VISUAL AND AUDITORY SKILLS OF GRADE THREE BOYS WHOSE SPELLING ERRORS HAVE BEEN CLASSIFIED AS EITHER VISUALLY OR PHONETICALLY BASED

by

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ABSTRACT

by Everett John Herring, B.Ed.
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Spelling errors were classified as being of two main types. With some exceptions, those graphemes which could stand for a particular phoneme, but were incorrect for the specific word, were classed as visually based errors. Those errors where the grapheme could not stand for the required phoneme were classed as phonetically based errors.

The questions considered were as follows; Will visual type spelling errors, when considered as individual phonemes, as entire words, or as the percentage of total errors be significantly correlated with the visual skills of: visual memory for word forms, visual memory for geometric forms and visual sequential memory? Will phonetic type

spelling errors, when considered as individual phonemes or as entire words, be significantly correlated with the skill of auditory discrimination?

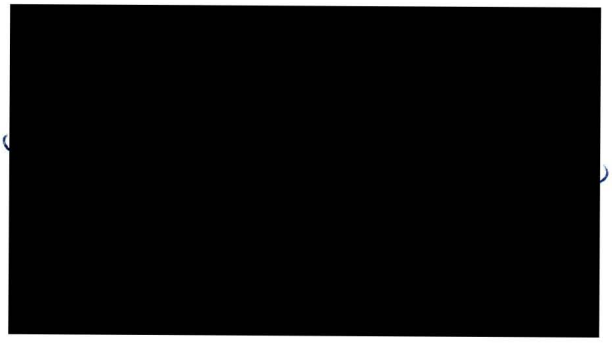
Thirty grade three boys were selected on the basis of their poor performance on the spelling subsection of the Wide Range Achievement Test. These boys were then given a battery of visual and auditory skill tests.

Using the spelling errors, (as made by the student and classified by the researcher) as the dependent variables and the skill tests as the independent variables, a stepwise regression analysis was conducted. This analysis yielded seven significant simple correlations, but there were no significant multiple correlations.

The correlations were significant between the test of visual memory for word forms and: 1.) the number of words phonetically wrong, 2.) the number of phonetic type errors, and 3.) the percentage of errors which were visually based. The correlation between the number of errors on the test for visual memory for geometric forms and the percentage of words which were visually wrong was also significant. The correlations between the score on the test of visual memory for geometric forms and; 1.) the percentage of

visually based errors, 2.) the percentage of words visually wrong, and 3.) the number of words phonetically wrong were significant. These correlations were all significant at the .05 level of probability.

Visual memory for word forms and visual memory for geometric shapes, appear to be significantly correlated with the type of spelling errors made by children. Auditory discrimination and visual sequential memory, as tested in this study, do not appear to be correlated with the types of spelling errors made. The person who remembers what he sees, as tested in this study, can apparently remember phonetic generalizations. It does not necessarily follow that he can remember whether the generalization is appropriate for the present word. The person who cannot remember what he sees, as tested in this study, apparently cannot remember even potentially useful phonetic generalizations.



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DEDICATION

Initially, it was my parent's encouragement that helped me to enjoy trying things for myself and learning from my own experience. It was upon my mother's suggestion that I first considered entering the teaching profession. They have stood behind me with their support in the ensuing years. I would, therefore, like to dedicate this thesis to my parents, Mr. & Mrs. E. W. Herring.

CHAPTER I

INTRODUCTION

Statement of the Problem

Spelling is an acquired skill that, when free of errors, receives little notice. Acquiring this skill is not easily achieved by all. This can be seen by reading the written production of many in our society.

Much has been written regarding spelling (Weir & Venezky, 1968; Fries, 1963; Schonell, 1957; Schonell, 1959; Cahen, 1971; Dieterich, 1972; Hendrickson, 1967; Horn, 1954; 1960; Hudson & Toler, 1949; Hunt et al, 1963; Jensen, 1962; Russell, 1968). These writers have considered spelling to be everything from a simple global skill to a combination of specific skills. Less material is available that breaks spelling down into specific skills and deals with its component parts (Boder, 1969, 1971a, 1971b; Kinsbourne & Warrington, 1965, 1966b; Radaker, 1963).

Considering spelling to be a unitary skill does not appear to have given a method of teaching that is effective for all students. Those who have analyzed spelling have

not found the specific skills needed in spelling, nor have they developed instructional methods that apply to the individual student's skills. Little has been done that would indicate the skills lacking in conjunction with a spelling problem of a specific type.

If a consistent pattern of spelling errors can be found to be associated with specific skill strengths and/or weaknesses, methods can be developed that are practicable for instruction. A survey of the student's spelling errors would be a good source of preliminary information regarding the student's skills and his needs in regard to spelling instruction.

This study will attempt to find associations between skills in the visual and auditory areas and particular types of spelling errors. More specifically its purpose will be to find associations between the skills of; visual memory for geometric shapes, visual memory for word forms, visual sequential memory, and auditory discrimination; and visually and phonetically based spelling error classifications.

Will visual type errors, when considered as individual phonemes, as entire words, or as the percentage of total errors, be significantly correlated to the visual

type skills either singly or in combination? Will phonetic type errors, when considered as individual phonemes or as entire words, be significantly correlated with the auditory skill?

Limitations of the Study

The study will be limited in that only boys at the grade three level will be studied.

A second limitation will be that the motor skills involved in written production of spelling will not be considered.

The study will not take into account the ability of the good speller. It is possible that the ability to spell correctly may be related to factors other than the skill areas considered here.

Basic Assumptions

It will be assumed that spelling errors can be categorized as to whether they are visually or phonetically based.

It is also assumed that the most common phonetic generalizations have been presented to the student by the time he finishes the third grade. An error, that does not indicate the proper use of these generalizations in connection with the attempted word, will be considered to be the result of an improper learning of these generalizations.

Summary

An attempt has been made in this chapter to give some background for the present study. Little has actually been done in this area and yet several studies have started to indicate that worthwhile information is obtainable.

CHAPTER II

REVIEW OF THE LITERATURE

Spelling as a Part of Language

Communication between humans can be oral, written or perhaps symbolic in some other manner. It is the written aspect of communication that shall be of concern in this chapter. It is when one attempts to put down ideas in a written form, that a systematic approach to the choice of symbols becomes important. We have to choose the grapheme, to represent a given phoneme, that is agreed to by those around us who will want to read our written message. We call this choice of the proper grapheme, spelling.

Putting ideas into a code, or encoding, is the basis of language (Hanna, Hodges & Hanna, 1971; Fries, 1963; Hodges, 1965). The combinations of sounds, that we have arbitrarily chosen to accept as words, are social contrivances that allow communication (Hanna, Hodges & Hanna, 1971; Gleason, 1955). We accept as words those spoken symbols which we allow to represent

ideas. Language is not a concrete and fixed system of reality, but a symbolic representation of that reality.

Writing is one step further removed from reality in that we are using graphic symbols to stand for or represent spoken symbols. The speakers of a language agree to the use of certain phonemes as being meaningful in that language. Writing is an attempt to indicate on paper which phonemes were used. If the written system is entirely phonemic or alphabetic there will be one and only one symbol or grapheme for each phoneme. A written symbol would then always represent a spoken symbol, which singly or in combination with others would represent some segment of the speaker's reality.

Spelling in our American-English language system is complicated to a greater or lesser degree by the fact that our written language is not strictly an alphabetic system. We sometimes use two written symbols to represent the same sound; "f" and "ph" both stand for the initial sound as found in the word "fold". We sometimes have one written symbol to represent two sounds as the "g" symbol in "gem" and "get" (Gates, 1957; Hanna, Hanna, Hodges & Rudorf, 1966; Horn, 1954).

Spelling as an Instructional Program

> Hodges, 1965; has stated that, an effective program of spelling needs to consider three factors: 1) the subject matter involved; that is the American-English language, how it is represented in writing, and the bases for selecting the words to be learned; 2) the nature of the learner; that is, how the child learns to spell; and 3) the kind of instructional practices which can effectively help the pupil to acquire understandings of his language and to develop competencies in using it (p. 629). Much has been

written about these three areas and the findings in each area will be summarized.

The American-English Language

Written languages can be ideographic; with one symbol standing for a complete idea or word, syllabic; with one symbol standing for a sequence of phonemes that constitutes a syllable; or alphabetic, with one symbol standing for an individual phoneme. Pure examples of any one of these writing patterns are difficult to find. Our American-English has only a few symbols that could perhaps be called ideographic, the "+" sign would approximate this in that it can stand for the ideas or words of "more", "plus" or "and". We use syllabic symbols very rarely, if at all. If our language were alphabetic, we would need forty-six symbols to stand for our forty-six phonemes (Gleason, 1955; p. 50, lists 46 phonemes as being used in English, other writers list

more or less phonemes; Hanna used 52 in his analysis Hanna, Hanna, Hodges & Rudorf, 1966). American-English is however closer to an alphabetic writing system than to syllabic or ideographic. The discrepancies from this pattern have been the basis of much argument regarding spelling. There are those, (Hanna, 1965; Shah, 1972; Hall, 1961) who very strongly emphasize the alphabetic nature of American-English.

In an effort to find out the extent of the application of these generalizations, Hanna and others at Stanford University have undertaken an extensive study of 17,000 words. The analysis " accurately describes the phoneme-to-grapheme (sound to letter) matching under varying conditions of (1) position, and (2) stress (Hanna et al in Horn, 1966; p. 57)." They found that,

> 19 of 30 consonant phonemes are represented by 19 different graphemic options, or 63 percent, over 80 percent of the time in the corpus. Of the 22 vowels phonemes, only 6, 27 percent, are represented by 6 different graphemic options above the 80-percent criterion for all their occurances in the corpus (Hanna, Hanna, Hodges & Rudorf; p. 101).

This is without regard to position or stress. When position was added as another consideration the regularity increased. When the 22 vowel phonemes, in a 52-phoneme classification, are analyzed without

> regard for positional effect, their mean percentage of correspondence to the alphabetic principle is 62.27 percent. When position is considered, the percentage increases to 74.65 percent. Likewise when only 6 vowel phonemes in this classification exceeded the 80-percent criterion when positional restrictions were tabulated, 15 of these 22 phonemes, 68 percent now exceed the 80-percent criterion..... when the 30 consonant phonemes are analyzed in this way, their mean percentage of correspondence to the alphabetic principle increases from 83.99 to 87.14 (Hanna, Hanna, Hodge & Rudorf, 1966; p. 101).

When stress is added these percentages rise to 78.17 percent for vowels and 89.98 for consonants. The authors use this data to conclude that American-English is alphabetic in principle to a greater degree than their critics would allow.

Horn (1960) lists seven reasons why he considers English to be far enough removed from the alphabetic principle so as to make the teaching of generalizations less than a complete answer. These are quoted by Yee as follows:

> 1. Over one-third of the words in A Pronouncing Dictionary of American English have more than one acceptable pronunciation due to regional and cultivated differences.
> 2. Many different spellings can be given most sounds and even the most common spellings have numerous exceptions.
> 3. A majority of words contain silent letters and about a sixth are spelled with double letters even though only one of the letters may be pronounced.
> 4. Responses become uncertain when more than one reasonable choice is available, such as 'bizzy for busy, honer for honor'.
> 5. Unstressed syllables characterized by the

> schwa or short i sound are very hard to spell by sound.
> 6. Any spelling rule, phonetic or orthographical can be used incorrectly as well as correctly.
> 7. Some spelling elements are fairly consistent, such as word positions and the adding of prefixes and suffixes. More adequate evidence is needed to realize the value of relating sounds to symbols, but it appears that such value should be utilized as an aid to spelling rather than as a substitute for the direct study of these words (Yee, 1966; p. 66).

The evidence is not all in, but it appears that we need to concede that our American-English is basically alphabetic with many exceptions that will require special consideration.

There has not been consensus on what it is that we should be teaching regarding spelling from the many American-English words. Three basic positions have been: 1) We should learn to spell words we are presently using and those dealing with ideas, in which we are interested. (2) We should be learning those words which we will eventually need to have available. (3) We cannot learn to spell all words in school and the classroom teacher cannot decide which words to teach.

Those who argue for generalizations, contend that the use of sufficiently accurate generalizations will allow the student to spell most if not all words. They would suggest that since there are those words which are

not easily learned in this way,"(probably less than 3 percent) it seems best to simply learn them by rote memory" (Hanna, Hodges & Hanna, 1971; p. 123).

Horn (1954) has outlined a program of choosing words using their frequency of use by the students, the difficulty experienced by the children and the future expectancy of use of the word as the criteria (p. 9).

There is no one set of words, (nor even agreement that there should be a set), that is agreed to as being what should be taught in our schools. Most researchers would agree that generalizations would work for some words and that others would need to be learned individually, the disagreement would be on the stress to be placed on each aspect.

The Nature of the Learner

Can spelling be taught to a student or is it simply a by-product of his other language experiences? Peters (1967) puts it as a question in the title of her book, Spelling: Caught or Taught? She summarizes the research as follows: a) Not all children need formal spelling lessons, though the competence of any such children in spelling must be regularly tested (Kyte, 1948).

b) Children are likely to learn how to spell (catch) only about 4% of the words they read (Nisbet, 1941).

> c) Catching words incidentally seems to occur when childrens' attention is centered on some object other than improving the skill itself (Hildreth,1956).
> d) The casual experience of words in reading lessons is, in the case of young and backward children, insufficient for recording permanent impressions (Schonell, 1942).
> e) College students' spelling improves by reading, particularly of words brought to their attention. Better spellers learn more new words through reading than poor spellers (Gilbert, 1935).
> (from Peters, 1967; p. 13).

This research would seem to indicate that spelling skill is not picked up incidentally with language activities. Others have indicated relationships between specific skills and spelling. Perhaps development in a particular skill will allow spelling to develop incidentally.

Hartman (1931) indicates that his research with sixty-three college students shows that spelling is "largely dependent upon one special form of visual reaction and not upon general superiority in any sense modality....." (Hartman, 1931; p. 699). The special form of visual reaction that he refers to is identified as being visual memory span for meaningful visual stimuli.

Radaker's study (1963) would seem to substantiate this finding of Hartman's. He found that training sixty

grade four pupils in "imagery is successful in improving spelling performance over longer periods of time" (Radaker, 1963; p. 371).

Hudson and Toler (1949) found that "remedial instruction in Auditory-Visual discrimination pays big dividends in the improvement of spelling" (Hudson & Toler, 1949; p. 469). They had worked with 259 students, at the grade four to six level, who were low in spelling ability.

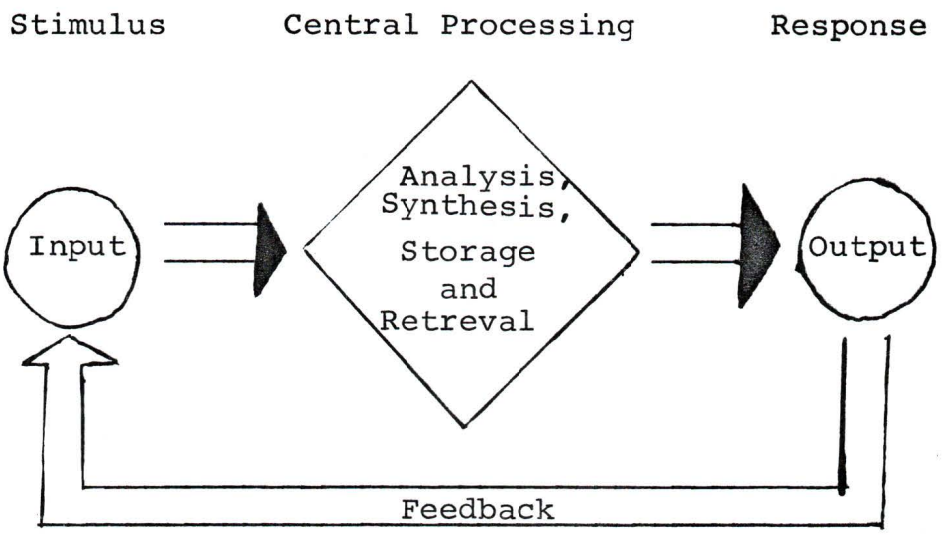
Rubenstein (et al, 1971) concluded that a word presented visually is recoded phonemically. This would substantiate Hudson and Toler's findings of a combined Auditory-Visual discrimination being involved in spelling since both would seem to be involved interrelately.

Using a model of information processing such as that suggested by Chalfant and Flathouse (1971), we would see that most of what we know about how children learn is from observation of the response. We can check the input to some extent in checking the acuity of the sense organs, ie: the eyes and ears. Rubenstein has inferred from his observation somewhat of what is occurring in the central processing area. Little is actually known of what takes place when we learn. Studies that suggest the skills involved as do those listed earlier, (Hartman, 1931; Radaker, 1963; Hudson and Toler, 1949; and

Rubenstein et al, 1971) are for the most part inferring back from studies of the response behavior. This, together with studies of the stimuli, appears to be the most likely source of information for some time to come (Chalfant & Flathouse, 1971).

FIGURE I

Information Processing



(Chalfant & Flathouse, 1971; p. 253)

The purpose of the present study will be to examine the type of spelling response as related to skills that affect the input reception and retention. If we can, by considering the output, identify some possible areas of difficulty in the area of stimulus reception, we will

have moved another step closer to the place where we can develop an effective instructional program in spelling.

The Instructional Practices

How is spelling then to be taught? As indicated earlier, Peters (1967) says it must be taught and not caught for at least the majority of children.

What has been done and what has research shown to be effective? Traditional spellers have given instructions such as; look carefully at the word, say it to yourself, write it, check your spelling and repeat the process if an error is made. This basic skeleton has been enhanced with varying sets of activities which were to enable the student to better understand and remember the word.

Linguistically based spelling programs have presented words to students, generally grouped according to some generalization and instruction was given that, it was hoped, would allow the student to arrive at the generalization inductively (Hanna et al, 1971).

There are programs that would have the student use as many sense modalities as possible in studying the word. He should see, hear, feel, write, visualize etc. Fernald was the pioneer in this field with her

Visual-Auditory Kinesthetic Tactile (VAKT) approach. All of the programs suggest that there are some difficult words ("mavericks" or "demons") that must be memorized. They disagree about the number of these.

With a trend away from a lecture type approach and more of a discovery approach being taken toward teaching; spelling instruction and rote drill were downgraded. Peters says that it is in the wake of this approach that it was hoped by teachers that spelling could be "caught" in the process of other activities. "They comfort themselves with the doctrine that spelling can be picked up incidentally while attending to more important things like creative writing " (Peters, 1967; p. 2).

Golladay (1971) in working with four classes of low ability seventh year students used four methods of instruction; tachistoscope, cyclo-teacher, lecture-discussion and a list of words given for learning. Sixty-five percent of the students receiving the lecture-discussion method achieved 80% or more right on a spelling test, compared to 36% for the tachistoscope method, 33% for the cyclo-teacher and 28% for the list of words. This would indicate that some methods are certainly more productive than others at least for the slow learners.

Little is available in the way of research that indicates how specific instructional methods, specific skill deficits and specific types of spelling errors are related. Golladay would likely have found some individual students who achieved better under one of the other methods, that appeared to be less effective, when the whole group was considered.

Do students have specific skill deficiencies that make a specific method better for them? Golladay's research does not tell us this. Hartman (1930) found a correlation between a specific skill and spelling. Would he have found an even higher correlation had he classified the type of spelling errors made?

Spelling as Related to This Study

Early studies in spelling have considered it to be an undivided skill. Attempts at correlating this global skill area with specific skills were often contradictory in their outcomes (Radaker, 1963; Groff, 1968). It appears that the assumption that all children learn to spell in a singular manner led, to a great extent, to much of the controversy over the study of spelling.

One such area of controversy was in the area of whether a phonetic approach (teaching generalizations or

spelling rules) or a visual approach (teaching word lists, using pretests and proofreading, look and say methods) was the better method to be used in teaching spelling.

Stanford investigators, as represented by Hanna (Hanna & Moore, 1953; Hanna & Hanna, 1960; Hanna & Hanna, 1965; Hanna, Hodges & Hanna, 1971) have found that phonetic generalizations do exist as an important part of our written language. In a research project, under the auspices of the United States Office of Education, seventeen thousand words were analyzed. They found that:

> This statistical analysis ascertained that the correct graphemic option can be predicted for a given occurrence of a phoneme, in these 17,000 words, approximately 90 per cent of the time when the main phonological factors of position in syllables, syllable stress, and internal constraints underlying the orthography are taken into consideration (Hanna and Hanna, 1965; p.21).

Yet when these words were given as phonemes to a computer that had been programmed regarding these factors, only 49% were correctly spelled.

The use of word lists as a basic tool in teaching spelling has been advocated strongly by Horn (1954). He would see phonetic generalizations as one of many tools to be used in a basically visual spelling program.

Although much research has been done on the written

language, there appears to be very little supporting evidence that the teaching of phonetic generalizations is as effective in teaching spelling as Hanna's research would indicate that it should be. Davis (1972) in her study of several spelling programs, found that " as a whole the generalizations were only moderately useful to spelling" (p. 713).

Yee (1969) in working with one hundred-six classes of grades two through six, using Kottemeyer and Ware's Basic Spelling Goals found that: In accounting for variance in pupils' phonetic spellings, the results indicate that the most potent contribution to variance is pupil's sex, with the milder positive effect of pretesting second, and the uncertain effect of phonetic generalizations least significant (p. 87).

Another area of research in regard to spelling, that has produced differing results is the relationship of visual and/or auditory perception to spelling. Radaker (1963) found that the training of visual imagery significantly improved spelling results, even when the post-testing was done one year later. Hartman (1931) in working with college students found that " immediate memory span for meaningful visual stimuli correlated .78±.03 with the spelling criterion (p. 699)."

Gates (1926) in testing three hundred-ten children

in grades one through six, found that " visual perception varies widely according to the form of perceptive responses when the kind of items remain constant"(p. 442) and that "ability to perceive word forms (with the influence of age and intelligence eliminated) is substantially associated with the reading and spelling ability" (p. 442). Jensen (1971) has found a difference between immediate and delayed recall in regard to both visual and auditory memory for digits when working with one hundred-fifty undergraduates. Immediate recall was better when the stimuli were presented auditorily, but delayed recall was better when the stimuli were presented visually. This is confirmed in a study by Parkinson (1972) when working with individual letters presented visually and aurally.

None of these studies has tested the skills as related to a specific type of spelling error. Gates checked perception for word forms, but related it to the general area of reading and spelling ability. Jensen has checked visual and auditory memory for digits but did not relate it to word forms or spelling. Parkinson checked on memory for letters but made no correlation to spelling. Hartman found that immediate memory span for meaningful visual

stimuli correlated with spelling, but he is considering spelling as one unified skill.

Specific skills that have been associated with spelling have been suggested to include:

-Visual Discrimination
-Visual Sequential Memory
-Visual Memory
-Auditory Discrimination
-Auditory Sequential Memory
-Auditory Memory
-Auditory/Visual Integration
-Fine Motor Muscular Control
-Visuomotor Coordination
-Tactile-Kinesthetic Memory
(Boder, 1971a, p. 305-306; Bannatyne, 1971; p. 344-345).

There appears to be no research to check the correlation between the specific skills and the type of spelling error made. In this study it is being suggested that such a correlation may exist and that it should prove useful in the teaching of spelling.

Boder (1969, 1971a, 1971b) has classified dyslexics as falling into three categories. These children, by definition, are having difficulty reading, and Boder states that "an invariable correlation has been found between reading and spelling performances of a dyslexic child, so that how he reads and how he spells are mutually predictive" (Boder, 1969; p. 285).

By using a diagnostic screening procedure that

employs reading and spelling, Boder has grouped dyslexics into dysphonetic dyslexia, dyseidetic dyslexia and combined dysphonetic and dyseidetic dyslexia or alexia. Children in the first category have difficulty with the auditory skill areas of reading and spelling. Those in the second category have problems in the visual skill areas, while those in the third group have difficulty in both the auditory and visual skill areas. Krippner (1973) has designated Boder's three groups as visiles, audiles and tactiles.

Johnson and Myklebust (1967) have grouped these children into two groups with the caution that "dyslexia is rarely found in isolation. Other disabilities are manifest as part of the total syndrome"(p. 150). Their groups are the visual dyslexic and the auditory dyslexic. In spelling, the problem of dysgraphia, (the inability to express language in graphic symbols) may also be present.

Kinsbourne and Warrington (1966a, 1966b, 1966c) in working with four groups of patients found distinctive patterns of spelling occuring among patients with finger agnosia (Gerstmann Syndrome) tended to produce errors that had to do with letter order. Those with aphasia tended to have errors with extraneous letters.

Personke (Personke & Yee, 1971) in his comparison of

children from Jackson, Michigan and West Lothian County, Scotland, suggests that any misspelling that is still capable of rendering the correct sound is phonetic. He divided all errors on this basis as phonetic or non-phonetic misspellings. A lack of understanding of phonetic principles and sound/symbol relationships was evidently present in the children whose attempts at spelling produced combinations of letters that were not capable of rendering the required sound. In the errors that he classified as phonetic, evidently the child knew the phonetic principles and sound/symbol relationships, but could not recall which one to choose as appropriate for the particular word.

In looking for the basis of spelling errors, we would say that Personke's phonetic misspellings were not related to a deficiency in phonetic knowledge. They must have some other basis. It is being suggested here that this type of error has a visual memory basis. The child knows one or several possible ways of representing a phoneme but cannot visualize the correct grapheme for this particular word. In the same perspective, the errors classified as nonphonetic by Personke apparently are the result of a lack of phonetic knowledge and are here classified as being a phonetically based error.

The child who is dysphonetic to Boder or is an auditory dyslexic to Johnson and Myklebust would likely produce errors that are phonetically based in the classification of this study. The child who fits Boder's dyseidetic group or Johnson and Myklebust's visual dyslexic would likely produce errors of the visually based type in this classification.

In this way it is being suggested that spelling errors can be categorized as to type. If the sound symbol relationship is not established and "fish" is spelled as "lont" for example, phonetic knowledge would appear to be lacking. If, on the other hand, "fish" is spelled "phish", then it would indicate a problem of visual memory. The student has not remembered which grapheme to choose to complete this word, although he knows that the grapheme "ph" can stand for the required phoneme.

Summary

Much has been written in regard to spelling and the difficulties of teaching and learning how to acquire the skill. Emphasis has been placed on the subject matter, the student and the methodology. The type of error made by the student has received less attention. Some (Personke,

1971; Johnson and Myklebust, 1967; Kinsbourne and Warrington, 1966a, 1966b, 1966c; and Boder, 1969, 1971a, 1971b) have started to work in this direction.

The present study will not deal with methodology of teaching, as this would be a possible next step. It will deal basically with the student and how he learns and the subject matter with which he is working. The type of error that he makes will be the response considered in an attempt to infer the internal process. The skill tests will be an attempt to measure his input reception and retention.

CHAPTER III

EXPERIMENTAL DESIGN

Definitions

A grapheme is the minimally different written mark that is used to represent some portion of the phonemic structure of the associated or underlying spoken language. (Gleason, 1955).

A phoneme is "a minimum feature of the expression system of a spoken language by which one thing that may be said is distinguished from any other thing which might have been said" (Gleason, 1955; p. 9).

A phonetic generalization is a phoneme/grapheme correspondence that is applicable to many words; (eg: 1.The "a" phoneme as in hay is generally represented by the graphemes "ay" at the end of a word: 2. When adding "ing" to the end of words that end in "ie", change the "ie" to "y" before adding "ing").

Students with spelling problems will be defined as those falling below the fortieth percentile on the spelling portion of the Wide Range Achievement Test (WRAT).

Words of high phonetic representation potential will be those words that can be phonetically represented in more than one way (eg: reason--reeson, reasun).

Visual type spelling errors will be defined as misspellings that have word reversals, transpositions of letters, replacements of a grapheme by others that can stand for the same sound, and the ommission of silent letters.

Phonetic type spelling errors will be defined as misspellings that have no phonetic relationship to the correct spelling, with the exception of reversals and transpositions as noted above.

Visual retention skill for geometric forms will be defined as that which is measured by the Revised Benton Visual Retention Test (RBVRT).

Visual retention skill for word forms will be defined as that which is measured by the Memory for Word Forms Test (MFWFT).

Auditory discrimination skill will be defined as that which is measured by the Meikle Auditory Discrimination Test (MADT).

Visual sequential memory will be defined as that which is measured by the Gaddes Dynamic Visual Retention Test (GDVRT).

Population and Sample

The population of the study was grade three boys from Vancouver Island with spelling problems. The study dealt mainly with boys in elementary schools, in Duncan, British Columbia, but it also concerned two grade three classes from Quadra Elementary School in Victoria.

The Victoria children were given the Memory for Word Forms Test in order to obtain normative data. Norms were obtained for boys, girls and the total group.

The Grade Three children in Duncan Elementary, Khowhemun, Koksilah and Alexander Schools in Duncan were given the spelling section of the Wide Range Achievement Test. Those boys who scored below the fortieth percentile were then given the Peabody Picture Vocabulary Test in order to obtain a sample of uniform vocabulary intelligence rating. As a result of this screening, the sample remaining was twenty-five boys whose I.Q. rating on the PPVT came between 85 and 115. Due to the lateness in the term it was not deemed advisable to attempt to screen through additional students to obtain a larger sample. After the battery of tests had been administered to this group, it was also administered to the five students who had an I.Q. rating above 115 on the PPVT. In order

to determine if the scores achieved by these students were significantly different than the larger group, t tests were run. None of the mean scores were significantly different even as low as at the .20 level. These five students were then included with the larger group and a total sample of thirty grade three boys was used for the calculations.

Boys were chosen, because Yee (1969) found that sex accounted for more variance than either pretesting or the teaching of phonetic generalizations. Girls scored signficantly higher in grades two, three and six (grades four and five were also tested). In only two out of twenty classes were the boys' mean scores higher than the girls.

Maccoby (1966) lists six other studies where spelling achievement was considered across sex. All six found girls superior to boys. Ages ranged from 8 to 15 and testing measures were: school achievement, Stanford Achievement Test (SAT), California Achievement Test (CAT) and Differential Aptitude Test (DAT).

Test Administration

The normative data (see Appendix I) for the Memory for Word Forms Test was obtained by giving the test individually to 57 Grade Three students at the Quadra Elementary School. Plans were then to have the complete

study conducted within the area of Greater Victoria. This later became impossible and no counter check has been run to see if the results in Victoria would have been reproduced in Duncan. The boys in the sample, scored significantly lower (at the .01 level) than did the boys in the normative sample in the Victoria classes. This is explainable, by the sampling method that chose those boys in Duncan who were having difficulty in spelling.

The spelling subtest of the Wide Range Achievement Test was administered to seven class groups in the four Duncan schools. The girls scores were not further used. The boys scores were tabulated and those below the 40th percentile were chosen to be given the Peabody Picture Vocabulary Test. This test was administered individually. Those boys scoring between the I.Q. range of 85 - 115 were chosen for the sample, with the later addition of five who scored higher, as noted earlier.

The testing for the battery was conducted in the writer's camper unit on the back of his truck. This allowed the situation to be uniform for all the boys even though they came from several buildings at the four schools. It was possible to cut out outside light and distracting sights. Outside noises were harder to control.

Minor sounds did not interfere, but louder noises were occasionally heard inside the camper unit. These did not appear to interfere with the test results.

Testing Instruments

Wide Range Achievement Test - Spelling Subtest

The Wide Range Achievement Test (WRAT) is a test of three academic areas; spelling, arithmetic and reading. Only the spelling section was used here to obtain a sample of boys who were having difficulty in spelling. This section consists of forty-five words of increasing difficulty which are to be spelled from oral dictation.

The WRAT manual lists these figures for the test reliability using the split-half correlation of coefficients method: at age eight the spelling subtest had a coefficient of .978; at age nine r=.977 (Jastak and Jastak, 1965; p. 13). Correlation coefficients between the two levels or forms of the spelling subtest are given as:

AGE	r
9.0 - 9.5	.896
9.6 - 9.11	.884
10.0 -10.5	.886

(Jastak and Jastak, 1965; p. 14)

One set of validity coefficients given in the manual is based upon intercorrelation with the WISC. The spelling subtest of the WRAT is cited as producing coefficients at ages eight through eleven with the WISC Verbal, WISC Performance, and WISC Full of .68, .42, and .62.

Merwin and Thorndike in Buros Seventh Annual Mental Measurements Yearbook call these figures into question. They question the sampling procedures, the lack of data, and the interpretation of the results. Thorndike, would hesitantly admit its usefulness as a means of getting a "quick estimate of each person's general level of ability and educational background" (Buros, 1972; Vol. 7 N. 36).

Norms for Level 1 were standardized in 5,868 school children and adults in several states.

Peabody Picture Vocabulary Test

In this test, the student is asked to point to one of four pictures in response to a stimulus word. There are new pictures from which to choose for each stimulus word.

The Peabody Picture Vocabulary Test (PPVT) is not primarily a test of intelligence as much as it is a test of vocabulary knowledge. There are, however, norms that give an intelligence score. The use of the test in the present study was to select a group of subjects who were

approximately equivalent in vocabulary knowledge and, to the extent that it was measured by the test, intelligence.

The manual gives reliability coefficients of .79, .74, and .77 for ages eight, nine, and ten respectively, using the alternate form reliability coefficient method (Dunn, 1965; p. 30). Ten studies cited list coefficients ranging from .54 to .97 on either the test-retest or equivalent forms methods (Dunn, 1965; p. 31).

Correlations between the PPVT and the intelligence tests have produced coefficients of varying ranges.

Tests		Low	High	Median
PPVT MA	'37 Binet MA	.60	.87	.71
PPVT MA	'60 Binet MA	.82	.86	.83
PPVT IQ	'37 Binet IQ	.43	.92	.71
PPVT IQ	WISC Full	.30	.84	.61
PPVT IQ	WISC Verbal	.41	.74	.67
PPVT IQ	WISC Performance	.19	.82	.39
PPVT IQ	WAIS Full	.40	.83	.79
PPVT IQ	WAIS Verbal	.47	.86	.84
PPVT IQ	WAIS Performance	.27	.70	.62

Piers, in Buros Sixth Mental Measurements Yearbook, quotes from the above coefficients and adds, "The PPVT is probably now the best of its kind. It seems to do at least as well as the Ammons FRPV and has considerably more range than the Van Alistyne" (Buros, 1965; 6:530). The

test was standardized on 4,012 subjects from ages two years six months to eighteen years. These subjects were whites from the Nashville, Tennessee area.

Revised Benton Visual Retention Test

The student is shown a plate on which are line drawings of geometric shapes. This plate is exposed for ten seconds and then the student is asked to draw the shapes from memory in the administration used for the present battery of tests. Scoring can be either the number of plates, out of ten, which are correctly reproduced, or the number of individual errors made.

The Revised Benton Visual Retention Test (RBVRT) has been developed to be used to diagnose patients with brain damage. Much has been written regarding its use in this regard (Silverstein, 1962, 1963; Benton & Collins, 1949; L'Abate et al, 1963; Buros, 1965). Norms have been produced for Administrations A and C with normal children (Benton, 1963; Benton et al, 1966). This test is a test of memory for geometric shapes which are presented visually. It also entails visual perception and motor control. There are four possible administrations; copying, ten second exposure with immediate reproduction, five second exposure with immediate reproduction and a ten second exposure with reproduction after a fifteen second delay.

No reliability or validity figures are given in Buros. Schofield states, "it provides a quick and convenient technique for clinical screening of gross defect in visual retention" (Buros, 1953; 4:360).

Memory for Word Forms Test

The Memory for Word Forms Test (MFWFT) is constructed in two parts. The first part is patterned after the RBVRT (Benton, 1963) with the variation that two, three, four, five and six letter words will be presented in place of the geometric shapes. These are to be reproduced from memory by the subject. The second part is patterned after Guilford's Memory for Listed Nonsense Words (Guilford, 1971). Words will be used in place of the nonsense words since Smith and Haviland (1972) and Neisser (1967) indicate that we do recognize words differently than nonwords.

In part "A" the student is shown a three by five inch card on which is typed a single word. This is exposed for ten seconds. After it has been covered, the student is to write it on the provided sheet of paper. There are fourteen words, from two to six letters in length, that are exposed in this manner. Score is the number of words correctly reproduced.

In part "B" the student is allowed ten seconds to look at a three by five inch card on which fourteen words of varying length are typed. This card is removed and after a ten second wait, the student is given a piece of paper on which the same fourteen words, plus six extra words, have been typed. The student is to circle those words that he remembers seeing on the original card. In order to limit the influence of guessing the number of wrongly circled words was subtracted from the number of those correctly circled.

Gaddes Dynamic Visual Retention Test

The Gaddes Dynamic Visual Retention Test (Gaddes, 1966, 1967, 1969), has been designed to provide a test of visual memory "in which the stimulus presentation can be controlled by the examiner, and in which sequential presentation is essential to its operation" (Gaddes, 1969; p. 1). Norms for 363 Victoria school children ages 8 to 13 have been established (Spreen & Gaddes, 1969; p.174).

Meikle Auditory Discrimination Test

The Meikle Auditory Discrimination Test was developed by Dr. Stewart Meikle while he was a faculty member at the University of Victoria. This test has been recently changed, so that the original norms based on Victoria

children no longer apply to the present test. There are norms available using children from Calgary, Alberta where Dr. Meikle now works. The writer has been unsuccessful in obtaining full information on these. Reliability and validity data are not available.

The student is asked to listen to sixty sets of two words and tell whether the words in each set are the same or different.

Test of Spelling - Used as Basis for Classification of Errors

Four Grade Three spelling texts were used to choose the words for this test (Billington, 1957; Bremer & Long, 1964; Green, 1959; Hanna, Hanna & Hodges, 1967). Those words, which had a high possibility of being represented in more than one manner were chosen from these four texts. This gave a list of eighty-three words. Every fourth word from this list was chosen to be included in the test to be used. The words used are listed in Appendix II.

Spelling errors were marked and classified on two bases; 1) each phoneme representation by a grapheme or graphemes was considered by itself. In this scoring, an individual could have several errors per word and they could be of either type or a combination of both types in a given word.

2) Each word was scored as a unit. If the graphemes used could be used to represent the required phoneme in that position in other words or if there were letter transpositions, the error was listed as a visually based error. If the graphemes could not represent the required phoneme the error was listed as a phonetically based error.

Statement of Hypotheses

1. a) There will be a significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the visual memory tests.

b) There will be a significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the visual memory tests.

2. a) There will be a significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the Meikle Auditory Discrimination Test.

b) There will be a significant correlation between the number of words incorrectly spelled, which have been

classified as being of a phonetically based type error, and the score obtained on the Meikle Auditory Discrimination Test.

3. a) There will be a significant correlation between the number of spelling errors, which have been classified as being visually based, and the scores obtained on combinations of any two or more of the visual tests.

b) There will be a significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the scores obtained on combinations of any two or more of the visual tests.

4. a) There will be a significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the scores obtained on the visual tests.

b) There will be a significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error and the scores obtained on the visual tests.

5. a) There will be a significant correlation between the percentage of spelling errors made, which have been

classified as visually based, and the scores on combination of any two or more of the visual tests.

b) There will be a significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the scores on combinations of any two or more of the visual tests.

Analysis of Data

A stepwise regression analysis has been conducted having as variables: 1) Number of visually based errors

2) Percentage of visually based errors

3) Number of phonetically based errors

4) Number of words visually wrong

5) Percentage of words visually wrong

6) Number of words phonetically wrong

The predictors used are:

1) Score on the BVRT

2) Number of errors on the BVRT

3) Score on the GDVRT

4) Score on the MADT

5) Score on the MFWFT-"A"

6) Score on the MFWFT-"B"

The variables of percentage of phonetically based errors, and percentage number of words that are phonetically wrong, produce the same statistics as do the percentages of the visually based errors and the percentage of the words that are visually wrong. They are therefore not used.

Significance, for the purposes of this study, will be established at the probability level of .05.

CHAPTER IV

FINDINGS

In this study, spelling errors were classified as being visually or phonetically based. The children who made these errors were given a battery of visual and auditory skill tests. The number of errors and the skill levels of thirty children were correlated. This was in an attempt to find skills which were related to specific types of spelling errors.

The numbers referred to in this chapter are those denoting the working statements of the hypotheses as found in Appendix III.

Correlational Analysis

Table I shows the intercorrelations for all the variables involved in this study, together with their means and standard deviations. The score on the BVRT significantly correlated with the percentage of errors in both categories, that is with the percentage of errors with the grading which considered each phoneme individually

TABLE I

Intercorrelations, Means and Standard Deviations for the Six Independent and Six Dependent Variables (N=30)

	1	2	3	4	5	6
1. BVRT--Number correct		-.864**	.669**	.164	.380*	.133
2. BVRT--Number errors			-.727**	-.230	-.284	-.142
3. GDVRT				.274	.474**	.230
4. MADT					.338	-.124
5. MFWFT-"A"						-.088
6. MFWFT-"B"						
7. No. of Visual Errors						
8. % of Visual Errors						
9. No. Phonetic Errors						
10. No. Words Vis. Wrong						
11. % Words Vis. Wrong						
12. No. Words Pho. Wrong						
Mean	4.93	7.80	18.87	52.97	10.57	5.07
Standard Deviation	1.96	3.61	3.72	2.67	2.32	2.39

* Significant at .05 level

** Significant at .01 level

TABLE I (continued)

Intercorrelations, Means and Standard Deviations for the Six Independent and Six Dependent Variables (N=30)

	7	8	9	10	11	12
1.BVRT--Number correct	.065	.351*	-.298	.261	.406*	-.370*
2.BVRT--Number errors	-.180	-.275	.179	-.326	-.378*	.290
3.GDVRT	-.012	.211	-.231	.167	.283	-.309
4.MADT	.132	.164	-.169	.145	.154	-.167
5.MFWFT-"A"	.102	.414*	-.493**	.173	.341	-.428*
6.MFWFT-"B"	.203	.170	-.057	.216	.232	-.147
7.No. of Visual Errors		.638**	-.323	.819**	.622**	-.334
8.% of Visual Errors			-.903**	.708**	.905**	-.867**
9.No. Phonetic Errors				-.472**	-.769**	.904**
10.No. Words Vis. Wrong					.871**	-.624**
11.% Words Vis. Wrong						-.902**
12.No. Words Pho. Wrong						
Mean	12.50	58.80	9.47	7.67	51.90	7.33
Standard Deviation	2.98	15.74	5.02	2.64	19.05	3.29

* Significant at .05 level

** Significant at .01 level

and with the grading which considered each word as a unit. In the former case there was another test that had a higher significance than the BVRT, namely the MFWFT-"A". In the latter case the BVRT had the most significant correlation. Therefore, the null hypothesis was rejected for hypotheses 4.1 and 4.7.

There was a significant negative correlation between the score on the BVRT and the number of words incorrectly spelled, which had been classified as being phonetically based, but no significant correlation was found with the other three dependent variables. Therefore, the null hypothesis, was rejected for hypothesis 2.7 and retained for hypotheses 1.1, 1.7 and 2.1.

The number of errors made on the BVRT correlated significantly only with the percentage of words incorrectly spelled, which had been classified as being of a visually based type error. Therefore, the null hypothesis was retained for hypotheses 1.2, 1.8, 2.2, 2.8, and 4.2, and rejected for hypothesis 4.8.

Neither the GDVRT nor the MADT correlated significantly with any of the dependent variables and therefore the null hypothesis was accepted for hypotheses 1.3, 1.9, 2.3,2.9, 4.3, 4.9, 1.4, 1.10, 2.4, 2.10, 4.4 and 4.10.

The MFWFT-"A" had a significant positive correlation with the percentage of visual errors and significant negative correlations with the number of phonetic type errors and the number of words, incorrectly spelled which had been classified as being of a phonetically based type error. Therefore, the null hypothesis was accepted for hypotheses 1.5, 1.11 and 4.11, and rejected for hypotheses 2.5, 2.11 and 4.5.

Since the MFWFT-"B" did not correlate significantly with any of the dependent variables, the null hypothesis was accepted for hypotheses 1.6, 1.12, 2.6, 2.12, 4.6 and 4.12.

Stepwise Regression Analysis

A stepwise regression analysis yielded the probability levels for the variable that showed the largest correlation with the criterion as well as that for subsequent variables. In no instance did a second variable have a significant probability level that indicated that it would be worthwhile to use the multiple regression statistic.

There were no variables that showed significant correlation, singly or in combination, with the dependent variables of; 1) the number of spelling errors classified as being visually based, and 2.) the number of words, in-

correctly spelled, which had been classified as being of a visually based type error.

For the dependent variables of; 1.) percentage of spelling errors, classified as phonetically based, 2.) number of words incorrectly spelled, which had been classified as being of a phonetically based type error; the independent variable with the highest predictive value was the MFWFT-"A" with probability levels of .02, .005 and .018. The variable with the next highest predictive value, the score on the BVRT, did not reach a significant probability level when considered in combination with the MFWFT-"A".

For the dependent variable of the percentage of words, incorrectly spelled, which had been classified as being of a visually based type error, the variable with the highest predictive value was the score on the BVRT. The next highest was the MFWFT-"A" but it did not reach a significant probability level when considered in combination with the score on the BVRT. As a result of these findings the null hypothesis was accepted for hypotheses 3.1, 3.2, 3.3, 3.4, 5.1 and 5.2.

Summary of Analysis

Seven of the null hypotheses were rejected on the basis of the anlaysis of the data. These were hypotheses 2.5, 2.7, 2.11, 4.1 4.5, 4.7 and 4.8.

CHAPTER V

CONCLUSIONS AND SUGGESTIONS FOR FURTHER STUDY

Conclusions--Correlation Analysis

From the hypotheses 2.5, 2.7, 2.11, 4.1, 4.5, 4.7 and 4.8 for which the null hypothesis was rejected, it can be seen that; 1. Three of them involve the MFWFT-"A".

2. Three of them involve the score on the BVRT.

3. One involves the number of errors on the BVRT.

4. Two involve the number of words incorrectly spelled, which have been classified as being of a phonetically based type error.

5. One involves the number of spelling errors, which have been classified as phonetically based.

6. Two involve the percentage of spelling errors, which have been classified as visually based.

7. Two involve the percentage of words, incorrectly spelled, which have been classified as being of a visually based type error.

These correlations are summarized in TABLE II. The two independent variables that measure visual memory correlate negatively with phonetically based type errors. The subject who can remember what he sees, as tested by the independent variables of the MFWFT-"A" and the BVRT, can apparently also remember phonetic generalizations as indicated by the lower number of errors involving phonetics (Hypotheses 2.5, 2.7 and 2.11) and the higher percentage of errors that are phonetically correct (Hypotheses 4.1, 4.5 and 4.7). The subject who can not remember what he sees and consequently has a high number of errors on the BVRT, apparently cannot remember his phonetic generalizations either, since he produces a smaller percentage of visually based errors (Hypothesis 4.8). These are errors that contain a possible, but not the traditionally accepted, graphemic representation for the given phoneme.

It would appear that the ability to remember which grapheme to choose is related to some skill other than those which have been examined in this study. Perhaps expectancy of uniformity is a factor that could be examined. If the subject expects that a phoneme will always be represented in the one way that he remembers, he may not search for other alternatives.

TABLE II

Summary of Significant Analysis Results

Independent Variable	r	Type of Correlation	Dependent Variable
MFWFT-"A"	-.428	Negative	No. Words Phonetically Wrong
MFWFT-"A"	.493	Positive	No. Phonetic Type Errors
MFWFT-"A"	.414	Positive	% of Errors Visually Based
BVRT--Number Errors	-.378	Negative	% of Words Visually Wrong
BVRT--Score	.351	Positive	% of Errors Visually Based
BVRT--Score	.406	Positive	% of Words Visually Wrong
BVRT--Score	-.370	Negative	No. Words Phonetically Wrong

When the child is being taught phonetic generalizations, their uniform applicability is stressed and the possibility of a variation is often downplayed. This can be illustrated in the errors of several of the sample studied here; K11 spelled "hate", "obey" and "weigh" as "hayt", "obay" and "way"; R13 spelled "straight", "hate", "obey" and "weigh" as "strate", "hate", "obaye" and "wae", J20 spelled "earth", "learned", and "other" as "rth",

"lrnd" and "uthr", and J21 spelled "graph" and "photo" as "grave" and "votow". These children apparently had a phonetic generalization that they used, but it was one which either did not apply to these particular words or was completely inapplicable as the use of the "v" grapheme for the "f" phoneme.

Conclusions--Stepwise Regression Analysis

Apparently the tests used were testing skills that were similar enough so that in the three instances when there were two that had significant correlations with the same dependent variable, a combination of those two did not significantly improve the predictability. The correlations between the tests would indicate this similarity. The correlation between the score on the BVRT and the number of errors on the BVRT was predictably high at -.864. The correlation between the score on the BVRT and the MFWFT-"A" was .380.

Further Comparisons Using Normative Data

There was no sample of good spellers in this study with which to compare the poor spellers. The results failed to produce two groups of spellers with distinctive patterns of errors as had been expected. In an attempt to check, to some extent, the ability of the tests

used to separate poor spellers from a normal group, t tests were run between the sample scores and the normative data. This information is contained in TABLE III. The results cannot be conclusive because we cannot be certain that the normative sampling represents a "normal" range of spelling ability.

> The sample used for the GDVRT norms was: "a randomly selected population of school children in several Victoria schools. Repeaters,children with known learning or behavior problems and children with known brain dysfunctions were excluded. Tests on these "normal" children produced an average IQ of 112 for all age groups .....the sample can be considered as representative for a middle-class Western Canadian school population" (Spreen & Gaddes, 1969; p.170).

If we assume a normative curve of spelling ability for the group and run t tests between this group and the sample of pupils with spelling problems from this study, we find that the mean scores are not significantly different. It is unlikely that the GDVRT is a useful predictor of spelling ability.

The norms for the MFWFT were run with the entire third grade population of an average Victoria school. The children represented, can be assumed to exhibit an average range of spelling ability at the third grade. When the t tests were run between this group and the sample,

TABLE III

NORMATIVE DATA - COMPARED WITH SAMPLE DATA

TEST	DATA	GROUP	NORMATIVE DATA		SAMPLE DATA		t VALUE
			N	DATA	N	DATA	
BVRT Correct	Mean	9 yrs	?	4	23	5.04	
		10 yrs	?	5	7	4.55	
		Total	?	?	30	4.93	
	Stan. Dev.	9 yrs	?	?	23	2.09	
		10 yrs	?	?	7	1.18	
		Total	?	?	30	1.96	
BVRT Errors	Mean	9 yrs	?	9-10	23	7.96	
		10 yrs	?	7-8	7	7.28	
		Total	?	?	30	7.80	
	Stan. Dev.	9 yrs	?	?	23	3.88	
		10 yrs	?	?	7	2.41	
		Total	?	?	30	3.61	
GDVRT	Mean	9 yrs	65	20.4	23	18.91	1.26
		10 yrs	47	20.4	7	18.71	.77
		Total	?	?	30	18.87	
	Stan. Dev.	9 yrs	65	5.1	23	3.91	
		10 yrs	47	4.8	7	2.65	
		Total	?	?	30	3.72	
MADT	Mean	Total	Appx 600	53.57	30	52.97	
	Stan. Dev.	Total		?	30	2.67	
MFWFT-"A"	Mean	Total	57	12.49	30	10.57	2.91*
	Stan. Dev.	Total	57	1.92	30	2.32	
MFWFT-"B"	Mean	Total	57	4.67	30	5.07	-.79
	Stan. Dev.	Total	57	2.14	30	2.39	

*=$p < .01$?=Data unavailable

the MFWFT-"A" showed significant differences (at the .01 level) between the groups whereas the MFWFT-"B" showed no significant differences.

Data was not available with which to compare the sample with the normative sample on the BVRT and the MADT.

While it is admitted that the above analysis is open to question in that the spelling ability of the normative groups is not known, it may be assumed that the MFWFT-"A" is the only one of the tests checked that is potentially useful in differentiating between a "normal" group and a group of children with spelling problems.

Possible Explanation For The Findings

In re-examining the study, there are three areas that could help explain the findings or lack of more conclusive findings. The first, which has already been mentioned, is the limiting effect of considering only a group of poor spellers. The results did not break the sample group into separate groups of students who showed extreme tendencies toward one or the other kind of spelling error. Perhaps, if the study had included a second group of students who showed good spelling ability, the tests might have been

able to discriminate between good spellers and poor spellers and maybe even been more effective in dividing them according to the kind of error. This restriction is called "restriction of range"(Kaufman, 1972; Guilford and Fruchter, 1973). By restricting the range of potential scores, the degree of correlation is minimized. When the range of differences, which are being compared, is reduced, the potential for correlation is reduced as well. "It is possible for a test that shows low validity in a restricted group to be very effective in a more heterogenous population" (Kaufman, 1972; p. 4).

There is a method whereby an estimate can be made of what the correlation would have been if restriction of range had not been in effect (Kaufman, 1972). Since the required data were not available for the unrestricted group involved in this study, the formula can not be applied.

Barnsley indicates that for reading, the good-poor reader design "tends to obscure the relationships between 'psychological process' variables and reading" (Barnsley, 1973; p. 3). He explains further; As reading ability has been shown to be dependent upon more than one prerequisite behavior, it is possible that a deficiency on only one of these variables is sufficient to produce reading difficulties. There-

> fore, it is highly probable that the selection of a poor reading group results in a sample that represents several causes of reading difficulties. Thus, an experiment that utilized a "good-poor reader design" might end up with only one or two children in a poor reader sample of 30 that were inferior in the particular psychological process under investigation. Due to the small representation in the poor reader group of children deficient in the hypothesized prerequisite skill, it would be impossible to demonstrate statistical significance" (Barnsley, 1973; p. 4). This type

of finding is equally possible in studies of spelling. Simply expanding the study to include a group of good spellers would not necessarily improve the results. In this study the effect, of considering only thirty poor spellers, may have to lose those whose spelling difficulties are related to a lack of visual skill, in the larger group of the sample. Perhaps for some students there are significant correlations undetected here.

A second possible area of difficulty with the present study would be in the choice of words on which to base the classification of errors. Choosing words, on the basis that there exist more than one means of representing the phoneme in that position, in a word, may have predetermined to some extent the type of error made by the students.

The third possible explanation for the present findings is the choice of tests. Tests may exist, or it may

be possible to construct tests that more accurately measure the skills that are related to spelling ability.

Suggestions For Further Study

1.) Expanded Range

The lack of more significant findings in the present study may be attributable to the restriction of range as already noted. This could be overcome by studying an expanded range of children in regard to age and spelling ability.

2.) Other Skill Tests

There may be other tests that could be more useful in measuring the visual and auditory skills which are related to spelling. Gaddes (personal communication, July, 1973) has suggested that speeding up the administration of the GDVRT, to bring it more into line with reading and spelling type skills, would perhaps produce more significant results. There was no test for visual discrimination used in this study. Delayed visual memory was not really measured, although the MFWFT-"B" was a partial attempt in this direction. Perhaps the MFWFT-"A" could be altered so as to test delayed visual memory for word forms and administration D of the BVRT used regarding

geometric forms. A test of phonetic skill would also be a useful addition to the battery of tests.

3.) Different Words

A further study could consider using other words on which to base the classification of errors. Perhaps an extension of the list, to include other words which may be more representative of the total range of words used by third year students, would be a useful consideration.

4.) Teaching Expectancy of Ambiguity

The findings appear to indicate that visual memory is not as closely related to the choice of the "correct" grapheme as it is to the choice of any potentially correct grapheme. There might be value in teaching a unit to students in order to help them learn to expect ambiguity or lack of uniformity in the representation of phonemes. Pretesting and posttesting regarding the types of spelling errors made, would indicate if such an expectancy affects the care taken in choosing the grapheme.

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APPENDIX I

MEMORY FOR WORD FORMS TEST

The tests conducted in the Quadra Elementary School, Grade Three classes, were the two parts of the Memory for Word Forms Test. This test was designed basing Part A on Benton's Visual Retention Test and Part B on Guilford's Memory for Nonsense Words Test.

Part A consists of showing a student a word, which he is unlikely to know, for ten seconds and then having him reproduce it from memory. The words vary from 2 to 6 letters in length. The score is the number of words correctly reproduced.

The words as printed on 3" by 5" cards for Part A are:

id - base of life tendencies

ai - three toed sloth

zen - Eastern Religion

adz - kind of hatchet

kin - relatives

wadi - dried up river bed

dais - platform

lieu - in place of

helix - spiral form

nymph - stage of insect life cycle

umbra - shadow

syntax - grammatical organization

bisque - rich soup made from shellfish, birds or rabbits

phylum - division of animal or vegetable kingdom

(Definitions from Websters New Collegiate Dictionary, 1958)

Part B consists of showing the student a list of 14 words, (which he is unlikely to know) for ten seconds, waiting for 10 seconds and then asking the student to circle as many of these words as he can remember. He is given a list of twenty words from which to choose. To eliminate the effect of guessing, the number wrong are subtracted from the number right.

The words for Part B were:

Exposed

fa	gnu	lyre	tibia	milieu
pi	yen	tolu	bayou	syrinx
	ret	orgy	annex	boucle

Expanded list from which to choose:

ar	gnu	lynx	tibia	milieu
pi	ret	orgy	annex	boucle
li	yen	tolu	bayou	concha
fa	zag	lyre	culex	syrinx

Words for Part B with definitions:

fa - note of the musical scale

pi - Greek letter

gnu - African antelope

yen - an intense desire

ret - to soak in water

lyre - instrument like a harp

tolu - kind of Balsam

orgy - excessive indulgence in any activity

tibia - big bone

bayou - tributary, minor river

annex - to add on

milieu - environment, setting

syrinx - vocal organ of birds

boucle - fabrics, with knotted and curled appearance

ar - a metric measure equalling 119.6 sq. yards.

li - a Chinese unit of measure equal to about one-third of a mile

zag - a deviation from a straight line

lynx - a wildcat with long legs, short stubby tail and often tufted ears

culex - a mosquito

concha - a structure shaped like a shell

(Definitions from Webster's New Collegiate Dictionary, 1958)

Normative Data for MFWFT

	Boys N=31		Girls N=26		Total N=57	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Part A	12.32	2.12	12.68	1.75	12.49	1.92
Part B	4.10	1.97	5.22	2.46	4.67	2.14

There are some things that are of importance in this test administration. The girls' higher scores are a confirmation of the tendency for girls to outperform boys in the elementary academic subjects.

The high number of perfect scores in Part A indicates that many grade three students can remember more than six letters when they are exposed for 10 seconds. Perhaps extending the test to include seven and eight letter words would be a worthwhile alteration for later consideration. Another possible alteration might be to change the exposure time from 10 seconds/word to 2 seconds/letter.

Of the words wrongly circled in Part B, 38.4% were when 'lynx' was circled. This could be partly explained because it was in the place of 'lyre' which has a very similar appearance. The similarity between 'culex' and 'annex' is not quite as pronounced and the 20.9% of errors

made on this word may indicate this. No word exposed has a form very similar to 'concha' and the 4.7% error made on this word may confirm that the subjects use the form of the word to aid in recall.

Part B - Words Wrongly Chosen

Word	Number of times chosen	% out of total
ar	12	14
li	13	15
zag	6	7
lynx	33	38.4
culex	18	20.9
concha	4	4.7
	86	100

Reliability coefficients were computed. Using the Kuder Richardson formula 20 produced the following results: MFWFT-"A" r=.71 and MFWFT-"B" r=.47

The correlation between the two parts of the list was .31 using the normative sample and .088 using the study sample. This would indicate that they test relatively unrelated skills.

APPENDIX II

SPELLING WORDS USED FOR CLASSIFICATION OF ERRORS AND TYPES OF ERRORS MADE ON THOSE WORDS

Word Required	Error Classed as Visual	Error Classed as Phonetic
minute	minit minut minet minite	mineut mit mineat minuit miniet minte munite mineit minty
busy	bizy bisse bisy bize bizzy bise bizey biszey	besse bizzea bece bivy beasy bezy
straight	strat strait strate	srat stright stat state stirte
hate	hayt haet hat hait	
reach	reche rech reech	reatch rest rach
crowd	croud croude crowde crowed	crod crode crawd code groud krod ckrawud clade caood

people	pepel peopel peopl peple pepple pepoul pepole pepil pepule	pople peapele poele
talk	tauk tolk tocke tock tok	take touck toak toack toce toke
earth	erath erth erthe rth	bearthe ath eath arth resh
wear	ware waer where	were wire whar rare war wery wer wher
graph	graf grafe	craf gaph gaf grave
badge	bage bag baj baje	babg pag bache
obey	oba obae oday obaye obay odae owba	obaey opay obe obawy oby

view	vew vyu vue veyou voo vuyou	veou wvoo voeaw vuow voue vow vwy veuy revec verier avuw vowe viwe veire
learned	lerned loorned lernd lrnd lurned learnd	lerd lred lornd lrened leandened leaned loernd
these	thes theze theis theas thess	theys theses qes
other	uther uthr uthere	oler thour ather uths outher uthered
sure	sher shoower shure shoor	
weigh	whay waeigh way wheigh wae whae waigh	wea wave wigth waelel waight weghe weie wighe
photo	fotoe fotow foto phohto foato photoe	fato fotoll foteo fotle fotol fodo votow fothery

APPENDIX III

WORKING STATEMENTS OF THE HYPOTHESES

1.1 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the BVRT.

1.2 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the number of errors made on the BVRT.

1.3 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the GDVRT.

1.4 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the MADT.

1.5 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the MFWFT-"A".

1.6 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on the MFWFT-"B".

1.7 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the BVRT.

1.8 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the number of errors on the BVRT.

1.9 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the GDVRT.

1.10 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the MADT.

1.11 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the MFWFT "A".

1.12 There will be no significant correlation between the

number of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the MFWFT "B".

2.1 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the BVRT.

2.2 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the number of errors made on the BVRT.

2.3 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the GDVRT.

2.4 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the MADT.

2.5 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the MFWFT "A".

2.6 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on the MFWFT "B".

2.7 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the score obtained on the BVRT.

2.8 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the number of errors on the BVRT.

2.9 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the score obtained on the GDVRT.

2.10 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the score obtained on the MADT.

2.11 There will be no significant correlation between the

number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the score obtained on the MFWFT "A".

2.12 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a phonetically based type error, and the score obtained on the MFWFT "B".

3.1 There will be no significant correlation between the number of spelling errors, which have been classified as being visually based, and the score obtained on combinations of any two or more of the tests.

3.2 There will be no significant correlation between the number of words incorrectly spelled, which have been classified as being of a visually based type error, and the scores obtained on combinations of any two or more of the tests.

3.3 There will be no significant correlation between the number of spelling errors, which have been classified as being phonetically based, and the score obtained on combinations of any two or more of the tests.

3.4 There will be no significant correlation between the number of words incorrectly spelled, which have been

classified as being of a phonetically based type error, and the scores obtained on combinations of any two or more of the tests.

4.1 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the score obtained on the BVRT.

4.2 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the number of errors made on the BVRT.

4.3 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the score obtained on the GDVRT.

4.4 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the score obtained on the MADT.

4.5 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the score obtained on the MFWFT "A".

4.6 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the score obtained on the MFWFT "B"

4.7 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the BVRT.

4.8 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the number of errors made on the BVRT.

4.9 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the GDVRT.

4.10 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error and the score obtained on the MADT.

4.11 There will be no significant correlation between the

percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the MFWFT "A".

4.12 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the score obtained on the MFWFT "B".

5.1 There will be no significant correlation between the percentage of spelling errors made, which have been classified as visually based, and the scores on combinations of any two or more of the tests.

5.2 There will be no significant correlation between the percentage of words incorrectly spelled, which have been classified as being of a visually based type error, and the scores on combinations of any two or more of the tests.

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Title of Thesis/Dissertation

VISUAL AND AUDITORY SKILLS OF GRADE THREE BOYS WHOSE SPELLING ERRORS HAVE BEEN CLASSIFIED AS EITHER VISUALLY OR PHONETICALLY BASED

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