepted as a probable indicator of Instructional level.

**Student B:**
- word recognition: 92%
- comprehension: 45%

Though the word recognition score is slightly above the frustrational level criterion, the comprehension score reflects inadequate responses to more than half of the questions. Thus, this student may be considered to have reached frustration level when reading this material.

**Student C:**
- word recognition: 93%
- comprehension: 70%

This mixture of scores indicates a need to analyze the types of errors made. Based only on the data provided, the best conclusion might be that at this point, the pupil is at either the Instructional or the Frustrational level; the Instructional level is more likely if signs of tension and frustration are absent.
Administration of the IRI

- Tell the student what will be expected during the assessment process.

- Read the introductory statement to the student.

- Ask the student to read the passage orally. Mark all miscues on the teacher's copy as the student reads. (See attached miscue key.)

- Remove the passage from the student's view, and ask the accompanying comprehension questions. Record incorrect responses. Remember that no partial credit can be given on comprehension questions.

- If the student met both the criteria (word recognition and comprehension) for the instructional level, STOP. If not, move down as many passages as needed before you find the child's instructional level. If you find that the student cannot read the PP (pre-primer level), then it is okay to say that the student is reading below a PP level. Remember the criteria for instructional level is different for each grade level.

- When the student reaches a frustration level on the passage, you may abandon that passage and move down a level.
Recording Reading Miscues

Many teachers find it helpful to tape-record the student's oral reading. That way, if the student reads rapidly or you miss what the student said, you have a record of the student's performance.

There are many systems for marking oral reading errors, or miscues. For consistency, we will be using the system outlined in our basal series. The following chart lists the major types of miscues and how they should be marked.

<table>
<thead>
<tr>
<th>Reading Miscue</th>
<th>Marking</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. omissions</td>
<td>Circle the word, word part, or phrase omitted.</td>
<td>I will let you go in.</td>
</tr>
<tr>
<td>2. insertions</td>
<td>Insert a caret (') and write in the inserted word or phrase.</td>
<td>We bought a parrot.</td>
</tr>
<tr>
<td>3. substitutions</td>
<td>Write the word or phrase the student substitutes over the word or phrase in the text.</td>
<td>Dad fixed my bike.</td>
</tr>
<tr>
<td>4. mispronunciations</td>
<td>Write the phonetic mispronunciation over the word.</td>
<td>Have you fed the dog?</td>
</tr>
<tr>
<td>self-corrections</td>
<td>Write the letters SC next to the miscue that is self-corrected.</td>
<td>We took our space.</td>
</tr>
<tr>
<td>repetitions</td>
<td>Draw a line under any part of the text that is repeated.</td>
<td>It is your garden now.</td>
</tr>
<tr>
<td>punctuation</td>
<td>Circle punctuation missed. Write in any punctuation inserted.</td>
<td>Take them home. Then come back, and you and I will go to town.</td>
</tr>
<tr>
<td>hesitations</td>
<td>Place vertical lines at places where the student hesitates excessively.</td>
<td>Pretend this is mine.</td>
</tr>
</tbody>
</table>
APPENDIX C

CONSENT FORM
Dear Parent:

Your child has needed some additional help in language arts. It has been recommended that s/he participate in an instructional program that will help build learning abilities and thinking skills. These specific learning abilities will enhance your child's academic performance. We are confident that your child will benefit from participation in the Bridges Learning Lab. Participation in the lab will occur mainly during CAMPE time.

Please return this permission slip as soon as possible. We look forward to working with ______________________ in Bridges Learning Lab. Students usually refer to the lab as Brainy Lane.

If you have any questions or concerns, please call the Brainy Lane staff at 259-3743.

Sincerely,
Bridges/Brainy Lane staff

My child ________________________________ has permission to begin an Instructional program for specific learning abilities in the Bridges Learning Lab/Brainy Lab.

__________________________________________
Signature

__________________________________________
Date

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
As you know, Penn Harris Madison school corporation is always looking for new ways to help students succeed. This year children from Elm Road Elementary and Elsie Rogers Elementary are participating in a specific research study about reading and language arts achievement. My name is Donna Campbell and I am organizing this effort for the corporation and for my doctoral dissertation through Andrews University.

In order to know which teaching strategies are most effective, we must collect data on many students. Students in the study will be asked to complete a reading/language arts assessment. This assessment will be done both in a small group setting and on an individual basis. Individually, your child will be administered an informal reading inventory. The information from this reading inventory can help the teacher better teach your child. The teacher is free to share that information with you if you would like. Otherwise, your child's name will never be used. Instead, an identification number will be assigned, and referred to only in that way.

You will be allowed to ask questions and receive satisfactory answers before consent is offered. Participation in this study is purely voluntary. Your child will miss very little time from his/her class time. This is not meant to be a stressful experience for your child. In fact, the assessment process will most likely be less demanding than daily classroom expectations. If at any time your child feels uncomfortable or does not want to continue, they may do so.

If you allow your child to participate, both you and teachers can gain valuable information regarding his/her reading and comprehension level. All information gathered, can be used in some way, by his/her teacher. But most important, your child will be helping us to learn more about how all children learn.

If you have any questions, you may call Mr. Heller, the principal or myself. I can best be reached at Elm Road Elementary, 259-3743. If a phone call is not convenient, you may write me or visit me at Elm Road Elementary, 59400 Elm Road, Mishawka, IN 46544.

Sincerely,

Mr. Heller
Donna Campbell

My child, ________________________________, has permission to be involved with this educational research project.

______________________________  ______________________
Signature                            Date
REFERENCE LIST


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.


Dugan, J. (1996). Enhancing less proficient readers' literary understanding through transactional literature discussions. Dissertation Abstracts International, 57(7A), 2942. (University Microfilms No. AAG96-37855)


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.


Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.


VITA

Donna Turner Campbell

EDUCATION

ANDREWS UNIVERSITY
Ph. D., Educational Psychology

ANDREWS UNIVERSITY, JUNE 1995
Master of Arts, Educational and Developmental Psychology

INDIANA UNIVERSITY, MAY 1991
Bachelor of Science in Education

EXPERIENCE

CLINICAL NEUROPSYCHOLOGY, INC.
Educational Consultant, September 1999 - Present

INDIANA UNIVERSITY SOUTH BEND
Associate Faculty Department of Education, Fall 1996 - Present

JOINT SERVICES FOR SPECIAL EDUCATION
School Psychologist, August 1996 - August 1999

LEWIS CASS INTERMEDIATE SCHOOL DISTRICT
Pre-Doctoral Internship, September 1995 - May 1996

BERRIEN COUNTY JUVENILE DETENTION CENTER
Pre-Doctoral Internship, December 1995 - May 1996

UNIVERSITY CENTER FOR ASSESSMENT AND LEARNING
Initial Clinical Director/Educational & Psychological Examiner,
September 1994 - July 1995

ANDREWS UNIVERSITY
Graduate Research Assistant, 1994-1995

HUNTINGTON LEARNING CENTER
Director/Educational Planner, February 1993-March 1994
**MICHIGAN SCHOOL DISTRICTS**
*Internship/Long-term substitute, 1991*

**NYLONCRAFT LEARNING CENTER**
*Head Teacher 4-5 year olds, September 1989-August 1990*

**PROFESSIONAL AFFILIATIONS**

- National Association of School Psychologists
- Indiana Association of School Psychologists
- Michigan Association of School Psychologists
- Pi Lambda Theta Honor Society - President
- Phi Delta Kappa
- Phi Kappa Phi Honor Society
- Adult Literacy Council Volunteer

**PUBLICATIONS**