

1968

A Comparative Study of a Linguistic and a Traditional Approach to Spelling

Dale Henry Saylor
Central Washington University

Follow this and additional works at: <https://digitalcommons.cwu.edu/etd>



Part of the [Curriculum and Instruction Commons](#), [Educational Assessment, Evaluation, and Research Commons](#), and the [Educational Methods Commons](#)

Recommended Citation

Saylor, Dale Henry, "A Comparative Study of a Linguistic and a Traditional Approach to Spelling" (1968). *All Master's Theses*. 979.

<https://digitalcommons.cwu.edu/etd/979>

This Thesis is brought to you for free and open access by the Master's Theses at ScholarWorks@CWU. It has been accepted for inclusion in All Master's Theses by an authorized administrator of ScholarWorks@CWU. For more information, please contact scholarworks@cwu.edu.

75

A COMPARATIVE STUDY OF A LINGUISTIC
AND A TRADITIONAL APPROACH
TO SPELLING

A Thesis
Presented to
the Graduate Faculty
Central Washington State College

In Partial Fulfillment
of the Requirements for the Degree
Master of Education

by
Dale Henry Sayler

July 1968

LD

5771.3

S2756

SPECIAL
COLLECTION

[REDACTED]

[REDACTED]

170878

APPROVED FOR THE GRADUATE FACULTY

John A. Schwenker, COMMITTEE CHAIRMAN

Alan R. Bergstrom

Roy Ruebel

ACKNOWLEDGEMENT

An acknowledgement page is out of necessity an incomplete work. Missing from it are the names of many people who have given of their time, wisdom, materials, patience and talent in helping to complete this paper. To those persons who helped intentionally or incidentally, many thanks.

The author is deeply indebted to the following persons for guidance, assistance and encouragement: Mr. John Schwenker, committee chairman, for many hours of consideration and numerous suggestions, and to other members of the committee, Dr. Alan Bergstrom and Dr. Roy Ruebel for constructive advice and criticism.

Thanks must go to Mr. Robert Allen and Mrs. Dorothy McGrath of Hoover Elementary School for guidance and help given in preparation of this study.

Lastly, a special debt of gratitude is due my wife Marilyn for her moral support, patience and assistance.

TABLE OF CONTENTS

| CHAPTER | PAGE |
|--|------|
| I. THE PROBLEM AND DEFINITIONS OF TERMS USED. | 1 |
| Importance of the Study. | 3 |
| The Problem. | 3 |
| Hypothesis | 3 |
| Definition of Terms. | 3 |
| Limitations of the Study | 5 |
| Overview and Summary | 6 |
| II. REVIEW OF THE LITERATURE | 7 |
| III. METHODS AND PROCEDURES | 16 |
| Description of Spelling Texts. | 16 |
| Selection of Students. | 17 |
| Selection of Personnel | 19 |
| Procedures | 19 |
| IV. RESULTS, RECOMMENDATIONS, AND CONCLUSIONS. | 21 |
| Conclusions. | 25 |
| Recommendations for Further Research | 26 |
| BIBLIOGRAPHY | 27 |
| APPENDIX A | 29 |
| APPENDIX B | 33 |
| APPENDIX C | 36 |

LIST OF TABLES

| TABLE | | PAGE |
|-------|---|------|
| I | Comparison of I.Q. and Pre-Test Scores for Experimental and Control Groups | 18 |
| II | Comparison of Post-Test Spelling Scores for Experimental and Control Groups | 21 |
| III | Mean Difference Scores of Pre- and Post-Tests for Upper and Lower Third of Control and Experimental Groups . | 23 |
| IV | Results of t Tests for Scores Used in Table III, | 24 |
| V | Statistical Results of Experimental and Control Groups-- Experimental Group Results | 36 |
| VI | Statistical Results of Experimental and Control Groups-- Control Group Results, | 37 |
| VII | Statistical Comparisons, | 38 |

CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Methods of teaching spelling have been many and varied over the past years. Researchers have tried to prove that some approaches were better than others. Some of the more popular approaches used in teaching spelling over the years have been:

1. Study-test spelling method
2. Corrected test method
3. Test-study method
4. Flash-card method
5. Words used in composition approach

Most of these typical spelling approaches, according to Hodges, have patterned their spelling programs and word lists around the following criteria:

1. Grouping words according to their utility in children's writing.
2. Grouping words around some central theme (such as colonial life).
3. Grouping words by their visual similarities (such as nation, function, invitation).
4. Grouping words around some spelling rules (such as words ending in y, change the y to i before adding suffixes).
5. Simply grouping words largely at random (12:630).

Horn, Petty, McKee, Dolch, Rinsland, Betts and others have argued for balanced spelling programs which use a variety of approaches. A main source of confusion in spelling methods has been basic disagreement over which instructional approach should predominate over other approaches.

Part of the problem in spelling is that while the language changes, often times spelling remains the same. Hanna states:

Our difficulties are compounded when we insist on retaining the original spelling of a word, even though we have radically altered its pronunciation. Pupils and teachers continue to be harassed by the phonetically unreliable structure to English and hounded by the public which demands an improvement in spelling ability and performance (6:9).

Homonyms, local geographical pronunciation, foreign words, and sound-to-letter irregularities cause problems as to when a spelling would be the correct choice in the sentence used. Rosemier states, "Although the difficulty of selecting the proper spelling for a given context is frequently recognized, a few suggestions have been made concerning the methodology a teacher might employ in developing error free student performance" (16:309). Research is continuing that seeks to find the best method by which spelling may be taught.

Computerized research has opened up fields of spelling investigation that were impossible before the use of computers. One of these computer studies dealt with a linguistics approach to the study of spelling (Hanna and Associates). This study of spelling provides evidence that the American-English Language is highly consistent in its sound-to-letter relationship. From his study, Hanna has developed a spelling program quite different in its approach to teaching spelling. It is a linguistic approach and is based on speaking-listening cues to spelling. It is built on the premise that American-English is somewhat consistent in its sound-to-letter relationships. Rules and phonetic generalizations are emphasized based on phonological, morphological, and syntactical principles. Word lists are not used in the linguistic approach, but words are used only to help students discover phonetic generalizations and rules for themselves.

Importance of the Study

Controversy about the merits of teaching spelling using linguistic principles has risen in recent years. Claims have been made for and against using linguistic methods in teaching spelling. In 1967, Hanna's newly developed linguistic spelling program was selected for use in the elementary schools of Yakima, Washington. Hanna's older traditional spelling program had been used prior to 1967. The writer conducted an experimental study testing Hanna's newly developed spelling program against his former spelling program.

The Problem

It was the purpose of this study to compare a modern linguistics method in spelling instruction to a previously used traditional method to answer the question: Is the linguistic method more effective than the traditional method in teaching spelling?

Hypothesis

The null hypothesis investigated was: There will be no differences in spelling achievement between sixth grade children taught by a modern linguistics method and those taught by a traditional method.

Definition of Terms

All of these were taken from Phoneme-Grapheme Correspondences as Cues to Spelling Improvement except linguistics which was taken from Harold G. Shane's booklet Linguistics and the Classroom Teacher.

Algorithm. A rule or set of rules to define a process (7:1715).

Closed Syllable. A syllable ending in a consonant phoneme (7:1715).

Environment. The position in which a phoneme occurs in syllables in relation to other phonemes within the same syllable (7:1715).

Free Morpheme. A morpheme which can be used as an independent word; e.g., pin (7:1715).

Grapheme. A written sign representing a phoneme; an alphabetical symbol (7:1715).

Haptic. Tactile, kinesthetic and surface movement sensations obtained through the fingers and hands (7:1715).

Initial position. The occurrence of a phoneme at the beginning of a syllable (7:1715).

Linguistics. The scientific study of language. The study of human speech including the nature, structure, and modification of language (18:2).

Medial position. The occurrence of a phoneme in the middle of a syllable (7:1715).

Morpheme. The minimum meaningful unit of language (7:1715).

Morphology. The study of the ways morphemes are grouped into words (7:1715).

Orthography. A set of rules by which the phonemes of oral language are transcribed into the graphemes of written language according to accepted standards (7:1716).

Phoneme. A class of sounds which are phonetically similar and which are distinctive to the extent that the substitution of one for another changes the word meaning (7:1716).

Phoneme-grapheme correspondence. The relationship between a phoneme and a graphemic option representing a phoneme in writing (7:1716).

Phonology. The study of the sound structure of a language (7:1716).

Primary stress. The louder or more prominent stress given to syllables in polysyllabic words (7:1716).

Secondary stress. The stress given to syllables which is louder or more prominent than that given to unstressed syllables, but not as loud or prominent as the stress given to the primary stressed syllables (7:1716).

Syllable final position. The occurrence of a phoneme or grapheme at the end of a syllable (7:1716).

Unstressed syllable. A syllable which receives the lightest stress in pronouncing a word (7:1716).

Word-final position. The occurrence of a phoneme or a grapheme at the end of a word (7:1716).

Limitations of the Study

In teaching the experimental program, the teacher had no formal training in linguistic spelling techniques. Children in both experimental and control groups had previously used Building Spelling Power as a spelling text in lower grades. The control group, therefore, may have had an initial advantage.

The two classes may have been exposed to different events in their other classroom activities that could have affected spelling achievement. Explaining to students that they were part of a pilot study in spelling may have caused students to extend more than usual effort.

The limited study was a comparison of two sixth grade groups in a public elementary school in Yakima, Washington during a nine week period of the standard school year.

Overview and Summary

In 1967, a new spelling approach was introduced on the elementary level. The new text, Hanna's spelling text, was built around the linguistic theories of teaching spelling. What impact would that have on the teaching of spelling? The study was designed to be a comparison between the two Hanna approaches.

Chapter I is a statement of the problem and definition of the terms. Chapter II reviews the literature on a linguistics or phonetic approach to spelling. This was done in an attempt to establish a base for the two approaches used in this paper. Methods and procedures of the study make up Chapter III. The final chapter consists of results, recommendations, and conclusions from the study.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter was to review the literature on the linguistic approach to spelling. Some authorities felt the linguistic approach was impractical and had little relevance in the teaching of spelling. Others felt the reverse was true. This review of literature tried to show both points of view.

Controversy over the best methods by which to teach spelling has developed over the years. This controversy continues today involving leading authorities in spelling. The debate centers on the question of whether competency in spelling can be attained through a general use of spelling generalizations (21:154).

Some authorities, led mainly by Ernest Horn, say that American-English language spelling forms are highly irregular and offer learners and their teachers only a confusing and contradictory mass, resistant to any broad systematized set of spelling rules. Paul Hanna and others argued that there was phonetic regularity on sound-to-letter relationships in spelling and that learning spelling would become more efficient and easier by learning spelling rules.

This controversy grew in 1953 when Hanna and Moore presented an article that received wide attention in education journals. The study dealt with an investigation of a 3,000 word spelling list "to determine the extent to which each speech sound in the words comprising the spelling vocabulary of the elementary school child is represented consistently in

writing by a specific letter or combination of letters" (9:330).

According to the researchers, the results indicate that phonetic sounds to a high degree were consistently represented by particular letters. One finding showed that "approximately four-fifths of the phonemes contained in the words comprising the spelling vocabulary of the elementary school child are represented by a regular spelling" (9:330).

Ernest Horn, Thomas Horn, Hahn, Sister Evangelist Marie, Petty, Jackson, and others are spelling authorities who tend to agree that spelling cannot be taught best in a sound-to-letter approach.

In 1954, Ernest Horn conducted a study on 10,000 words that was quite similar to Hanna and Moore's study. His results were quite different. As an example, Horn found the sound of long \bar{a} occurred 1,237 times in the list, with 601 exceptions to the most common spelling; the sound of K was found 2,613 times with 932 exceptions . . . Horn wrote:

Some of the claims recently made for the contribution of phonics to spelling and the related proposal to spell by "word analysis, sounding, and logical reasoning by analogy," do not, unfortunately appear to be soundly grounded in essential related evidence. One is hardly justified in calling spellings "regular" or in teaching commonest spellings as principles or generalizations when the exceptions are numbered not by the score but by hundreds. When the evidence on both the consistency and the irregularities of English spelling is critically and realistically assessed, little justification is found for the claim that pupils can arrive deductively at the spelling of most words they can pronounce. There seem no escapes from the direct teaching of the large number of common words which do not conform in their spelling to any phonetic or orthographic rule (13:425).

In 1960, Thomas D. Horn speaking about teaching phonic generalizations said, "Although some recent studies have explored the possibilities

of teaching phonic generalizations it is clear that only those generalizations which have few exceptions and apply to many words can be used" (14:175).

The value of teaching spelling by using rules or not using rules was investigated by Sister Evangelist Marie. She conducted this study using three procedures: (1) the inductive method presented relevant words and developed the rules from them, (2) the deductive method stated the principle and illustrated it by specific words, and (3) the thought procedure associated the words with their meanings. No rule was used in the thought procedure. The thought method produced significantly greater progress in spelling than did either of the other two methods. Because of this, Sister Marie says that, "It may be inferred that the development of meaning is the single most important factor in spelling mastery and should receive emphasis in any spelling program" (19:604).

In 1960, Hahn found that additional teaching of phonics in reading to pupils in grades three through six, produced no significant difference in spelling errors compared to results obtained from pupils in similar grades receiving no phonics instruction.

Pupils were tested in three schools in three separate school districts in Pennsylvania by Hahn in 1964. Spelling instruction was varied in the three schools to test different methods of teaching. According to Hahn, . . . "pupils in School A had received much formal training in phonics for two years while pupils in School B and C received a normal amount of such training as a part of their regular reading program. No special phonics work was done in spelling classes in any school" (3:385).

According to Hahn, the results of the spelling tests for the three school districts showed no statistical differences between the mean scores of the phonics and normal groups. The phonics group scored lowest of all three districts on a spelling test made up of words that none of the pupils had studied and upon which phonics training should have helped most if phonics training has transfer validity. Since phonics training was provided in the reading program and not the spelling program, this could have caused the difference.

Ernest Horn, Hahn, Pettv, Thomas Horn, Sister Evangelist Marie, Jackson, and others in the spelling field feel that spelling rules and the use of phonetics in spelling is of small value. The American-English spelling system traditionally has been assumed to be so inconsistent that each spelling word to be learned requires a separate learning act. The discussion of the research that follows shows the opposite view that learning to spell does not have to be a gradual accumulation of necessary and practiced words.

In 1962, a team of modern day linguists aided by computerized research and a grant from the United States Office of Education, studied the idea that spelling could be taught from a sound-to-letter approach and that certain rules could apply in the spelling of most words. This team consisted of Paul R. Hanna, Richard E. Hodges, E. Hugh Rudorf, and others at Stanford University. Their main contention was that the "American-English language is not based upon a one-to-one relationship between phoneme and grapheme, but that there are patterns of consistency in the orthography which, based upon linguistic factors, may be said to produce

correspondences that are surprisingly consistent" (6:23).

Using modern computer technology in Phase I of the research, they examined the degree of consistency in seventeen thousand different words and also analyzed the structure of the American-English orthography in general. They found the orthography was actually "a far more consistent reflection of spoken language than had been assumed, particularly when the several components of the phonology (sound system) underlying the orthography are examined" (17:31). Granting that phonemes have more than one way of being spelled, Hodges and Rudorf however, point out that the great majority of phonemes in spoken American-English are indeed consistently represented in writing when the main phonological factors of: (1) position in syllables, (2) syllabic stress, and (3) internal constraints, are considered. They found when the preceding factors are considered, certain letters and combinations of letters can be spelled with an 89.6 per cent consistency (17:31).

In Phase II, a second computer program called for predicting the spelling of the sample of seventeen thousand different words. The process in the second phase was as follows.

For each phoneme a set of rules, an algorithm, was constructed which indicated which spelling of what phoneme should be used under various conditions of position, stress, and environment. The algorithm was then programmed into the computer and the computer keyed to spell back the seventeen thousand words in the list.

Results of the computer study showed that of the seventeen thousand words, 49 per cent were spelled correctly and 51 per cent incorrectly. Of

the 51 per cent spelled incorrectly, 37.2 per cent were spelled with only one error, 11.4 per cent with two errors, and 2.3 per cent with three or more errors. As interpreted by Hanna, Hodges and Rudorf, the results strengthened "the phonological approach to spelling since many of . . . (the) errors may not constitute a serious spelling problem. Many of them could be obviated with the mastery of simple morphological rules" (17:32). Suggestions by Hodges and Rudorf are that "regularities exist in the relationship between phonological elements in the oral language and their graphemic representations . . . and that a pedagogical method based upon oral-aural (speaking-listening) cues to spelling may well prove to be more efficient and powerful than present methods which rely primarily upon visual and hand learning approaches" (17:31). Thus results of the two linguistics analyses' by Hanna and his associates showed certain consistencies in sound-to-letter relationships. From such results, Hanna, Hodges and Rudorf felt that more emphasis on instruction of phonetic relationships may be more valuable than the usual "drill" method. They have insisted, nevertheless, that a balanced program must be maintained. In 1959, Hanna wrote:

While we know that the brain acts as a unit, we can still educate the brain for spelling through first emphasizing one type of input and imagery, and then stressing another type. Each of the types - visual, oral-aural, and haptical - must be systematically planned and learned in the spelling program. And as each type of imagery is learned, it must be systematically joined and coordinated with the other types of imagery so that the net result is a reinforcement by each of the other (4:21).

Hodges and Rudorf gave the following as a model for the spelling

of American-English. "The orthography of American-English is determined by a set of rules for unit phoneme-grapheme relationships based, with decreasing productivity, upon three levels of analysis-phonological, morphological, and syntactical" (17:34). These three levels of analysis can be further broken down and summarized as shown in the following tabular form:

1. Phonological factors
 - Position
 - Stress
 - Environmental factors
2. Morphological factors
 - Compounding
 - Affixation
 - Word families
3. Syntax

A modern spelling program built upon new research on linguistics and on teaching-learning theories according to Hanna would:

1. Start from the child's possession of a large aural-oral vocabulary.
2. Teach him how to break these words into component sounds.
3. Lead him to discover the correspondences between the phonemes and the alphabetical letters that have come to represent these sounds in standard American-English spelling.
4. Help him discover the influence that position, stress, and context have in the choice of a particular grapheme from among the several options.
5. Guide him to go beyond the phonological analysis to examine the morphological elements such as compounding, affixation, or word families.
6. Teach him how to use all his sensorimotor equipment of ear-voice-eye-hand to reinforce each other in fixing the standard spelling in his neural system.
7. Help him to build a spelling power that should make possible a writing vocabulary "unlimited" or limited only by the size of his spoken vocabulary (5:49).

To make children aware that print represents sound and sound represents meaning, children should explore spelling patterns, that is, the correspondence of letter to sound. From studying spelling patterns, children can realize that all words are not completely different from each other, but that their common features suggest that there is order and system to English spelling (1:192).

Williams and Levin found English spelling was quite irregular when individual letters and sounds were considered. Clusters of letters, however, appear to have a higher regular relationship with sound patterns than do single letters (20:516).

Hildreth said: "English is approximately six-sevenths phonetic, that is, about eighty-five per cent of the words contain regularly sounded elements" (11:5). She, however, gave no information to support her statement.

Results of Groff's study on words selected from the New Iowa Spelling Scale show that:

1. About three out of every four words in the scale are not spelled entirely phonetically. However, less than one of every five letters in these words is non-phonetic.
2. Teachers should be aware of the larger per cent of words that are partly non-phonetic and devise some method of making pupils aware of this fact.
3. The small per cent of non-phonetic letters in these words suggests that it is not likely to be a formidable or time consuming task to teach the child to spell the non-phonetic parts of words.
4. The evidence could also indicate that the teacher should evaluate pupils spelling in terms of parts of words that are misspelled rather than in terms of total words misspelled (2:48).

This second group of researchers felt that a balanced approach to

spelling must be maintained. They felt, however, that the underlying theme of any modern spelling program should be based on a sound-to-letter approach. They felt that the child comes to school with a large speaking vocabulary and that the spelling program should further develop the speaking vocabulary so that a child can spell any word needed to carry out his written communication.

The review of the literature has shown that spelling researchers disagree on any one best approach to teaching spelling. Researchers were generally divided into two groups: those advocating a modern linguistic approach and those advocating a more traditional word study or drill approach.

The writer chose to conduct a study with two sixth grade groups using the two approaches mentioned in the literature review because they represented the two ends on the continuum in teaching spelling and because both were being studied by the Yakima School System. Chapter Three will include a description of texts, procedures, and selection of students and personnel used in the study.

CHAPTER III

METHODS AND PROCEDURES

Description of Spelling Texts

Power to Spell consists of thirty-six lessons. The lessons are divided into five parts labeled A, B, C, D, and E. According to Hanna:

The list of words included in this textbook is an extensive one because groups of words are introduced to illustrate particular principles.

Each lesson is designed to introduce or reinforce a linguistic principle or process underlying the orthography. A, B, and D develop principles or the uses of the dictionary; C and E both provide a test of the pupils' growing mastery.

The lessons in this book are not organized or presented in a traditional manner . . . there is no standard word list presented at the beginning of each lesson. Words are introduced and used as they are needed to illustrate a principle or process or to help children discover for themselves cues to certain basic principles in our orthography.

The intent is not to have pupils learn x number of words each week to a total of x number of words for the year, but rather to have them discover and apply each week some principle or principles underlying the structure of the orthography.

Words used in the lessons are chosen for their effectiveness in permitting the child to discover the principle or process being taught. They do not necessarily coincide with words on lists indicating children's knowledge of words at this particular grade level (8:6-7).

Every sixth lesson is a review of the preceding five lessons.

Lessons thirty-one to thirty-six are a review of the total year's work.

Building Spelling Power also consists of thirty-six lessons. Each lesson is designed for one week's work in spelling and is divided into sections A, B, C, and D. Section A was used on the first day of the week

to introduce and discuss the meanings of the eighteen words in the list. The second day section B was used as a trial test to find out the words known and those which needed further study. Section C was used the third day to study two review words from previous lessons, words missed on the trial spelling test and any words which were misspelled on daily written work in other subject areas. Section D is called Building Spelling Power. In this section the student uses previously learned techniques to spell new words or learn some principle of spelling to help him spell better. Section D provides necessary phonics instruction.

Every sixth lesson, a review lesson, was used to check the spellings of the words presented in the preceding five lessons. A sample lesson from each spelling text is shown in Appendices A and B.

The basic word list used in the text consisted of four hundred and ninety words. It was selected from several lists compiled by such leaders in spelling as Gates, Rinsland, McKee, Dolch, Betts, and Fitzgerald.

Selection of Students

Students in two sixth grade rooms at Hoover School in Yakima, Washington were used in the study. At the beginning of the school year, students at Hoover are randomly placed in classrooms by the administration. There was, at the time of the study, no ability grouping between sixth grade classes. A coin was flipped to determine which class would use the traditional speller, Building Spelling Power, the other one then used the linguistic speller, Power to Spell. Sixteen boys and fourteen girls comprised the experimental group. In the control group there were four-

teen boys and fifteen girls. Since the number of students available for randomization was small, I. Q. and spelling abilities were also checked to insure similar groups on these two criteria. The I.Q. scores for each group were compared statistically by use of a t test. The pre-test spelling achievement scores were compared in the same manner as the I.Q. scores. The results are shown in Table I.

TABLE I
COMPARISON OF I.Q. AND PRE-TEST SCORES FOR
EXPERIMENTAL AND CONTROL GROUPS

| Group | Mean | Standard Deviation | Variance | Standard Error | df |
|--------------------------|--------|-----------------------|----------|-------------------|----|
| Experimental I.Q. | 107.73 | 9.56 | 91.44 | 1.74 | 57 |
| Control I.Q. | 106.75 | 9.43 | 89.04 | .27 | 57 |
| Experimental Pre-test | 6.15 | 1.50 | 2.25 | 1.75 | 57 |
| Control Pre-test | 6.46 | 1.99 | 3.98 | .37 | 57 |

The critical ratio for t is 2.00 at .05 level of significance. A t score of .394044 was obtained for the I. Q. comparison and a t score of .662425 was obtained for the pre-test comparison. Lack of significant difference in I. Q. and pre-test scores between the groups on the t test showed the two groups to be similar on these criteria measurements.

Selection of Personnel

One teacher was selected at random to teach spelling to both the experimental and control groups. However, this teacher had no formal training in linguistics but followed very closely the teachers manual. This procedure was employed to diminish the halo effect that might influence the study.

Procedures

The study was conducted over a nine week period from September 25 to December 1. This time was selected as it coincided with the introduction of Power to Spell in the district. The week of November 20-24 was omitted because of the two day Thanksgiving vacation involved. The Iowa Tests of Basic Skills Form II was administered at the beginning and Iowa Tests of Basic Skills Form I was administered at the conclusion of the study. The spelling achievement levels of the two groups were compared statistically by use of a t test. The critical ratio for the .05 level of significance was selected.

To explain the different tests used in each class, the experimental group of students was told they were part of a pilot program in spelling that would last nine weeks. Each day during the morning session of school a regular period was set aside for both groups for spelling instruction. This time was adhered to as much as the total school schedule would allow. The recommendations of the textbook authors were followed in regard to the presentation of the material in each lesson. Lessons one to seven were covered in Power to Spell. These lessons were

used because it was felt that it was necessary to begin a new spelling text on it's introductory lessons. Lessons nineteen through twenty-seven were covered in Building Spelling Power. Because almost all students had previous experience with Building Spelling Power, the author randomly selected the lessons used in the study.

Chapter Four will include the results, conclusions, and recommendations of the study.

CHAPTER IV

RESULTS, RECOMMENDATIONS, AND CONCLUSIONS

The purpose of the present study was to examine and compare statistically a modern linguistic spelling approach to an older traditional approach. A control and an experimental group were randomly selected. After nine weeks of spelling instruction, a spelling achievement test was given to each group. The spelling section from Form I of the Iowa Tests of Basic Skills was used as the post-test.

The mean differences in achievement between experimental and control groups on the post-test was calculated. To check if there was any significant difference on the mean scores of the post-test, a t test was used. The level of significance was .05. The critical ratio for t was 2.00. Table II summarizes the results of these comparisons.

TABLE II
COMPARISON OF POST-TEST SPELLING SCORES FOR
EXPERIMENTAL AND CONTROL GROUPS

| Test | Experimental Mean | Control Mean | df | t | p |
|-----------|----------------------|-----------------|----|----------|-----|
| Post-test | 6.31 | 6.97 | 57 | 1.847951 | .05 |

It is noted from the data that no significant differences occurred between mean achievements of the experimental and control groups. Therefore, the null hypothesis that there would be no significant differences

in spelling achievement of sixth grade children taught by a modern linguistic method as compared to children taught by a traditional method is supported. The gain in mean scores between pre- and post-tests for the experimental group was 1.6 months and for the control group it was 5.1 months. Results of the Iowa Tests of Basic Skills are given in raw scores which are converted to grade level equivalents. These grade level equivalents are given on a ten point or ten month basis, e.g., a score of 61 would be sixth grade first month or 6.1. During the nine weeks the study lasted, a natural gain of 2.1 months on the results of the Iowa Tests of Basic Skills would be expected. With a critical ratio of 2.00 and t score of 1.847951, the mean gain of 5.1 months for the control group may have proved significant had the study run longer than nine weeks.

Using a frequency study, the researcher checked all spelling words used from both texts during the time of the study, against test words used in Form I of the Iowa Tests of Basic Skills. This was done to determine whether words that had been used in the study might have been used in the post-test giving a possible testing advantage to one group or the other. Form I contained seven of the words used in Power to Spell and eight words used in Building Spelling Power. This small number of words found to be the same on the post-test and the word lists would seem to not affect the study since the seven found in the experimental group list and the eight found in the control group list offset each other and probably would not give a testing advantage to either group.

The teacher of the experimental group felt the higher ability spelling students were more able to use the linguistic approach. She

felt the lower ability spelling student had difficulty in working with and using the generalizations and principles contained in the linguistic approach. To check the teacher's observation on higher and lower ability spelling students, the writer ran the following table.

TABLE III
MEAN DIFFERENCE SCORES OF PRE- AND POST-TESTS FOR UPPER
AND LOWER THIRD OF CONTROL AND EXPERIMENTAL GROUPS

| Control Group Upper Third | Control Group Lower Third | Experimental Group Upper Third | Experimental Group Lower Third |
|--------------------------------|------------------------------|--------------------------------------|--------------------------------------|
| -1.0 | - .3 | .1 | - .3 |
| - .1 | .0 | .8 | - .2 |
| .6 | 1.2 | 1.5 | -1.0 |
| - .9 | 1.4 | .5 | 1.7 |
| .5 | 3.5 | .3 | 1.8 |
| .2 | - .5 | 1.3 | -1.4 |
| - .6 | 1.9 | .5 | - .3 |
| .9 | 1.8 | .6 | .4 |
| .9 | 1.1 | 1.4 | - .7 |
| .8 | 2.1 | -1.3 | -1.7 |
| Mean Gain 1.3 or Loss | 12.2 | 5.7 | - 1.7 |

The figures in Table III show the gain or loss in spelling achievement scores between the pre- and post-tests. These scores are for the upper and lower third of the control and experimental groups. The top ten and lowest ten scores on the post-test results were used to select

the upper and lower third students for each group. The scores show a loss or gain in spelling achievement as measured by the Iowa Tests of Basic Skills. The reader is reminded that the experimental group used Hanna's modern linguistic approach and the control group used Hanna's older traditional approach.

To check the significance of the scores shown in Table III a t test was used. Table IV gives the results of the t tests. For all t scores shown in Table IV the degrees of freedom were 8; P was .05 with a critical ratio of 2.31 for t .

TABLE IV
RESULTS OF t TESTS FOR SCORES USED IN TABLE III

| t For C1 and C3 | t For C1 and E1 | t For C1 and E3 | t For C3 and E1 | t For C3 and E3 | t For E1 and E3 |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| -2.404346 | -1.266540 | .680686 | 1.395815 | 2.579337 | 1.632088 |
| C1 = Control group upper third C3 = Control group lower third E1 = Experimental group upper third E3 = Experimental group lower third | | | | | |

Analysis of the results in Tables III and IV show the greatest growth in spelling achievement was made by the lower third of the control group. The least amount of growth was made by the lower third of the experimental group. The lower third of the experimental group had the only loss, -1.7 months, in spelling achievement between pre- and post-

tests. The lower third of the control group had the highest gain, 12.2 months, of all four groups. When the lower thirds were compared statistically at the .05 level, a significant difference was established. A critical ratio of 2.579337 is greater than the criterion critical ratio. This would seem to indicate a superiority of Hanna's traditional spelling approach over his linguistic approach when used to teach low achieving spelling students. The top third of the experimental group had a gain of 5.7 months. The lower third of the experimental group had a loss of -1.7 months. This would seem to indicate that the top third of the experimental students were able to discover and put to use the generalizations and principles presented in the linguistic approach, while the lower achieving third was unable to do this.

Conclusions

There was no significant difference between the control and experimental groups in spelling achievement. This lack of significant difference would indicate that a modern linguistic approach to spelling is not superior nor is it inferior to a more traditional approach. This study shows significantly that the lower third of the control group had greater spelling success using the older traditional spelling method than the lower third of the experimental group had using the newer linguistic method. This would indicate that low achieving spellers perhaps cannot use the linguistic method as easily and efficiently as the traditional method.

The upper third of the control group did not gain as much as the upper third of the experimental group. It might be concluded from this that they were not sufficiently challenged by Hanna's traditional spelling approach. Evidence in this study would indicate that a variety of spelling approaches are needed to successfully cope with the individual student differences found in a typical classroom situation.

Is there a best way to teach spelling? This study lends support to the theory that there is no one best method of teaching spelling.

Recommendations for Further Research

The researcher would like to have another study conducted in his school district at the earliest possible time. This is recommended because the sampling was small and used over a relatively short period of time. This is recommended also because the results of this research were significant, especially in the upper and lower thirds of the groups tested. (See Table IV.)

Perhaps this study shows that before purchasing new materials for classroom use, they should be carefully checked. This would perhaps insure proper placement, usage, and feasibility of these materials. Since Hanna used no particular recognized word list in his Power to Spell series it could be recommended that his linguistic principles and generalizations of spelling be used along with teaching a recognized basic list of spelling words.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Botel, M. "What Linguistics Says to This Teacher of Reading and Spelling," Reading Teacher, 18:188-193, December, 1964.
2. Groff, Patrick J. "The New Iowa Spelling Scale: How Phonic Is It?" The Elementary School Journal, 62:46-49, October, 1961.
3. Hahn, William P. "Phonics: A Boon to Spelling?" Elementary School Journal, 64:383-386, April, 1964.
4. Hanna, Paul R., and Jean S. Hanna. "The Teaching of Spelling," National Elementary Principal, 45:19-28, November, 1965.
5. Hanna, Paul R., and Jean S. Hanna. "Applications of Linguistics and Psychological Cues to the Spelling Course of Study," Research On Handwriting and Spelling, National Council of Teachers of English, Champaign, Illinois: 1966, pp. 43-49.
6. Hanna, Paul R., and Jean S. Hanna. "Spelling as a School Subject: A Brief History," National Elementary Principal, 38:8-23, May, 1959.
7. Hanna, Paul R., Jean S. Hanna, Richard E. Hodges, and Edwin H. Rudorf. Phoneme-Grapheme Correspondences as Cues to Spelling Improvement. Bureau of Research, United States Department of Health, Education, and Welfare, OE-32008. Washington: Government Printing Office, 1966.
8. Hanna, Paul R., Jean S. Hanna, Richard E. Hodges, and Edwin H. Rudorf. Power to Spell. Boston: Houghton Mifflin Company, 1967. 189 pp. Teachers Manual 32 pp.
9. Hanna, Paul R., and J. T. Moore. "Spelling From Spoken Word to Written Symbol," Elementary School Journal, 53:329-337, February, 1953.
10. Hanna, Paul R., and Jean S. Hanna. Building Spelling Power. Boston: Houghton Mifflin Company, 1955. 112 pp. Teachers Manual 87 pp.
11. Hildreth, Gertrude. Teaching Spelling. New York: Henry Holt and Company, 1955. 346 pp.
12. Hodges, Richard E. "The Psychological Bases of Spelling," Elementary English, 42:629-635, October, 1965.
13. Horn, Ernest. "Phonetics and Spelling," Elementary School Journal, 57:424-432, May, 1957.

14. Horn, Thomas D. "Research in Spelling," Elementary English, 37:174-177, March, 1960.
15. McGuigan, F. J. Experimental Psychology A Methodological Approach. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1960, 314 pp.
16. Rosemier, R. A. "Effectiveness of Forwarning About Errors in Response--Selective Learning," Journal of Educational Psychology, 56:309-314, December, 1965.
17. Rudolf, Hugh E., and Richard E. Hodges. "Searching Linguistics for Cues for the Teaching of Spelling," Research on Handwriting and Spelling, National Council of Teachers of English, Champaign, Illinois: 1966, pp. 29-35.
18. Shane, Harold G. Linguistics and the Classroom Teacher. Washington, D. C.: Association for Supervision and Curriculum Development, NEA, 1967. 120 pp.
19. Sister Evangelist Marie. "A Study of Teaching Rules in Spelling," Elementary English, 40:602-604, 647, October, 1963.
20. Williams, Joanna P., and Harry Levin. "Word Perception: Psychological Bases," Education, 87:515-518, May, 1967.
21. Yee, Albert H. "The Generalization Controversy On Spelling Instruction," Elementary English, 43:154-161, February, 1966.

APPENDIX A

APPENDIX A

POWER TO SPELL SAMPLE LESSON

Some Sound Cues

A.

1. Study the following groups of words containing /b/. How many ways is /b/ spelled?

| (a) | (b) | (c) | (d) | (e) |
|--------|-------|--------|---------|--------|
| belief | throb | label | lobster | ribbon |
| breezy | glib | mobile | cabinet | nibble |

2. To discover the factors that influence the spelling of /b/, answer the following questions:

(1) In what part of the words in group (a) do you hear /b/?

In group (b)?

(2) Say the words in group (c) and group (d) to yourself. In which syllable does /b/ occur? What kind of vowel sound comes before /b/ in group (c)? In group (d)?

(3) Say the words in group (e): /ribə'n/, /nibəl/. Where do you hear /b/ in these words? How is /b/ spelled? Compare the spelling of /b/ in group (e) with the rest of the words. What does this comparison tell you about the spelling of this sound?

3. If you could look at hundreds of words containing /b/, you would find that the rules you have just noted are very reliable. Thus the position of the sound determines the way /b/ is spelled. The sound is never spelled bb at the beginning of a word or after a long vowel in the middle of a word. With one exception /b/ is never spelled bb at the end of a word. This one exception is a word whose sound-spelling is /eb/. How is this word spelled? What does it mean?

4. See if you can discover a rule for spelling the sound you hear at the end of song, by studying the following words.

| | | | |
|--------|-------|--------|------|
| singer | cling | bang | hang |
| sink | clink | banker | hank |

5. Write the following list of words on paper using the rules you have just reviewed to help you spell them correctly:

- /flungk/ /bringk/ /shringk/ /róng/
- (1) Write two words that have the sound-spelling /rungk/.
- (2) The name for what part of the body has the sound-spelling /tung/?

1. Say the following three words aloud to a neighbor and have him say them aloud to you: all, or, law. Do the vowels sound the same to you in all three words? There is nothing wrong with pronouncing or hearing them as slightly different. But most speakers of American English probably hear the same vowel sound in all three words. The symbol for this sound is /*ə*/. The neighboring sounds can often give you a cue to these seemingly irregular spellings.

2. Copy the words below and arrange them in alphabetical order. They represent the most common spelling of /*ə*/ before r. Look up any unfamiliar words in the Speller Dictionary to find their meanings.

| | | | |
|-----------|---------|----------|--------|
| former | resort | organize | mortal |
| fortunate | torture | abnormal | orbit |

3. The four sound-spellings below represent an exception to this pattern for spelling /*ə*/ before r. Write the words on paper, using the Speller Dictionary if you need to. Then write a rule that tells when to use this spelling of /*ə*/ before r.

/thw^ərt/ /kw^ərt/ /sw^ərm/ /w^ərp/

4. Study the five familiar words below. The syllables in heavy type represent typical patterns of spelling /*ə*/. By examining them, you can form some tentative rules for spelling this vowel sound. Write your rules on paper and number them, using the five sentences below the words as a guide.

reward salt because autumn jaw

- (1) When /*ə*/ follows /w/, it is usually spelled _____.
- (2) When /*ə*/ comes before /l/, it is usually spelled _____.
- (3) When /*ə*/ comes before /z/, it is usually spelled _____.
- (4) When /*ə*/ begins a word, it is usually spelled _____.
- (5) When /*ə*/ ends a word, it is usually spelled _____.

5. Test these rules on the words listed below. Copy each word on a paper and write after the word the number of the sentence in Exercise 3 that contains the rule that applies to it.

| | | | | |
|---------|--------|----------|-----------|----------|
| quarter | squawk | applause | recall | flaw |
| falter | clause | outward | authentic | audience |

C. What Have You Learned?

Number a paper from 1 through 12. After each number write the word or words missing in the sentence of that number. Your teacher will say each sentence for you.

1. His speech was much too _____.
2. A sculpture that has moving parts is called a _____.
3. The mountain climber was _____ to the _____ of the cliff.
4. The answer to the question was on the top of my _____.
5. This seashore _____ was a _____ choice for our vacation.
6. The villain tried to _____ the plans of our hero.
7. These _____ antiques will be sold next month.
8. We have had an _____ amount of rainfall this year.
9. Only a few of us _____ have as yet had the opportunity to _____ the earth.
10. Did you get to class before the bell had _____?
11. If you have good study habits, you will not _____ the test.
12. The _____ him with prolonged _____.

D.

1. In Part B you reviewed the rules for spelling /ô/. As in the case of most rules, there are some exceptions to these rules also. Some of these exceptions are listed below.

| (a) | (b) | (c) | (d) |
|---------|--------|---------|-------|
| fault | crawl | awkward | worn |
| assault | shawl | awning | sworn |
| vault | sprawl | awful | |

Write the following sentences on paper, and complete them by filling the blanks.

- (1) Before /l/, /ô/ is usually spelled _____ but in group (a) /ô/ is spelled _____ and in group (b) /ô/ is spelled _____.
- (2) At the beginning of a word, /ô/ is usually spelled _____, but in group (c) /ô/ is spelled _____.
- (3) After /w/, /ô/ is usually spelled _____, but in group (d) /ô/ is spelled _____. Write the homonym for worn. _____

2. Study the following words:

astronaut

taught

ought

In American English, /ô/ followed by /t/ is always spelled in one of these three ways. It is not very difficult to memorize how to spell the few words in which /ô/ is followed by /t/. Your Study Steps will help you learn these special spellings.

E. Making Sure You Know

Number a paper from 1 through 20. Your teacher will give you a test on 20 words. Write only the test word after its number on your paper--not the sentence illustrating the use of the word. Use the Study Steps to help you remember any word you misspell.

Test 4E

1. Our club decided to _____ a trip. (organize)
2. We made plans at a _____ meeting. (cabinet)
3. Our _____ leader is now in Maine. (former)
4. He is a _____, who lives by the ocean. (banker)
5. His home is near a historic _____. (seaport)
6. The port is famous for its _____. (lobsters)
7. It was our _____ we could visit him. (belief)
8. One _____ day, we went lobster fishing. (breezy)
9. One man carried a _____ of rope. (hank)
10. We could smell the _____ from the ocean. (salt)
11. We heard the chains _____ at the moorings. (clink)
12. Soon we were _____ bound with the tide. (outward)
13. Curt's feet _____ over the side of the boat. (hung)
14. He felt a little _____ at his toe. (hibble)
15. All at once, he felt a _____ of pain. (throb)
16. No _____ ever gave a louder yell. (singer)
17. A lobster _____ was fastened to his toe. (claw)
18. Curt's _____ gave the men a good laugh. (torture)
19. It was too bad the men forgot to _____ him. (warn)
20. He should _____ a "Keep Off" sign on his toe. (hang)

Study Steps to Good Spelling: Say, Hear, See, Write

1. Say the word. Hear the sounds in the word.
2. Look at the word. Say the word again and notice the letter or group of letters that stands for each sound.
3. Think about the word and its meaning. Does it have either a prefix or a suffix?
4. If the word is spelled other than you thought it would be, study the part that seems unusual to you.
5. Cover the word and write it the way you remember it is spelled.
6. Uncover the word. Look at the word you wrote in Step 5. Did you spell it correctly? If not, study the word again.

APPENDIX B

APPENDIX B

BUILDING SPELLING POWER SAMPLE LESSON

Building Spelling Power Lesson 20

A. Using th as a Suffix

As your teacher reads the first three Spelling Words, listen for the sound you can hear in all three. This sound is always spelled th, no matter where it comes in a word.

As your teacher reads the rest of the Spelling Words, listen and look to find out in which words th is used as a suffix. In tenth, eleventh, and growth, you can see what the root word is. In depth, the th is added to the word deep, but a change is made in the root word. What is that change? Length really comes from long, but the short o becomes short e. What changes are made in the root words nine, eight, and twelve when the th suffix is added? The word throat begins with the same sound as throw and three. The last three Spelling Words are contractions. Help your class decide what two words were used to make each contraction.

The Spelling Words

| | | | |
|---------|----------|---------|-----------|
| nothing | eleventh | eighth | throat |
| method | growth | ninth | isn't |
| faith | depth | twelfth | shouldn't |
| tenth | length | twelve | doesn't |

C. Word Study

Review words: month fourth

A month is called that because it is about the length of time between one full moon and the next. Remember that month and Monday were named for the moon. Fourth comes from the number four. It has a homonym, forth, which means forward.

Write the Review Words in the blank below where they make sense.

April is the _____ of the year.

Words Missed in First Test

Words Missed Last Week

Other Words I Need to Study

B. First Test

1. There are _____ months in a year.
2. It is hard to have _____ in someone who has lied to you.
3. Mary is coming, but Dotty _____.
4. Miss Brown taught us a _____ of proving addition.
5. The submarine reached a _____ of one thousand feet.
6. A crumb got stuck in my _____ and made me cough.
7. Six from six leaves _____.
8. Mother said I _____ eat so fast.
9. I need another _____ of pipe.
10. After the seventh place come the _____, _____, _____, _____, and _____ in that order.
11. Mother _____ like it if I'm late for meals.
12. After several years' _____ this tree will be taller than the house.

D. Building Spelling Power

Often when you come to the end of a line in writing, you find that you don't have room to write the whole of the next word. If it is a word that can be divided correctly at the end of a line, use a hyphen to show that you are breaking the word and write the rest of the word on the following line.

There are two kinds of words which should never be broken at the end of a line. They are:

1. Words of three or four letters, even if they are two-syllable words such as any or lion.
2. Words of one syllable, even if they are long words such as stretched.

These two kinds of words must always be written on one line. Decide whether each word that follows may be correctly divided at the end of a line. If the word cannot be divided, write the whole word on the line which follows it. If it can be divided, check with your Speller Dictionary for the correct places to divide it. Then write the word on the line which follows it, putting a hyphen in each space between syllables. The first one is done for you.

| | |
|------------------|-----------------|
| understood _____ | breakfast _____ |
| valley _____ | beneath _____ |
| permission _____ | spread _____ |

| | | | |
|----------|-------|-----------|-------|
| navy | _____ | disappear | _____ |
| fertile | _____ | envy | _____ |
| fifteen | _____ | scratched | _____ |
| pleasant | _____ | fault | _____ |
| author | _____ | student | _____ |

On the fifth day of each lesson a test is given on the spelling words presented in Section A.

Final Test

1. My baby brother _____ like spinach. (doesn't)
2. A meadow lark has a black mark on its _____. (throat)
3. I know a good _____ for proving long division. (method)
4. It _____ cold enough to freeze the pond. (isn't)
5. There is _____ John likes better than baseball. (nothing)
6. There are _____ eggs in a dozen. (twelve)
7. Mother said I _____ read when I had the measles. (shouldn't)
8. If you have _____ in a person, you trust him. (faith)
9. The rate of _____ of boxwood is very slow. (growth)
10. The _____ of this rug is six feet. (length)
11. The skin diver reached a _____ of seventy feet. (depth)
12. Tuesday is the seventh, so Wednesday is the _____. (eighth)
13. Thursday will be the _____. (ninth)
14. Friday will be the _____. (tenth)
15. Saturday will be the _____. (eleventh)
16. Sunday will be the _____. (twelfth)

Review Words

1. December is the last _____ of the year. (month)
2. This is the _____ time I have been to the circus. (fourth)

APPENDIX C

APPENDIX C

STATISTICAL RESULTS OF EXPERIMENTAL AND CONTROL GROUPS

TABLE V

EXPERIMENTAL GROUP RESULTS

| Student | I.Q. Score | Pre-Test Results | Post-Test Results | Difference |
|------------|---------------|---------------------|----------------------|------------|
| Vern B. | 104 | 3.4 | 5.1 | 1.7 |
| Debbie B. | 103 | 5.8 | 6.2 | .4 |
| Barbara C. | 104 | 5.9 | 5.7 | - .2 |
| Harry C. | 109 | 6.0 | 5.7 | - .3 |
| Lou Ann C. | 111 | 7.3 | 7.2 | - .1 |
| Debbie E. | 103 | 7.4 | 7.7 | .3 |
| Brent F. | 125 | 9.6 | 9.7 | .1 |
| Pam G. | 104 | 6.8 | 6.2 | - .6 |
| Sam G. | 104 | 3.1 | 4.9 | 1.8 |
| John G. | 107 | 3.8 | 5.7 | 1.9 |
| Jeanine H. | 101 | 6.3 | 5.3 | -1.0 |
| Sheila H. | 117 | 8.5 | 7.2 | -1.3 |
| Stan J. | 126 | 4.6 | 3.9 | - .7 |
| Jon K. | 121 | 5.8 | 7.2 | 1.4 |
| Randy L. | 116 | 7.5 | 8.0 | .5 |
| Alfred L. | 81 | 7.0 | 6.7 | - .3 |
| Terry M. | 105 | 6.3 | 4.9 | -1.4 |
| Allan M. | 116 | 8.3 | 9.1 | .8 |
| Jerry M. | 88 | 3.8 | 4.2 | .4 |
| Terry M. | 98 | 6.0 | 6.2 | .2 |
| Richard N. | 113 | 5.4 | 6.0 | .6 |
| Renee P. | 110 | 6.5 | 8.0 | 1.5 |
| Kathy P. | 105 | 6.3 | 5.7 | - .6 |
| Yvonne S. | 102 | 6.9 | 7.4 | .5 |
| Nancy S. | 105 | 5.0 | 4.7 | - .3 |
| Randy S. | 114 | 6.6 | 7.2 | .6 |
| Lesly S. | 115 | 7.4 | 7.0 | - .4 |
| David S. | 101 | 4.6 | 2.9 | -1.7 |
| Shari W. | 111 | 6.5 | 6.0 | - .5 |
| Joyce Z. | 113 | 6.3 | 7.6 | 1.3 |
| Mean | 107.73 | 6.15 | 6.31 | |

TABLE VI
CONTROL GROUP RESULTS

| Student | I. Q. Score | Pre-Test Results | Post-Test Results | Difference |
|-------------|----------------|---------------------|----------------------|------------|
| Shelly A. | 88 | 6.5 | 6.0 | - .5 |
| Kelly A. | 121 | 6.6 | 6.3 | - .3 |
| Paulette B. | 102 | 6.5 | 6.5 | .0 |
| Karen B. | 110 | 9.9 | 8.9 | -1.0 |
| Danny B. | 109 | 5.0 | 6.2 | 1.2 |
| Terry C. | 105 | 3.4 | 5.3 | 1.9 |
| Linda C. | 114 | 6.2 | 7.0 | .8 |
| Bob C. | 108 | 4.8 | 6.2 | 1.4 |
| Dean C. | 109 | 6.8 | 7.7 | .9 |
| Mark D. | 103 | 7.3 | 7.4 | .1 |
| Roger D. | 103 | 3.1 | 4.9 | 1.8 |
| Rhett D. | 131 | 8.1 | 8.7 | .6 |
| Lisa D. | 94 | 6.0 | 6.7 | .7 |
| Sandra D. | 110 | 7.8 | 8.3 | .5 |
| Carolyn E. | 115 | 8.7 | 8.1 | - .6 |
| Debbie F. | 115 | 6.3 | 6.7 | .4 |
| Karen G. | 110 | 7.2 | 8.1 | .9 |
| Jim G. | 102 | 2.7 | 6.2 | 3.5 |
| Ed H. | 109 | 8.5 | 7.4 | -1.1 |
| Paula M. | 97 | 9.0 | 8.9 | - .1 |
| Dan M. | 115 | 9.4 | 8.5 | - .9 |
| Janet P. | 114 | 7.0 | 6.8 | - .2 |
| Gaye R. | 98 | 6.5 | 7.4 | .9 |
| Jim S. | 102 | 3.8 | 4.9 | 1.1 |
| Anita S. | 93 | 6.3 | 6.3 | .0 |
| Cynthia U. | 90 | 6.9 | 6.7 | - .2 |
| Ken W. | 108 | 6.9 | 7.7 | .8 |
| Shane W. | 116 | 8.1 | 8.3 | .2 |
| Wade Y. | 105 | 2.1 | 4.2 | 2.1 |
| Mean | 106.75 | 6.46 | 6.97 | |

TABLE VII
STATISTICAL COMPARISONS

| | Standard Deviation | Variance | Standard Error |
|---------------------------|-----------------------|----------|-------------------|
| Experimental I.Q. | 9.56 | 91.44 | 1.74 |
| Experimental Pre-Test | 1.50 | 2.25 | .27 |
| Experimental Post-Test | 1.51 | 2.28 | .27 |
| Control I.Q. | 9.43 | 89.04 | 1.75 |
| Control Pre-Test | 1.99 | 3.98 | .37 |
| Control Post-Test | 1.24 | 1.55 | .23 |

t SCORES

| | |
|-----------|----------|
| I.Q. | .394044 |
| Pre-Test | .662425 |
| Post-Test | 1.847951 |