



Kindergarten performance for reading and matching four styles of handwriting
by Betty Jean Duvall

A thesis submitted in partial fulfillment of the requirements for the degree of DOCTOR OF
EDUCATION

Montana State University

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Abstract:

Research to support the claim that manuscript more nearly resembles the print in books was not found. The four general questions to be answered in this study were: (a) if there was a difference between scores for matching handwritten manuscript, cursive, italic and D'Nealian style letters to typeset, as measured by a Matching Letter Styles Test; (b) if there was a difference between scores for reading typeset and handwritten manuscript, cursive, italic, and D'Nealian letters from flash cards? (c) if there were main effect differences between reading and matching scores; and (d) if there were main effect differences between reading and matching scores for manuscript, cursive, italic, and D'Nealian.

An investigation was conducted in 1984, with a group of 69 kindergarten students from four elementary schools in Great Falls, Montana. Students were asked? (a) to match typeset distractors to small letters b, d, g, l, m, n, p, q, u, and v handwritten in manuscript, cursive, italic, and D'Nealian using a Matching Letter Styles Test, (b) to read the same small letters from flash cards reproduced in typeset and the handwritten in the same four styles, and (c) to write b and d like the models of the four styles tested.

A post-test-only design for repeated measurement with the independent variable of style was used. Statistical analyses to test the hypotheses were significant at the $<.01$ level. Mean scores for the students were significantly higher for matching italic and manuscript style to typeset than for matching D'Nealian and cursive. Mean scores for D'Nealian were significantly higher than for cursive. Mean scores for reading typeset, manuscript, italic, and D'Nealian were significantly higher than for reading cursive. Mean scores for matching were significantly higher than for reading. Students wrote more manuscript, italic, and D'Nealian letters b and d like the model than they wrote cursive.

By analyses of the data in this study, it was shown that cursive was harder to match, harder to read, and harder to write. The results of this study, the review of the literature, and observation lead the author to conclude that italic would be the best style of handwriting to teach.

KINDERGARTEN PERFORMANCE FOR READING AND MATCHING
FOUR STYLES OF HANDWRITING

by

BETTY JEAN DUVALL

A thesis submitted in partial fulfillment
of the requirements for the degree

of

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APPROVAL

of a thesis submitted by
Betty Jean Duvall

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

Research to support the claim that manuscript more nearly resembles the print in books was not found. The four general questions to be answered in this study were: (a) if there was a difference between scores for matching handwritten manuscript, cursive, italic and D'Nealian style letters to typeset, as measured by a Matching Letter Styles Test; (b) if there was a difference between scores for reading typeset and handwritten manuscript, cursive, italic, and D'Nealian letters from flash cards; (c) if there were main effect differences between reading and matching scores; and (d) if there were main effect differences between reading and matching scores for manuscript, cursive, italic, and D'Nealian.

An investigation was conducted in 1984, with a group of 69 kindergarten students from four elementary schools in Great Falls, Montana. Students were asked; (a) to match typeset distractors to small letters b, d, g, l, m, n, p, q, u, and y handwritten in manuscript, cursive, italic, and D'Nealian using a Matching Letter Styles Test, (b) to read the same small letters from flash cards reproduced in typeset and the handwritten in the same four styles, and (c) to write b and d like the models of the four styles tested.

A post-test-only design for repeated measurement with the independent variable of style was used. Statistical analyses to test the hypotheses were significant at the $<.01$ level. Mean scores for the students were significantly higher for matching italic and manuscript style to typeset than for matching D'Nealian and cursive. Mean scores for D'Nealian were significantly higher than for cursive. Mean scores for reading typeset, manuscript, italic, and D'Nealian were significantly higher than for reading cursive. Mean scores for matching were significantly higher than for reading. Students wrote more manuscript, italic, and D'Nealian letters b and d like the model than they wrote cursive.

By analyses of the data in this study, it was shown that cursive was harder to match, harder to read, and harder to write. The results of this study, the review of the literature, and observation lead the author to conclude that italic would be the best style of handwriting to teach.

CHAPTER I

INTRODUCTION

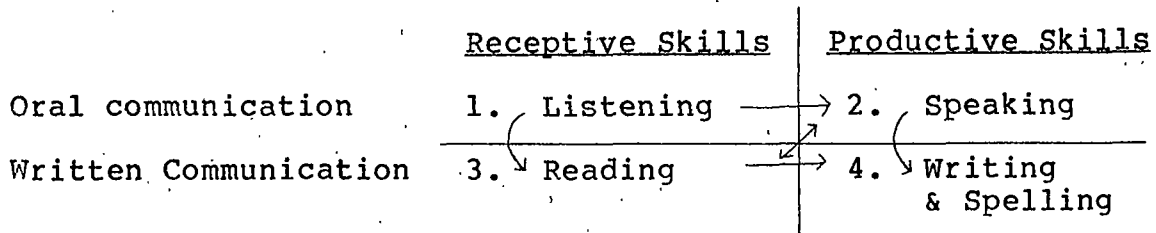
Over the past several decades one of the pervasive problems in elementary education has been what style of handwriting to teach. Currently in the United States, by general classification, four styles are being taught--manuscript, cursive, italic, and D'Nealian. The extent to which these styles are taught must be conjectured from earlier surveys. These surveys indicated that the majority of schools taught manuscript for initial instruction and made a transition to cursive before grade four. (Freeman, 1946; Herrick, 1963; Polkinghorne, 1946).

Educators attempting to select a style for handwriting instruction, based on research evidence, will find conflicting reports. Turner (1930) and Freeman (1936) found evidence to suggest that manuscript was more legible than cursive. Templin (1960) and Groff (1961), using adult populations, found that a feeling for the quality and legibility of one style of writing and a preference for its use were related to the sex of an individual. Studies by DiSpigno (1978), Lehman (1976), and Thomson (1954) claimed italic to be superior in both speed and legibility. Studies by

Freeman (1936), Hildreth (1945), Reeder (1930), Turner (1930), and Washburn and Morphett (1937) found little evidence to support the speed-superiority of cursive over manuscript.

The author feels the selection of a style of handwriting should be based on sound instructional theory, the legibility and speed with which the style can be written, and ease with which the beginning reader can associate typeset and handwritten letters. Reading and writing are both forms of language expressed with the same set of phonemic elements represented by the same set of graphic symbols, the ABC's, or alphabet. While reading is the visual decoding of the graphic symbols, writing is the motor-muscular encoding of the same graphic symbols that are then visually perceived. Reading and writing are the counterparts of listening and speaking.

In a course in the teaching of language arts, Dr. Elnora Old Coyote used the following diagram (based on Wilkinson, 1971) to express the interrelationships of the language arts.



The majority of studies seems to support the view that abilities in the four language arts are distinct but closely interrelated. Listening is closely related to

reading comprehension. Listening and reading comprehension are receptive skills. Speaking is closely related to writing and spelling. Speaking and writing and spelling are productive skills. Listening is related to speaking. Listening and speaking are used for oral communication. Reading is related to writing and spelling. Reading and writing and spelling are used for written communication. If it is misleading to speak about a single 'language skill', we can, nevertheless, recognize the interrelationship of speaking, listening, reading, and writing and spelling. Wilkinson (1971) stated, "They may be closer than we think; after all, handling a pen is not a linguistic skill, and yet lack of that skill may easily inhibit the fluency on paper of a good speller" (p. 116).

Writers of current books on teaching of language arts concur that one of the reasons for teaching manuscript is that it more nearly resembles the print in books; so, primary children learn only one graphic representation of the alphabet for reading and writing (Anderson and Lapp, 1979; Coody and Nelson, 1982; Dehaven, 1979; Hennings, 1982; Marcus, 1977; Norton, 1980; Petty, Petty and Becking, 1981; Rubin, 1975; Savage, 1977).

The ability of young children to recognize different letter styles, within the range of accepted variations of the Roman alphabet, was challenged by Hay (1965). Hay felt that the ability of young children to recognize letters

was far greater than most teachers of primary children admitted. Lehman (1976) claimed that manuscript models did not support the child's early experience with print in books and that the lack of unique design features caused confusion and frequent reversals. He felt that children had a better chance of associating handwriting models with past reading experience if their handwriting models were italic letters, because Roman typeset, and its slanted version italic, is our universal visual format for publishing.

One of the suggestions for research on handwriting by Horn (1962) was that there was a need for more evidence on the readability of various styles of writing. No studies were found that indicate: (a) that the young child can recognize one style of handwritten letters better than another, or (b) that, for the young child, one style of handwriting more nearly resembles the print in books.

Purpose of this Study

The purpose of the investigator was to study the following: (a) the ability of kindergarten children to match handwritten manuscript, cursive, italic, and D'Nealian letters to typeset, (b) the ability of kindergarten children to read typeset and handwritten manuscript, cursive, italic and D'Nealian letters, and (c) the relationship of reading and matching ability. This study was conducted in the 1983-84 academic year with the participation of kinder-

garten students in four classes from different elementary schools in Great Falls, Montana.

Importance of the Study

Handwriting is a basic skill and, together with reading, is universally recognized as a fundamental aspect of literacy. Huitt (1972) concluded,

A review of the published research on handwriting forces a nod of agreement with Pose Lamb's statement that 'handwriting is understressed, undervalued, and poorly taught.' Although most other areas of instruction have undergone much rethinking during the past two or three decades, handwriting instruction has seemed to remain relatively untouched and unchanged. (p. 219)

Surveys of the research and literature related to handwriting have been reported by Andersen (1965), Askov, Otto, Askov (1970), Herrick (1960), Horn (1962), Otto and Anderson (1969), Peck, Askov, Fairchild (1980), Petty (1966), and Shane and Mulry (1963). The research which might be labeled valid appears to result in conflicting conclusions as to which style of handwriting to teach. It is the author's opinion that a vast majority of the handwriting literature is of the nature of opinions.

A fundamental issue that has not been addressed in the literature is whether or not one style of handwriting is more easily recognized by the young child. In their study, Platter and Woestehoff (1967) investigated the degree to which reading skills were transferred from text print to cursive. In the investigation the author focused on

grade one, where only manuscript writing was typically used; grade three, where in the surveys it was indicated the transition in handwriting was generally made; and grade five, where children had usually received instruction in cursive writing for at least one year. The Word Recognition Test of Gates Primary Reading Test, Forms 1 and 2, was administered to 25 first-grade students. The entire Gates Reading Survey Test Forms 1 and 2 were administered to the 40 third-grade and 45 fifth-grade students. The printed Form 1 of each of those tests was reproduced in cursive handwriting. Each form of the test was administered in a single session. One-half of the students in each grade level group received the cursive form first, while the other half was given the printed form initially. Coefficients of correlation were obtained between the scores on the printed and cursive written forms of the Gates Reading Tests using Chi-square values. The correlations between scores on the printed and cursive written forms of the Gates Reading Tests were: .79, .83, .90 for grades one, three, and five, respectively. It would appear that a pronounced relationship existed between the students' ability to read print and cursive style writing.

Two conflicting studies on the style of handwriting taught and the relation to reading performance were found. Authors repeatedly refer to a 1931 study of Voorhis. These authors report that the use of manuscript writing in grade

one definitely hastened the growth of the ability to read. The present researcher was unsuccessful in obtaining a copy of the study by Voorhis, but found it cited as early as 1936 by Conard.

In a later study, Early, Nelson, Kleber, Treegoob, Huffman and Cass (1976) investigated the use of cursive writing in first grade. One class of 27 first graders (the experimental group) was taught cursive writing integrating all relevant modalities (visual, auditory, vocal, motor, tactual, and kinesthetic). Another class of 21 first graders (the control group) was taught manuscript writing by traditional methods. It was reported that "the evidence is at least strongly suggestive that certain factors in initially teaching manuscript writing to children must be reexamined in light of the data" (p.73). In this study, it was reported that the use of cursive writing: (a) did not adversely affect the child's reading or spelling performance, (b) reduced the number of reversal and transposition errors, and (c) increased the level of achievement in spelling.

Early et al. (1976) advocated the use of cursive writing as a remedial tool for children with learning disabilities and stated "that the almost universal practice of teaching manuscript writing initially may depend more on tradition than on scientific evidence" (p. 73). They did not suggest whether the technique integrating all relevant modalities or traditional methods could have accounted for the differences,

instead of the cursive/manuscript variable.

The research to support choosing manuscript, cursive, or italic handwriting, based on speed and legibility, is not conclusive. The decision is further complicated by suggestions to teach D'Nealian, a modified manuscript/cursive. The author feels a relationship of handwriting style to print for the beginning reader must be established before deciding which style of handwriting to teach based on writing efficiency. The relationship of reading and writing and spelling necessitate establishing the style that most easily transfers from one to the other. Research was not found that would aid choosing a style of handwriting to teach based on the relationship of that style to reading. In the results of the present study that relationship has been further established.

If children are able to read and match letters independent of the style in which they are written, it would seem attention might then be directed to the attributes necessary for fast, legible writing and determining a style for handwriting instruction based on those attributes. Conard (1936) stated, "The aim of all handwriting instruction is to develop skill so that the expression of thought and ideas may be recorded in an easy, fluent, and legible form for others to read" (p. 4). Choosing the style of handwriting that would best facilitate the aim is the dilemma with which educators are faced.

General Questions to be Answered

1. Is there a difference between kindergarten students' scores for matching handwritten manuscript, cursive, italic and D'Nealian letter styles to typeset?

2. Is there a difference between kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian?

3. Are there main effect differences between kindergarten students' reading and matching scores?

4. Are there main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian letters?

Summary

The question of which style of handwriting should be taught to best meet the needs of students has persisted for several decades. Cursive writing was taught for about seventy years, until manuscript was introduced from England about 1921. Currently, authors of books on teaching language arts suggest manuscript, with a transition to cursive, italic, or D'Nealian. The research evidence for making a choice based on the speed and legibility with which the style can be written is conflicting.

Since reading and writing are both symbolic representations of speech, a decision concerning what style of handwriting to teach should be assessed in relation to reading.

Although most supporters for teaching manuscript give its resemblance to the print in books as a reason for teaching it, evidence was not found to indicate that a resemblance exists and/or matters to the young learner. Studies used to test the ability of children to recognize letters in a variety of styles were not found.

The purpose of the author of this study was to investigate kindergarten children's ability to read and match handwritten manuscript, cursive, italic, and D'Nealian style letters to typeset. The results of this investigation may have important implications in selecting a style of handwriting for instruction to children.

CHAPTER II

REVIEW OF THE LITERATURE

In a comprehensive search, the author did not find literature directly related to the study. No research was found concerning manuscript more nearly resembling the print in books to children. The purpose of the author of this study was to investigate kindergarten children's ability to read manuscript, cursive, italic, and D'Nealian style letters and to match handwritten letters in the same styles to typeset. The results of this investigation would indicate if manuscript did more nearly resemble the print in books for the kindergarten student.

A description of the historical development of handwriting styles is provided here. In this description, the author will focus on cursive, manuscript, italic, and D'Nealian. These styles are currently being taught in the United States and were selected for this study.

Cursive Handwriting Style

The standardization of teaching handwriting probably began with the publication of Business Penmanship in 1848 when Platt Roger Spencer, a writing master, began to mass

produce materials for instruction. The quill had been replaced by the pointed steel nib as the standard tool for handwriting between 1825 and 1830. Shading could be achieved by pressing on the steel nib to widen the point and increase the flow of ink. The regular system of shading, used in writing the then popular roundhand style with a quill, was arbitrarily dropped by Spencer.

Spencer managed to create a major marketing organization and established the Spencerian Colléges of Penmanship which succeeded across the country. The highly ornamental cursive longhand style was appealing to elementary schools and commercial businesses for over thirty-five years (Lehman, 1976).

The cursive style longhand used by Spencer can be credited to the wide use of copperplate engraving, the only known means of reproducing copybooks for school use at that time (Hildreth, 1960; Wise, 1924). The influence of engraving on roundhand, the style from which copperplate engraving took its form, led to the joining of letters, to the elaboration of capitals, and to the increase in slant (Wise, 1924).

Later competitors of the Spencerian monopoly were G. A. Gaskell, who published his manual around 1880, followed by Charles Paxton Zaner in 1894 and Austin Palmer in 1910. Zaner and Palmer dropped the shading and introduced the use of uniform thin lines in writing (Lehman, 1976).

Readily available handwriting manuals and the driving momentum of the Industrial Revolution brought about standardized business operations, including handwriting used in transactions and record keeping. It was the commercial schools that were largely responsible for the promotion of writing, spurred by the need for record keeping at the onset of the Industrial Revolution. "From these schools there came a number of courses for the teaching of writing to be used in public schools. The criticism which may be made about many of these courses is that their authors lacked direct contact with child-problems and so failed to adapt the work to the elementary stage of development" (Dougherty, 1917, p. 283).

Lehman (1976) stated:

The competing publishers of the late 19th century relied on two facts to sell their versions of handwriting materials:

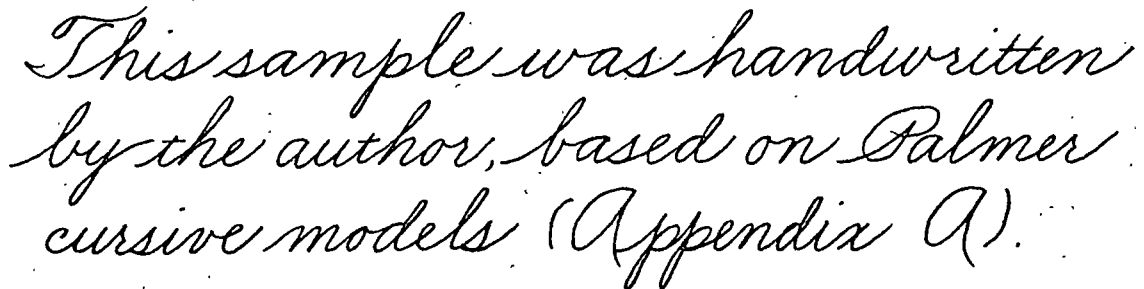
1. their own expertise in the making of the difficult letter models. The experts were capable of astounding demonstrations of penwork and built their sales with their demonstrations.

2. elementary schools were just beginning to use a graded system to fit the graduated development of the children and lacked experience in choosing appropriate materials for each grade. Every commercial system recommended itself as the answer for children's needs, but the commercial authors of handwriting materials lacked direct contact with children and did not adapt their work to the stages of child development. (p. 30)

Early experiments by Woodworth and McAllister to discover the most natural letter slope for handwriting were prompted by reports from Germany and France that cursive writing might cause curvature of the spine and eyestrain in students

(Dougherty, 1917). Woodworth (1899) and McAllister (1900) concluded that the most natural slope (slant) for writing was between five and fifteen degrees from the vertical. Little attention was given to this research. The first Palmer method sloped 38° and modern versions of Palmer method slope 30° from the vertical (see Figure 1).

All letter models, used by current publishers of cursive handwriting materials in America, although slightly different, are adapted from the models of Zaner and Palmer with the exception of the italic handwriting programs.



*This sample was handwritten
by the author, based on Palmer
cursive models (Appendix A).*

Figure 1. An example of Palmer cursive writing.

Manuscript Handwriting Style

Manuscript writing can be traced to the late 19th century and the revival of traditional letter models in book making, print and letter design in England. William Morris revived the study, which gained credibility with a broad audience of educators. One of his associates, a calligrapher named Edward Johnston, published a classic work Writing & Illuminating & Lettering in 1908. Although

Johnston published no models for schools, he gave an address at the annual Conference of London Teachers in January, 1913. Writers take varying views as to the content of that lecture, but are in general agreement that, although Johnston was not consulted, a misunderstanding of his recommendations led to the development of a style of writing using circles and vertical lines now referred to as manuscript (Enstrom, 1969; Fairbank, 1977; Hildreth, 1960; Lehman, 1976; Piggott, 1958).

Manuscript was introduced in America from England by Margaret Wise in 1921. In the preface to her book (1924), Wise said:

Manuscript writing, which has been spreading so rapidly in England during the last few years, is the name given to a simplified form of handwriting which aims at greater legibility, beauty and speed by doing away with the unnecessary joinings of the letters and returning to the plain capitals and miniscules of the Roman alphabet. It is, in effect, a return to the fifteenth century Italian cursive handwriting. It has been found much easier to teach in the early stages, and its help in the teaching of other subjects has not been negligible; but it has not been taught long enough to know its effect as a more mature handwriting. (p. xiii)

By 1936, Edith Conard reported that teachers in the Horace Mann School had decided on the best version of manuscript according to their experience. The manuscript agreed upon by the teachers was more rigid and geometric than Wise had intended. Lehman (1976) reports from personal correspondence:

Although Marjorie Wise effectively launched

manuscript handwriting with her manual during her stay in America from 1921-24, she later rejected her work as ill-advised and misused. In her judgement, italic models developed for children by the British calligrapher Alfred Fairbank in 1932 were the best solution. She actively supported the italic handwriting movement in England and joined as a member of the first board meeting of the Society of Italic Handwriting in 1952. But her manuscript letter models had spread throughout America with the help of Edith Conard and the support of the credibility generated at Columbia University. (p. 50)

Twenty-five years after the introduction of manuscript, in surveys from 727 schools representing forty-eight states, it was indicated that manuscript writing was being used for initial writing instruction in 84.3% of the schools (Freeman, 1936). The wide adoption of manuscript was attributed to new views concerning the place of writing in the school curriculum and the methods of teaching the skill (Hildreth, 1960).

Originally, teachers of manuscript handwriting intended that the students would continue writing manuscript, with no suggestion that at midpoint in learning a changeover to cursive style writing would be required (Hildreth, 1963; Lehman, 1976). In a summary of the research, Freeman (1936) concluded that manuscript was equal in speed to cursive and superior in legibility, but his conclusions at the end of his report stated:

1) Historical evidence, experiment, practice, and opinion indicate that cursive writing is better for upper grades and adult writing, 2) experiment, the trend of practice, and the opinion of those who have used it indicate that manuscript writing is preferable for beginners, 3) the

change should be made late enough to secure the advantages of manuscript writing as an initial style and early enough to minimize the difficulty of making the change. In the opinion of the writer, the point at which the change can probably best be made is the second half of Grade II. (p. 455)

Detailed summaries of the advantages in the use of manuscript writing have since been written (Anderson, 1965; Askov, Otto and Askov, 1970; Gray, 1956; Hildreth, 1960; Jackson, 1971; N.E.A. Research Division, 1951; West, 1950).

Regardless of the original intent, by 1946, Polkinghorne found that 66.14% of the sampled schools switched to cursive in grade three or above; and Freeman (1936) found that by grade four only 4.4% of those sampled were employing the manuscript style by the end of the third grade.

This sample was handwritten by the author, based on Zaner-Bloser manuscript models (Appendix A).

Figure 2. An example of Zaner-Bloser manuscript writing.

Concerns have been voiced about teaching children two very different styles of writing--manuscript and cursive. The round, vertical manuscript (see Figure 2) is poor preparation for learning the elliptical, slanted cursive. Learning two different forms requires time and the transition interferes with the development of children's ability in written composition (DeHaven, 1979; Fairbank, 1979; Hildreth, 1960; Lehman, 1976; Plattor and Woestehoff, 1967; Robinson, 1980;

Templin, 1960; Western, 1977).

Italic Handwriting Style

Margaret Wise introduced italic in 1921. The italic letters she introduced were changed and modified by the teachers and became the current style referred to as manuscript.

According to Fairbank (1979) the teaching of manuscript ignores the lesson taught by Renaissance history, namely that the Roman letter (as the manuscript) is one written with pen-lifts and that its fluent counterpart is italic which evolved from a need for fast writing. He felt that instead of teaching manuscript, that is not designed for fluency and must be abandoned, it would seem sensible to teach a simple italic hand as the first stage.

In the report on the adoption of italic in the Portland schools the following are listed as the reasons for teaching to italic handwriting:

1. It is simple, legible, written easily and rapidly.
2. Learning one system of handwriting eliminates a confusing transition from ball and stick manuscript to looped cursive.
3. Basic italic letterforms use natural hand movements, suitable for special students, such as those lacking fine motor skills. (Blank, 1983, p. 6)

Italic was originally recommended by Johnston (1908); and even before that Monica Bridges, inspired by the Morris revival of letters, published a book proposing the use of the 16th century italic letter models for the instruction

of small children (Lehman, 1976). Marion Richardson produced materials for schools as early as 1928. Alfred Fairbank developed italic models for children in 1932 (see Figure 3). According to a letter received by Lehman (1976), it was the models of Alfred Fairbank that Marjorie Wise felt should be taught. Wise actively supported the italic handwriting movement in England and rejected her work during her stay in America as ill-advised and misused.

*This sample was handwritten by the author,
based on Alfred Fairbank's italic print models
(Appendix A).*

Figure 3. An example of italic writing.

Piggott (1958) reported that over fifty text-books, sets of copy books, and manuals in which italic was recommended had been published in England between 1950 and 1958. Italic has been recommended by experts in writing and by school administrators (Berry, 1961; Blank, 1983; DiSigno, 1978; Fairbank 1979; Gourdie, 1974; Horn, 1962; Huitt, 1972; Knade, 1983; Lehman, 1976; Reynolds, 1969; Robinson, 1980; Thomson, 1954; Tracy, 1982; Wise, 1924).

In the Scottish Educational Journal, Thomson (1954) reported studies of the superiority of the speed of italic over the cursive script. The sentence "We are looking forward to our Christmas holidays." was given to classes

(age approximately 11 years) in two schools. The children were asked to write this first in ink in their "very best" handwriting, taking all the time and care they needed. They were then asked to write as many sentences as they could, for two minutes, at the speed they would use when writing an ordinary letter. Finally, they were asked to write as many sentences as possible in their fastest scribble for two minutes. Results were reported for the students fastest writing, though Thomson claimed the careful and the ordinary writing of the students showed a similar advantage for italic.

Thomson reported that while the legibility and regularity of students' cursive writing decreased greatly when written rapidly, the students' italic writing was still legible and "good to look at." On the average, students wrote italic 6.4% faster than cursive.

Reported by Thomson (1954) were experiments by Mr. Percy Wood using number of words per minute instead of number of letters. Wood tested students writing italic in his own school against students using three other styles in ten other schools. The sentence chosen was, "The quick brown fox jumps over the lazy dog."

When written at normal rate, the words per minute reported for students age 10+ for italic, Marion Richardson script, joined writing, and school copperplate were 14, 9.9, 5.3, and 4.5, respectively. When written at speed,

the words per minute reported for students age 10+ for italic, Marion Richardson script, joined writing, and school copperplate were 19, 13.3, 7.7, and 7.9, respectively. Students who wrote italic wrote more words per minute when writing at normal rate and when writing at speed. Rates for other ages are reported in the study, but the results reported for other ages show similar advantages for italic.

More recently, students being taught italic have been tested in the United States. Lehman (1976) reports that the objective of a three year investigation in 1972-74, in a suburb of Portland, Oregon, was to evaluate students being taught italic handwriting as a primary instructional alternative to the commonly used manuscript and cursive. Six first grade classes were selected for the study. Beginning in September, 1971, three classes studied italic and three studied manuscript as their basic first-grade handwriting instruction. One sample of the writing of each of the students from both groups was taken each year in January for objective evaluation and a second sample was taken in June for subjective evaluation. In the third and final year of the project, children in both groups performed at the same level of competence with regard to letter slope, spacing, and scale. But the students in the italic group deviated from their letter models only half as much when it came to letter shape.

A speed test administered in May, 1976, was used to

measure the 'normal' handwriting speed of the third grade students in a classroom setting. The average rate of production for the three classes writing cursive was 46.6 letters in two minutes. The average rate of production for the three classes writing italic was 73.3 letters in two minutes.

In a study at Kings Park, New York, (DiSpigno, 1978) the handwriting of students being taught italic was compared to the handwriting of students learning manuscript/Palmer. In September, 1976, 700 kindergarten through grade six students in one school switched to italic handwriting instruction. In four other schools the use of manuscript with a transition to Palmer was continued. In that report it was stated that italic was chosen because:

- 1) Students who write italic learn to write one alphabet from K-6 rather than the two alphabets required with the manuscript-Palmer system. Students avoid the trauma of shifting from one alphabet to an entirely different one in grade three.

- 2) Reports from Sweden, Germany, Scotland, England, and Portland (Oregon) state that italic is more legible, more attractive, and can be written with greater speed than Palmer.

- 3) The staff felt that italic had a simple beauty unmatched by any other handwriting. In addition to its simplicity, italic had the flexibility to be used in a formal as well as an artistic style. (DiSpigno, 1978, p. 2)

A comparative study was conducted during the 1977-78 academic year in grades three through six. The students' italic writing was clearly more legible at every grade level of the randomly selected samples from 1800 students in grades 3-6. The study did not report how the samples

were rated for legibility and appearance, but reported that the margin of superiority was significant at every grade ranging from 16.1% in grade five to 30.5% in grade four. Children wrote italic faster at grades three, four, and five. When legibility and appearance for the ten highest ranked samples selected from the students' writing from each school were compared, the italic writing was judged as good as the Palmer writing in grades 3 and 4 and better in grades five and six. The best writers using italic wrote almost 20 letters per minute faster in grades three, four, and five. The significant findings were related to the ten lowest ranked samples selected from the students' writing from each school. At every grade level, the samples of italic writing were evaluated 50% better than Palmer. There were no significant differences between the speed of the poorest ranked writers of italic and Palmer.

There are other comparative studies that support italic style handwriting (Berry, 1961; Great Falls Public Schools, 1980). Writers of current language arts books refer to italic as an alternative to manuscript/cursive (Anderson and Lapp, 1979; DeHaven, 1979; Petty, Petty and Becking, 1981).

D'Nealian Handwriting Style

D'Nealian was developed by Donald N. Thurber and published by Scott Foresman Company in 1978. Although the author

considers D'Nealian an adaptation of manuscript/cursive, writers of language arts texts suggest teaching it as an alternative to the traditional manuscript/cursive (DeHaven, 1979; Hennings, 1982; Petty, Petty and Becking, 1981).

The D'Nealian manuscript letter forms (see Figure 4) for beginning writers are slightly oval and slanted rather than round and vertical as in the traditional manuscript. Exits, or ending strokes, are added to these manuscript letters. In cursive D'Nealian letter forms, the general characteristics of cursive letters in other writing systems are retained. No research was found to support teaching D'Nealian, but because it was suggested, it was included in this study.

This sample was handwritten by the author, based on D'Nealian manuscript models (Appendix A).

Figure 4. An example of D'Nealian manuscript writing.

Summary

There are three styles of handwriting by general classification currently being taught in the United States, or four if D'Nealian is considered a separate style and not an adaptation of manuscript/cursive. Cursive, based on copperplate

engraving, might be considered the first standardized style of handwriting and was introduced in the late 1800's. In all handwriting systems, except those based on italic, modified forms of this cursive style are used.

Manuscript was developed by teachers. The letter models, originally introduced from England, were changed to a round, vertical form. Although manuscript was originally intended to supplant cursive, within twenty-five years, the majority of teachers in schools were teaching manuscript in primary grades, then teaching a transition to cursive in second or third grade. Manuscript probably gained its wide acceptance because of the general change in attitude toward writing and early claims for the use of manuscript as an aid to reading.

In 1932, Alfred Fairbank developed italic models for children based on the writing of the 16th century. Italic met with wide acceptance in Europe, but not until the last twenty years has it gained recognition in the United States.

D'Nealian was developed by a teacher about ten years ago to ease the problem of transition. Thurber modified the manuscript letter forms, but retained cursive as the terminal writing style.

Of the handwriting styles, there seems to be no conclusive evidence that one style is superior to another with regard to speed and legibility.

Reading and handwriting are related. Writers have

said manuscript more nearly resembles the print in books but no research evidence was found that one style of handwritten letters is more easily distinguished than any other by children. The purpose of the investigator in this study was to address this question, which appears fundamental to choosing a style of handwriting for initial instruction.

CHAPTER III

PROCEDURES

Without proficiency in reading and writing, it is difficult to achieve success either in or out of school. Educators are concerned with the development of these skills. Wilkinson (1971) expressed a relationship between reading and writing. In studies to show the effect of the style of handwriting instruction on reading performance, conflicting results were found. The degree to which children can recognize symbols written in various handwritten styles had not been assessed.

The purpose of the investigator in this study was to discover (a) if there was a difference between kindergarten students' scores for matching handwritten manuscript, cursive, italic, and D'Nealian letter styles to typeset, (b) if there was a difference in kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian, (c) if there were main effect differences between kindergarten students' reading and matching scores, and (d) if there were main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and

D'Nealian letters.

Statement of Research Hypotheses

Null Hypothesis 1

There will be no difference between the kindergarten students' scores for matching handwritten manuscript, cursive, italic and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles Test.

Null Hypothesis 2

There will be no difference between the kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian letters, as measured by reading from flash cards.

Null Hypothesis 3

There will be no main effect differences between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards.

Null Hypothesis 4

There will be no main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian, as measured by the Matching Letter Styles Test and reading from flash cards.

The statistical designs seen in Figures 5, 6, and 7 were employed to test the hypotheses.

Matching

Typeset	Manuscript	Cursive	Italic	D'Nealian

Figure 5. Statistical design to test hypothesis 1.

Reading

Typeset	Manuscript	Cursive	Italic	D'Nealian

Figure 6. Statistical design to test hypothesis 2.

Matching	Manuscript	Cursive	Italic	D'Nealian
Reading				

Figure 7. Statistical design to test hypotheses 3 and 4.

General Procedure

Kindergarten children enrolled in four classes in different schools in Great Falls, Montana, during the 1983-84 school year participated in the study.

A Matching Letter Styles Test was administered on which the students were asked to select and mark, from four typeset letters, the letter that was the same as the handwritten letter located in a box on the left-hand side of each item. Manuscript, cursive, italic, and D'Nealian handwriting styles were tested. The small letters b, d, g, l, m, n, p, q, u, and y were tested. Items and the distractors for the Matching Letter Styles Test were selected from responses to a questionnaire (see Appendix B). In the questionnaire, 23 teachers were asked to identify letters which, based on their experience, kindergarten children confused with other letters.

In the Matching Letter Styles Test, students were asked to write the letters b and d like the handwritten models of the manuscript, cursive, italic and D'Nealian style models. The letters b and d were chosen because they were identified by teachers as being confusing to students more times than the other letters.

Students were asked to read the same small letters b, d, g, l, m, n, p, q, u, and y from flash cards. Sets of flash cards were reproduced: in typeset, handwritten in manuscript, cursive, italic, and D'Nealian styles.

Data collected were statistically analyzed to determine:

1. If there was a difference between kindergarten students' scores for manuscript, cursive, italic, and D'Nealian as determined by matching handwritten small letters in each style to typeface, as measured by the Matching Letter Styles Test.

2. If there was a difference between kindergarten students' scores for typeset, and handwritten manuscript, cursive, italic and D'Nealian, as measured by reading small letters from flashcards.

3. If there were main effect differences between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards.

4. If there were main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian, as measured by the Matching Letter Styles and reading from flash cards.

Delimitations

The following were established as delimitations of the study.

1. Only students in four kindergarten classes in different schools in Great Falls, Montana, were included.

2. Only those students in attendance on testing dates were included.

3. Matching distractors reproduced in Palatino 24 point typeset and small letters *b*, *d*, *g*, *l*, *m*, *n*, *p*, *q*, *u*, and *y* handwritten in a corresponding size were assessed. The manuscript letters were based on Zaner-Bloser manuscript models (Barbe, Lucas, Hackney and McAllister, 1979). The cursive letters were based on Palmer cursive models (King, 1979). The italic letters were based on Fairbank italic print models (Stone and Fairbank, 1978). The D'Nealian letters were based on D'Nealian manuscript models (Thurber, 1978).

4. Reading small letters *b*, *d*, *g*, *l*, *m*, *n*, *p*, *q*, *u*, and *y* reproduced in Palatino Semi-Bold typeset (one inch *x* height) and letters handwritten in corresponding size in manuscript (based on Zaner-Bloser manuscript models), cursive (based on Palmer cursive models), italic (based on Fairbank italic print models), and D'Nealian (based on D'Nealian manuscript models) was assessed.

5. The time was limited to five seconds for response for each letter on the reading task.

6. The time was limited for responses on each part (20 items) of the Matching Letter Styles Test to 10 minutes.

7. Models were limited to those handwritten by the author.

8. Testing was limited to the following small letters: *b*, *d*, *g*, *l*, *m*, *n*, *p*, *q*, *u*, and *y*.

Limitations

The following was the only limitation of the study: the data of students who were absent on testing dates were excluded from the study.

Definition of Terms

In order to understand the study, certain terms need to be defined, as follows:

1. Calligrapher - a person trained in the art of fine writing or penmanship and usually an expert in the history of writing and writing style.

2. Copperplate engraving - writing etched with a burin onto a copper plate for printing. This printing process was popular in the 1800's.

3. Cursive - any of the styles of writing, based on roundhand, influenced by copperplate engraving and the models of Spencer, Zaner, and Palmer.

4. D'Nealian - the style of writing developed by Donald N. Thurber in the 1970's and published by Scott Foresman Company.

5. Elliptical - having the shape of an ellipse.

6. Hand - a style of penmanship, handwriting or signature.

7. Italic - a style of handwriting based on Chancery letters of the Renaissance. In about 1522 Arrighi wrote LaOpera on learning to write italic. It is possibly

the first book written for handwriting instruction.

8. Italic cursive - joined italic writing.

9. Italic print - a simplified version of italic writing in which the entrances and exits are removed from the italic cursive letters.

10. Manuscript - any of the styles of writing using circles, part circles and vertical lines to form the letters.

11. Model - the ideal representation of a style of letters to be emulated.

12. Point - the measurement used by printers; 72 points equal one inch.

13. Pointed steel nib - a pen point made of steel.

14. Read - for the purpose of this study, to name orally.

15. Small letters - lower case letters. Lower and upper case are used with reference to printing. Capital and small are used with reference to writing.

16. Style of writing - distinctive features of the letters used for writing.

17. Typeset - the name given to a style of type used for printing.

18. Weight - the thickness of line in print or writing with relationship to the height.

19. 'x' height - the body height of the small letter 'x'.

Description of the Population

The study was conducted in the 1983-84 academic year with the participation of sixty-nine kindergarten students from Lewis and Clark (N=18), Meadow Lark (N=17), Sacajawea (N=18), and Whittier (N=16) Schools. The four schools were selected from the sixteen elementary schools in Great Falls, Montana, as follows: the names of sixteen elementary schools were placed face down and four names were drawn. The population included students from one kindergarten class in each of the four schools. After permission was granted from the principals at Lewis and Clark, Meadow Lark, Sacajawea, and Whittier Schools, a teacher in each of the schools was contacted. The procedure of the study was explained and dates for testing set. The kindergarten students (N=69) were administered the Matching Letter Styles Test and a reading flash cards test.

On the Iowa Test of Basic Skills in 1983 (see Table 1), the average of the composite scores of the students in grades 4, 5, and 6 in the sixteen elementary schools in Great Falls, Montana, was 83.7.

The average of the students' composite scores for grades 4, 5, and 6 in Meadow Lark was 95.3. At Meadow Lark School, the students had the highest average composite scores of the sixteen elementary schools. The average of the composite scores of the students in grades 4 and 6 for Whittier (there was no fifth grade class at Whittier School) was 56. At

Whittier, the students had the lowest average composite scores of the sixteen elementary schools. The average of the composite scores for the students in grades 4, 5, and 6 in Lewis and Clark was 90.7 and in Sacajawea, 85.7.

Table 1

Composite Percentile Scores on the Iowa Test of Basic Skills
for Students in the Sixteen Elementary Schools
in Great Falls, Montana for 1983-84

	Grade 4	Grade 5	Grade 6	Average
Meadow Lark*	92	99	96	95.3
Lincoln	96	91	92	93
Mountain View	92	95	88	91.7
Lewis and Clark*	89	93	90	90.7
Riverview	89	87	90	88.7
Sacajawea*	83	80	94	85.7
Morningside	74	91	82	82.3
Chief Joseph	83	80	82	81.7
Sunnyside	79	76	85	80
Valley View	74	80	79	77.7
Loy	64	84	82	76.7
Roosevelt	74	63	92	76.3
Russell	69	68	88	75
Franklin	58	76	85	73
Longfellow	51	58	62	57
Whittier*	37	--	75	56
Means	79	84	88	83.7

*Schools in the study. Fourth, fifth, and sixth grade students at Meadow Lark scored the highest, and students in Whittier scored the lowest of the sixteen elementary schools in Great Falls, Montana, on the Iowa Test of Basic Skills in 1983-84.

The percentage of students receiving free lunch and the number of students receiving reduced rate are shown

on Table 2.

Table 2
School Food Service Information for the Sixteen
Elementary Schools in Great Falls,
Montana, for 1983-84

	Enrollment	Free Lunch	Reduced Rate
Longfellow	532	65%	8
Whittier*	226	43%	7
Franklin	394	32%	9
Russell	282	27%	10
Lincoln	339	26%	9
Sunnyside	313	25%	15
Chief Joseph	316	22%	13
Loy	434	22%	29
Mountain View	267	22%	7
Morningside	309	20%	11
Roosevelt	399	20%	11
Valley View	380	17%	11
Lewis and Clark*	387	16%	10
Riverview	393	16%	8
Sacajawea*	671	6%	6
Meadow Lark*	483	2%	2

*Schools in the study.

At Meadow Lark 2% of the students, at Sacajawea 6% of the students, at Lewis and Clark 16% of the students, and at Whittier 43% of the students received free lunch. Of the schools in the study, Meadow Lark had the lowest percentage of students receiving free lunch, and Whittier had the highest percentage of students receiving free lunch.

Collecting and Recording Matching Data

During the first week of the second semester, on days pre-arranged with the classroom teachers, the Matching Letter Styles Test (see Appendix B) was administered to students in the four kindergarten classrooms. The beginning of the second semester was selected because kindergarten students had not received instruction in handwriting.

The classroom teachers were asked to do the following: (a) to administer the test following the directions supplied, (b) to time the testing, and (c) to return the completed tests to the researcher.

Description of the Matching Letter Styles Test

The Matching Letter Styles Test consisted of two parts of twenty items each. Each of the letters b, d, g, l, m, n, p, q, u, and y was handwritten in four styles by the author to correspond in size to 24 point Palatino typeset (Appendix A). Students were asked to write b on Part I and d on Part II in each of the four styles being tested.

Handwritten letters were representative of manuscript, based on Zaner-Bloser manuscript models (see Appendix A); cursive, based on Palmer cursive models (see Appendix A); italic based on the italic print models of Alfred Fairbank (see Appendix A); D'Nealian, based on D'Nealian manuscript models (see Appendix A).

Items for the Matching Letters Styles Test and the

distractors were selected from responses to a questionnaire (see Appendix B). Kindergarten teachers were asked by questionnaire to identify letters, based on the teachers' experience, that kindergarten children confused with other letters. The results of a survey of twenty-three teachers, with a mean of 16 years teaching experience, and a mean of 11 years experience in kindergarten, are shown in Table 3.

The letters chosen for testing b, d, g, l, m, n, p, q, u, and y were the letters teachers identified most frequently as the letters kindergarten students confuse. Random selection of items was made by placing the letters b, d, g, l, m, n, p, q, u, and y written in manuscript, cursive, italic, and D'Nealian on forty separate 3 x 5 cards, shuffling, cutting, and recording in order.

Random selection of the distractors and matched letter for each item was made by writing the three distractors and the matched letter on cards. The cards were placed face down, rearranged, and selected in left to right order.

Where less than three distractors was identified, other letters identified as distractors were used. For example, the only distractors named for g were p and q. The distractors named for p included b, d, g, and q. The distractors named for q included b, d, g, and p. The distractors used on the Matching Letter Styles Test for g included p, q, b, and d (see Table 3).

Table 3

Number of Times Distractors Were Identified
by Kindergarten Teachers

<u>Letter</u>	<u>Confused with and number of responses</u>			<u>Totals</u>
b	d (23)	p (18)	q (18)	59
c	e (2)			2
d	b (22)	p (16)	q (15)	53
e	a (5)	c (3)	g (1)	9
f	l (1)	t (14)		15
g	p (8)	q (12)		20
h	b (1)	k (1)	n (10)	12
i	j (7)	l (4)		11
j	i (10)	q (1)		11
k	h (6)			6
l	i (13)	j (4)		17
m	n (13)	w (5)		18
n	h (5)	m (12)	u (7)	24
p	b (9)	d (8)	g (3)	43
q	b (7)	d (8)	g (2)	40
r	h (1)	n (8)	t (1)	10
s	z (3)			3
t	f (15)	r (1)		16
u	n (14)	v (5)		19
v	u (10)	w (9)	y (1)	20
w	m (4)	u (1)	v (9)	14
y	u (1)	v (4)		5
z	s (7)	x (1)		8

Note. Letters a, o, and z were not identified by any teacher as confused with another letter.

The researcher was curious about kindergarten students' ability to write. The study was conducted at the beginning of the second semester. By Great Falls School District policy, kindergarten students are not given formal handwriting instruction during the first semester.

Students were asked to write the letter b like the handwritten manuscript, cursive, italic, and D'Nealian style models on Part I. Students were asked to write the

letter d like the handwritten manuscript, cursive, italic, and D'Nealian style models on Part II. (see Appendix B). The letters b and d were chosen, because b and d were most often identified by teachers as confusing to kindergarten students.

Validity and Reliability of the Matching Letter Styles Test

Validity

A panel of judges (Dr. Elnora Old Coyote, Ms. Alice Hemphill, Ms. Marcia Folland) was asked to verify that the handwritten letters were representative of the models (see Appendix B).

Reliability

Reliability of the Matching Letter Styles Test was determined by administering the test twice to a kindergarten class (N=17) at Valley View School in May, 1983. Valley View kindergarten students were tested on the Matching Letter Styles Test on May 16-17 and again on May 24-25, 1983.

The data were analyzed using the Spearman rank correlation. The correlations for the individual styles were: manuscript, .8009, p value = .0000; cursive, .6808, p value = .0026; italic, .5974, p value = .01; D'Nealian, .6152, p value = .008 (see Appendix B). The small N=17 or the possible

correct score of 10 may have influenced the results. The reliability of the Matching Letter Style Test was acceptable for the purposes of this study.

Scoring Procedure

Correct responses for matching each of the styles, manuscript, cursive, italic, and D'Nealian to typeset, were counted and entered on the data summary sheet (see Appendix C).

Collecting and Recording Reading Data

Approximately one week after administering the Matching Letter Styles test, at a time pre-arranged with the classroom teachers, reading data were collected. Students, one by one, sat facing the researcher. Students were asked to read (name orally) the letters reproduced on flash cards.

Data recording sheets were printed listing typeset first, then the four handwritten styles in twenty-four orders (see Appendix D). Students' names had been written according to alphabetical class order at the top of the recording sheets. Students were assessed according to the order on the recording sheet. The order of the handwritten styles was randomly selected to minimize the possible systematic effect as the result of training.

The procedure below was followed for reading assessment.

1. One minute or less was spent establishing rapport.

2. One minute or less was spent giving directions and allowing the child practice to demonstrate understanding of the directions.

3. The flash cards were shuffled three times.

4. Each letter was shown and five seconds were allowed for response.

5. Positive feedback was given for each correctly named letter. No correction was given for misnamed letters. The correct letter was not named when no response was given in the time allowed. Self-corrected responses were considered correct.

6. Incorrect and "no response" were recorded on the data recording sheet (see Appendix D).

7. Number of correct responses for each of the styles was recorded on the summary sheet (see Appendix C).

Description of Flash Cards

Five sets of flash cards were reproduced with black ink on 40# white card stock 4 x 6 inches. Handwritten models were consistent in size and weight to the one inch x height Palatino Semi-Bold typeset used by the company of the adopted reading program of Great Falls School District #1.

Set #1: one each of the small letters b, d, g, l, m, n, p, q, u, and v in Palatino Semi-Bold typeset (see Appendix A), x height of one inch.

Set #2: one each of the small letters *b, d, g, l, m, n, p, q, u,* and *y* handwritten in manuscript, based on Zaner-Bloser manuscript models (see Appendix A), *x* height of one inch.

Set #3: one each of the small letters *b, d, g, l, m, n, p, q, u,* and *y* handwritten in cursive, based on the Palmer cursive models (see Appendix A), *x* height of one inch.

Set #4: one each of the small letters *b, d, g, l, m, n, p, q, u,* and *y* handwritten in italic, based on the italic print models of Alfred Fairbank (see Appendix A), *x* height of one inch.

Set #5: one each of the small letters *b, d, g, l, m, n, p, q, u,* and *y* handwritten in D'Nealian, based on D'Nealian manuscript models (see Appendix A), *x* height of one inch.

A panel of judges (Dr. Elnora Old Coyote, Ms. Alice Hemphill, Ms. Marcia Folland) verified that the handwritten letters were representative of the models (Appendix B).

Pilot Study

A pilot study was conducted to check the procedure, the Matching Letter Styles Test and the flash cards, and the accuracy of the instruments.

In May, 1983, kindergarten students at Valley View (N=17) and Sacajawea School (N=17) in Great Falls, Montana,

were tested. The procedure outlined in this Chapter was followed with one exception. The data for reading flash cards were not collected by the researcher.

Precautions were taken to assure the accuracy of the instruments. Data from the first testing of the Valley View students were hand calculated using the one-factor experiments with repeated measurements formula (Ferguson, 1981, 263, 318-320, Appendix E). Data were calculated on the MSU computer using the Biomed statistical package. This precaution was taken to insure the employment of the proper computer program.

From analysis of the data (see Appendix E) for the Matching Letter Styles Test for the kindergarten students at Valley View, the following were shown: the mean scores for matching italic style to typeset (8.889) and matching manuscript style to typeset (8.778) were significantly higher than the mean scores for matching D'Nealian style to typeset (8.056) and matching cursive style to typeset (4.333). The mean score for matching D'Nealian style to typeset (8.056) was significantly higher than the mean score for matching cursive style to typeset (4.333).

From the analysis of the data for the Matching Letter Styles Test (see Appendix E) for the kindergarten students at Sacajawea, the following were shown: the mean scores for matching manuscript style to typeset (9.000) and for matching italic style to typeset (8.529) were significantly

higher than the mean scores for matching D'Nealian style to typeset (7.824) and for matching cursive style to typeset (4.059). The mean score for matching D'Nealian style to typeset (7.824) was significantly higher than the mean score for matching cursive style to typeset (4.059).

From the analysis of the data for reading flash cards (see Appendix F) for the students at Valley View, the following were shown: the mean scores for reading D'Nealian style (5.944), manuscript style (5.667), typeset style (5.556) and italic style (5.444) were significantly higher than the mean score for reading cursive style (1.222).

From the analysis of the data for reading flash cards (see Appendix E) for the students at Sacajawea the following were shown: the mean scores for reading typeset (8.176) and manuscript style (8.000) were significantly higher than the mean scores for reading italic style (7.294) and cursive style (2.176). The mean score for reading italic style (7.294) was significantly higher than the mean score for reading cursive style (2.176). The mean score for reading D'Nealian style (7.765) was not statistically different from the mean scores for reading italic style (7.294), typeset (8.176), and manuscript style (8.000).

From the analysis of the data to compare reading letters in the four styles and matching the same four styles to typeset (see Appendix F) for the students at Valley View it was shown that the mean score for matching (7.514) was

significantly higher than the mean score for reading (4.569). For the students at Sacajawea the mean score for matching (7.353) was significantly higher than the mean score for reading (6.309).

From the analysis of the data to compare the scores of reading letters handwritten in the four styles and matching the four styles to typeset (see Appendix E) for students at Valley View, it was shown that the mean scores for manuscript style (7.222), italic style (7.167), D'Nealian style (7.000) were significantly higher than the reading and matching mean score for cursive style (2.778). For students at Sacajawea, the reading and matching mean score for manuscript style (8.500) was significantly higher than the reading and matching mean scores for italic style (7.912), D'Nealian style (7.794), and cursive style (3.118). The reading and matching mean scores for italic style (7.912) and D'Nealian style (7.794) were significantly higher than the reading and matching mean score for cursive style (3.118).

All data analyzed met the level of significance.

Summary

Kindergarten children enrolled in four classes in different elementary schools in Great Falls, Montana, during the 1983-84 school year were asked to match typeset distractors to small letters b, d, g, l, m, n, p, q, u, and y handwritten in four styles using a Matching Letter Styles Test. Students

were asked to read (name orally) small letters b, d, g, l, m, n, p, q, u, and y reproduced on flash cards. Five sets of flash cards were used: Palatino typeset and handwritten manuscript, cursive, italic, and D'Nealian. There were four general questions to be answered:

1. Is there a difference between the kindergarten students' scores for matching handwritten manuscript, cursive, italic, and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles Test?

2. Is there a difference between kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian, as measured by reading flash cards?

3. Are there main effect differences between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards.

4. Are there main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian, as measured by the Matching Letter Styles Test and reading from flash cards.

A post-test-only design for repeated measurement with the independent variable of style, i.e. manuscript, cursive, italic, D'Nealian was used. Analysis of variance was employed to determine if differences in scores were significant at the .01 level. A post hoc analysis was used to identify differences. Incorrect responses by letter and style were

tabulated for analysis.

A pilot study was conducted to check the procedure, the Matching Letter Styles Test, and the flash cards, and the accuracy of the instruments.

CHAPTER IV

DISCUSSION OF RESULTS

The style of handwriting to teach has been questioned by educators for the past several decades. Wilkinson (1971) expressed a relationship between reading and writing, because both are symbolic representations of speech. Studies to discover what effect the style of handwriting taught had on reading performance produced conflicting results. Writers of current books on teaching of language arts concurred that one of the reasons for teaching manuscript was that it more nearly resembles the print in books, so primary children learn only one graphic representation of the alphabet for reading and writing (Anderson and Lapp, 1979; Coody and Nelson, 1982; Dehaven, 1979; Hennings, 1982; Marcus, 1977; Norton, 1980; Petty, Petty and Becking, 1981; Rubin, 1975; Savage, 1977).

The ability of young children to recognize letters in different styles was challenged by Hay (1965). Lehman (1976) claimed that manuscript models did not support the Roman typeset used for reading. No studies were found to indicate that the young child could recognize one style of handwritten letters better than another, or that one

style of handwriting more nearly resembles the print in books.

The purpose of this study was to investigate: (a) if there was a difference between kindergarten students' scores for matching handwritten manuscript, cursive, italic or D'Nealian style letters to typeset, (b) if there was a difference in kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, or D'Nealian, (c) if there were main effect differences between kindergarten students' reading and matching scores, (d) if there were main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic or D'Nealian style letters.

The study was conducted in the 1983-84 academic year with the participation of sixty-nine kindergarten students from Lewis and Clark (N=18), Meadow Lark (N=17), Sacajawea (N=18), and Whittier (N=16) Schools. These four schools were selected by drawing the names from the names of the sixteen elementary schools in Great Falls, Montana.

A Matching Letter Styles Test (see Appendix B) was administered in which children were asked to select and mark, from four typeset letters, the letter that was the same as the handwritten letter. Manuscript, cursive, italic and D'Nealian handwriting styles were used to test the letters b, d, g, l, m, n, p, q, u, and y. Items and the distractors for the Matching Letter Styles Test were selected

from responses to a questionnaire (see Appendix B). (Recall these letters were selected by twenty-three kindergarten teachers who completed a questionnaire. The questionnaire asked the teachers to identify letters that, based on their experience, kindergarten children confused with other letters.)

Students were also asked to read the same small letters b, d, g, l, m, n, p, q, u, and y from five sets of flash cards reproduced in typeset, and handwritten in manuscript, cursive, italic and D'Nealian (see Appendix D).

A post-test-only design for repeated measurement of performance in matching and reading with the independent variable of style was used. Analysis of variance was employed to determine if differences in scores were significant at the .01 level. A post hoc analysis was used when the differences in scores showed significance beyond the .01 level of acceptance. Incorrect responses by letter and style were tabulated.

Students were asked to write the letter b and d like the models of b and d handwritten in manuscript, cursive, italic, and D'Nealian. (Recall the letters b and d were selected based on the information from the questionnaire completed by teachers (see Appendix B and Table 3, p. 42).

The number of letters written by the students like the models was tabulated. Handwritten letters were considered to be visually like or unlike the model. Minor variations in size and degree of slant were disregarded. The sequence

of how the letter was formed was not considered.

Null Hypothesis 1

In Null Hypothesis 1, it was stated that there would be no difference between the kindergarten students' scores for matching handwritten manuscript, cursive, italic and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles Test (see Table 4 and the sample test in Appendix B). The null hypothesis was rejected at $<.01$ level (see Appendix F). There was a significant difference between the kindergarten students' scores for matching handwritten manuscript, cursive, italic, and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles Test.

Table 4

Mean Scores for Manuscript, Cursive, Italic, and D'Nealian
Made by Kindergarten Students as Measured by
the Matching Letter Styles Test

Style	Schools				Combined Scores (N=69)
	Lewis & Clark (N=18)	Meadow Lark (N=17)	Sacajawea (N=18)	Whittier (N=16)	
Man.	7.500	8.118	7.444	7.750	7.696
Cur.	2.778	3.235	3.222	3.437	3.159
Ita.	8.111	7.941	8.056	7.687	7.957
D'N.	6.778	7.176	7.222	7.250	7.101
p =	.000	.000	.000	.000	.000

Note. Maximum score = 10.

From the post hoc analysis (see Table 5), it was shown that students could match italic (7.957) and manuscript (7.696) style letters to typeset better than D'Nealian (7.101) or cursive (3.159) style letters to typeset. Students could match D'Nealian style letters to typeset better than cursive style letters to typeset.

Table 5

Differences in Mean Scores for Manuscript, Cursive, Italic, and D'Nealian Made by Kindergarten Students as Measured by the Matching Letter Styles Test.

	Schools				Combined Scores (N=69)
	Lewis & Clark (N=18)	Meadow Lark (N=17)	Sacajawea (N=18)	Whittier (N=16)	
Style	Ita. A ^a	Man. A	Ita. A	Man. A	Ita. A
	Man. AB	Ita. A	Man. B	Ita. A	Man. A
	D'N. B	D'N. B	D'N. B	D'N. A	D'N. B
	Cur. C	Cur. C	Cur. C	Cur. C	Cur. C

^aA, B, and C represent differences in mean scores.

When the mean scores of the individual schools were examined, students scored lowest in matching cursive style letters to typeset in all cases. Lewis and Clark students could match italic (8.111) style letters to typeset better than D'Nealian (6.778) and cursive (2.778) style letters to typeset. These students could match D'Nealian style better to typeset than cursive style letters to typeset. Students' mean scores for matching manuscript (7.500) style

letters to typeset were not significantly different from the scores for matching italic or D'Nealian style letters to typeset.

Students at Meadow Lark could match manuscript (8.118) and italic (7.941) style letters to typeset better than D'Nealian (7.176) and cursive (3.235) style letters to typeset. These students could match D'Nealian style letters to typeset better than cursive style letters to typeset.

Sacajawea students scored significantly higher when matching italic (8.056) style letters to typeset than when matching manuscript (7.444), D'Nealian (7.222), and cursive (3.222) style letters to typeset. However, the mean scores for matching manuscript and D'Nealian style letters to typeset were higher than the mean scores for matching cursive style letters to typeset.

Mean scores for the students at Whittier were significantly higher for matching manuscript (7.750), italic (7.687), and D'Nealian (7.250) style letters to typeset than their mean scores for matching cursive style letters to typeset.

From the analysis of the data for the sixty-nine kindergarten students tested, it was shown that there was no significant difference in the scores for matching italic (7.957) and manuscript (7.696) style letters to typeset. The students matched italic and manuscript style letters better than D'Nealian (7.101) or cursive (3.159) style letters to typeset. The students matched D'Nealian style

letters better than cursive style letters to typeset. In all cases, students scored significantly lower when matching cursive style letters than when matching manuscript, italic, or D'Nealian style letters to typeset.

Null Hypothesis 2

In null Hypothesis 2, it was stated that there would be no difference between the kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian letters, as measured by reading flash cards (see Table 6). The null hypothesis was rejected at $<.01$ level (see Appendix F).

Table 6

Mean Scores for Manuscript, Cursive, Italic, D'Nealian,
and Typeset Made by Kindergarten Students

Reading Flash Cards

Style	Schools				Combined Scores (N=69)
	Lewis & Clark (N=18)	Meadow Lark (N=17)	Sacajawea (N=18)	Whittier (N=16)	
Man.	6.667	5.353	4.611	5.187	5.464
Cur.	1.778	1.176	.944	1.937	1.449
Ita.	6.444	4.882	4.944	5.125	5.362
D'N.	6.333	5.294	4.722	5.187	4.391
Typ.	6.000	4.471	4.444	5.437	5.087
p =	.000	.000	.000	.000	.000

Note. Maximum score = 10.

There was a significant difference between the kindergarten

students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian letters, as measured by reading flash cards. From the post hoc analysis, it was shown students scored significantly higher when reading typeset (5.087), italic (5.362), D'Nealian (4.391), and manuscript (5.464) style letters than when reading cursive (1.449) style letters from flash cards (see Table 7).

Table 7

Differences in Mean Scores for Manuscript, Cursive, Italic, D'Nealian, and Typeset Made by Kindergarten Students Reading Flash Cards

	Schools				Combined Scores (N=69)
	Lewis & Clark (N=18)	Meadow Lark (N=17)	Sacajawea (N=18)	Whittier (N=16)	
Style	Man. A ^a	Man. A	Ita. A	Typ. A	Man. A
	Ita. AB	D'N. AB	D'N. A	D'N. A	D'N. A
	D'N. AB	Ita. AB	Man. A	Ita. A	Ita. A
	Typ. B	Typ. B	Typ. A	Man. A	Typ. A
	Cur. C	Cur. C	Cur. B	Cur. B	Cur. B

^aA, B, and C represent differences in mean scores.

When the mean scores of the students in individual schools were examined, students scored lowest when reading cursive style letters from flash cards in all cases. Students at Lewis and Clark and Meadow Lark read manuscript (6.667 and 5.353) style better than typeset (6.000 and 4.471) from flash cards and could read typeset better than cursive

(1.778 and 1.176) style from flash cards. By the mean scores for reading flash cards, it was shown that students did not read italic (6.444 and 4.882) and D'Nealian (6.333 and 5.294) style significantly better than manuscript style or typeset.

By the mean scores for students at Sacajawea and Whittier, listed respectively, it was shown that the students read typeset (4.444 and 5.437), manuscript (4.611 and 7.187), D'Nealian (4.722 and 5.187), and italic (4.944 and 5.125) style letters significantly better than cursive (.944 and 1.937) style letters from flash cards.

When the data for reading flash cards by the sixty-nine kindergarten students were analyzed, students read flash cards handwritten in manuscript (5.464), italic (5.362), D'Nealian (4.391), and in typeset (5.087) significantly better than they read flash cards written in cursive (1.449) letters.

Null Hypothesis 3

In null Hypothesis 3, it was stated that there would be no main effect differences between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards (see Table 8). The null hypothesis was rejected at $<.01$ level. There were significant differences between kindergarten students' reading and matching scores, as measured by the Matching

Letter Styles Test and reading from flash cards.

Table 8

Mean Scores for Manuscript, Cursive, Italic, and D'Nealian
Made by Kindergarten Students as Measured by
Reading Flash Cards and the
Matching Letter Styles Test

	Reading	Matching	
Manuscript	5.464	7.696	6.580
Cursive	1.449	3.159	2.304
Italic	5.362	7.957	6.659
D'Nealian	4.391	7.101	6.246
	4.417	6.478	

Note. Maximum score = 10.

From the post hoc analysis, it was shown that the mean score of 6.478 for matching handwritten manuscript, cursive, italic, and D'Nealian letters to typeset was significantly higher than the mean score of 4.417 for reading typeset and handwritten manuscript, cursive, italic and D'Nealian style letters from flash cards.

In this study, students' mean scores indicated that they were able to match handwritten manuscript, cursive, italic and D'Nealian letters to typeset on the Matching Letter Styles Test better than they could read handwritten typeset and handwritten manuscript, cursive, italic and D'Nealian style letters from flash cards.

Null Hypothesis 4

In null Hypothesis 4, it was stated that there would be no main effect differences between kindergarten students' reading and matching mean scores for manuscript, cursive, italic, and D'Nealian, as measured by the Matching Letter Styles Test and reading from flash cards (see Table 9). The null hypothesis was rejected at $<.01$ level (see Appendix F). There were significant differences between kindergarten students' reading and matching mean scores for manuscript, cursive, italic, and D'Nealian, as measured by the Matching Letter Styles Test and reading from flash cards.

Table 9

Differences in Mean Scores for Manuscript, Cursive, Italic, and D'Nealian Made by Kindergarten Students as Measured by Reading Flash Cards and the Matching Letter Styles Test

Italic	A ^a
6.659	
Manuscript	A
6.580	
D'Nealian	A
6.246	
Cursive	B
2.304	

Note. Maximum score = 10.

^aA and B represent differences in mean scores.

In a post hoc analysis of the results (see Table 9), it was shown that students could match and read italic

(6.659), manuscript (6.580), and D'Nealian (6.246) style letters better than cursive (2.304) style letters when scores from the Matching Letter Styles Test and the scores from reading flash cards were considered together.

While there was no apparent reason to pose an interaction hypothesis, the computer program did generated a p value of .1260 for interaction which was not statistically significant at the .01 level of acceptance. If there was an interaction between the styles and matching and reading, this analysis did not disclose one.

Analysis of Students' Handwritten Letters

On the Matching Letter Styles Test, Part I, students were asked to write the letter b like the handwritten manuscript, cursive, italic and D'Nealian models. On Part II, students were asked to write the letter d like the handwritten manuscript, cursive, italic, and D'Nealian models (see Appendix B).

No hypothesis was formulated for writing the letters b and d. The researcher was not certain that kindergarten students could complete the task. Students, at the time the data were collected, had not been instructed in handwriting based on school board policy.

When the writing was analyzed, 44 sets of handwritten letters were selected from the 69 samples. Sets of handwritten letters were not selected: (a) if not all letters

had been attempted, (b) if a student had written more than one example, (c) if the wrong letter/s were written, (d) if none of the letters written were representative of any model.

From the 44 sets of letters selected, handwritten letters were judged to be like the model if the letter visually resembled the model. No consideration was given to the size, degree of slant, or if the letter had been formed in correct stroke sequence. The results are recorded (see Table 10).

Table 10

Analysis of Letters (b and d) Written by Kindergarten
Students Judged to be Like the Manuscript, Cursive,
Italic, and D'Nealian Models

	Styles				Chi Square	p
	Man.	Cur.	Ita.	D'N.		
Like the Model <u>b</u>	43	14	42	41	16.85	.001
	43	-	42	41	.054	.974
Like the Model <u>d</u>	41	8	43	33	24.86	.000
	41	-	43	33	1.471	.4838

Note. Maximum score = 44.

- Indicates the score was not used in the test.

The researcher questioned if there was a difference in the number of manuscript, cursive, italic, and D'Nealian letters the students were able to write like the model b. The researcher used a Chi Square to determine if there was a difference between the scores of 43, 14, 42, and 41 for manuscript, cursive, italic, and D'Nealian, respectively.

The Chi Square = 16.86 with the p value = .009 for the scores 43, 14, 42, 41 indicated there was a significance beyond the .01 level.

Following the discovery of this difference the researcher calculated another Chi Square for the scores of 43, 42, 41. This calculation produced Chi Square = .054 with a p value of .974.

The significance of the Chi square, for the scores 43, 14, 42, and 41 for manuscript, cursive, italic, and D'Nealian, respectively, can be accounted for by the low score for cursive letter b. Students wrote the letter b like the manuscript (43), italic (42), and D'Nealian (41) model of the letter b significantly more times than they wrote the letter b like the cursive (14) model.

The same procedure was followed for the number of manuscript, cursive, italic, and D'Nealian letters d that students wrote. From the 44 sets of letters selected, handwritten letters were judged to be like the model if the letter visually resembled the model. No consideration was given to the size, degree of slant, or if the letter

had been formed in correct stroke sequence. The results are recorded in Table 10.

The calculation of the Chi Square for the scores of 41, 8, 43, and 33 for manuscript, cursive, italic, and D'Nealian, respectively, produced a score of 24.86 with a p value = $<.01$. This indicated there was a significant difference beyond the .01 level between the scores for the four styles.

The Chi Square for the scores 41, 43, and 33 was calculated. The Chi Square = .054 with a p value = .974 for the scores 41, 43, and 33 indicated no significant difference.

The significance of the Chi Square, for the scores 41, 8, 43, and 33 for manuscript, cursive, italic, and D'Nealian, respectively, can be accounted for by the low score for cursive letter d. Students wrote the letter d like the manuscript (41), italic (43), and D'Nealian (33) model of the letter d significantly more times than they wrote the letter d like the cursive (8) model.

Analysis of Matching Letter Styles Test Data

Kindergarten students were asked to match typeset distractors to small letters b, d, g, l, m, n, p, q, u, and y handwritten in four styles using a Matching Letter Styles Test. The errors made by the sixty-nine students on the Matching Letter Styles Test (see Table 11) were tabulated by letter and by handwriting style. Manuscript,

cursive, italic, and D'Nealian handwriting styles were tested.

Table 11

Total Errors for Manuscript, Cursive, Italic, and
D'Nealian Made by Kindergarten Students as
Measured by the Matching Letter

Styles Test

Letter	Style				Total
	Man.	Cur.	Ita.	D'N.	
b	14	48	13	13	88
d	23	25	9	13	70
g	45 ^a	21	47 ^a	42	155
l	10	60	34	60 ^a	164 ^b
m	3	8	0	0	11 ^c
n	10	69 ^a	6	5	90
p	15	62	5	26	108
q	28	60	16	27	131
u	3	59	8	9	79
v	7	60	2	2	71

Note. Maximum score = 69.

^aHighest incidence of error for the style.

^bLetter with the highest number of errors.

^cLetter with the lowest number of errors.

On the Matching Letter Styles Test, students mismatched the letter l more than any of the other letters tested. Students made the fewest number of errors on the letter m. Every student correctly matched the handwritten italic and D'Nealian m to the typeset m. Every student incorrectly matched the cursive n (see Table 12).

Table 12

Typeset Distractor Errors for Handwritten Manuscript,
Cursive, Italic, and D'Nealian Letters Made
by Kindergarten Students as Measured by
the Matching Letter Styles Test

Hand- Written Letter Tested	Typeset Distractors	Style			
		Man.	Cur.	Ita.	D'N.
b	d	11	9	10	13
	p	2	13	0	0
	q	1	25	2	0
d	p	1	2	2	5
	b	22	16	5	4
	q	0	4	2	4
g	b	5	2	-	-
	q	36 ^a	-	34 ^a	25
	d	4	8	7	7
	p	-	11	5	10
l	q	1	47	1	2
	i	8	5	31	-
	j	1	8	2	63 ^a
m	w	2	6	0	-
	n	1	-	0	-
	u	0	0	0	0
	h	-	1	-	0
	v	-	0	-	0
n	m	1	66 ^a	0	1
	u	3	1	0	1
	h	6	2	6	1
p	b	0	-	0	1
	g	1	51	1	-
	q	13	6	4	24
	d	-	4	-	1
q	p	10	1	0	9
	g	14	46	1	13
	b	4	11	-	2
	d	-	-	7	-
u	h	3	1	0	-
	w	0	-	-	-
	v	0	1	0	1
	m	-	55	-	5
	n	-	-	8	3
v	u	2	10	1	2
	w	0	37	0	0
	y	5	13	0	0

Note. Maximum number of errors possible = 69.

^aHighest incidence of error for the style.

0 Letter used as a distractor but no errors made.

- Not used as a distractor for this letter.

The letters the students missed the most on the Matching Styles Letters Test by styles were: cursive n (69), D'Nealian l (60), italic g (47), and manuscript g (45). From the distribution of the errors by distractors (see Table 12) it was shown that the greatest incidence of errors by style was: the typeset m for the cursive n (66), the typeset j for the D'Nealian l (58), the typeset g for the manuscript g (36), the typeset g for the italic g (34).

The percentage the students incorrectly chose the distractor, in relation to the number of times that distractor could have been incorrectly chosen, is seen in Table 13.

Table 13

Percentage of Distractor Letter Errors Made by Kindergarten Students as Measured by the Matching Letter Styles Test.

Letter	Errors	Number of Errors Possible	Percent Distractor Chosen
j	74	276	26.8
q	231	1173	19.7
g	127	483	17.6
i	44	276	15.9
d	81	828	9.8
b	72	759	9.5
w	45	483	9.3
p	71	1035	6.9
n	12	276	4.3
h	20	690	2.9
u	20	759	2.6
v	2	414	.5

In the Matching Letter Styles Test, students made

the highest percentage of error (26.8%) in incorrectly choosing j. Students made the lowest percentage of error (.5%) in choosing y. The most used distractor on the Matching Letter Styles Test was q. The highest percentage of error made by the students was not q. Typeset i, j and n were used least as a distractor but did not receive the lowest percentage of error; of these j received the highest percentage of error. Fifty-eight children of the 69 tested confused the D'Nealian l for the typeset j.

Analysis of Errors on Reading Flash Cards

Kindergarten students were asked to read small letters b, d, g, l, m, n, p, q, u, and y reproduced on flash cards. Five sets of flash cards were used: Palatino typeset and handwritten in manuscript, cursive, italic, and D'Nealian styles. Errors by letter were tabulated for the sixty-nine students (see Table 14).

For each style, the greatest incidence of error made by the students was: cursive n (68), typeset q (65), manuscript l (62), italic l (62), D'Nealian l (51).

Kindergarten students made the greatest number of errors on the letter l and the least number of errors on the letter m. The order of errors from greatest to least were: l, q, d, g, b, u, n, y, p, and m.

Table 14

Frequency of No Response in Relation to the Number of Errors
Made by Kindergarten Students Reading Flash Cards

Letter	Style					Total
	Man.	Cur.	Ita.	D'N.	Typ.	
b	39	67	25	38	33	202
d	45	65	41	49	48	248
g	56	56	38	37	45	222
l	62 ^a	65	62 ^a	51 ^a	64	304 ^b
m	10	21	8	10	9	58 ^c
n	16	68 ^a	17	22	19	142
p	12	56	14	18	14	114
q	54	64	57	49	65 ^a	289
u	24	65	27	30	24	170
v	12	67	15	15	20	129

Note. Maximum number of errors = 69.

^aHighest incidence of error for the style.

^bLetter with the highest number of errors.

^cLetter with the lowest number of errors.

When the children were asked to name the letters from flash cards, if the child did not name a letter in five seconds, it was recorded as a "no response." There seemed to be a relationship between the number of no responses students gave to the number of incorrect responses (see Table 15). The students had the highest total number of no response (109) for the letter g. The no response given by the students for the letter g accounted for 46.9% of the errors made by kindergarten students reading g.

Students made the highest total number of errors (304) when reading the letter l. No response accounted for only 9.2% of the error. Although the kindergarten students missed l more than any of the letters tested, only 9.2%

of those errors was because the students did not respond in the allotted time.

Table 15

Frequency of No Response in Relation to the Number of Errors Made by Kindergarten Students Reading Flash Cards

Letter	Style					No Response	Total Errors	Total Per-cent
	Man.	Cur.	Ita.	D'N.	Typ.			
b	6	29 ^a	4	6	8	53	202	26.2
d	10	22	9	16 ^a	14	71	248	28.6
g	30 ^a	27	12 ^a	11	29 ^a	109 ^b	232	47.0
l	0	20	1	4	3	28	304	9.2
m	2	6	1	1	2	12 ^c	58	20.7
n	2	5	4	8	7	26	142	18.3
p	5	27	5	11	5	53	114	46.5
q	13	26	9	8	12	68	289	23.5
u	3	7	6	9	5	30	170	17.6
v	6	19	3	3	11	42	129	32.6

Note. Maximum number of no response = 69.

^aHighest incidence of no response for the style.

^bLetter with the highest total no response.

^cLetter with the lowest total no response.

The letters which children misnamed for the letter on the flash card were recorded and tabulated (see Table 16). The letter named instead of the letter on the flash card is shown by letter style. Only the letters which five or more of the sixty-nine students misnamed are shown in the table. The highest incidence of error (158 times) was students naming p for q.

Students named i for l a total of 138 times when reading manuscript, italic, and typeset. Nineteen students named

e when reading the cursive l. Forty-four students named j when reading the D'Nealian l.

Table 16

Letters Five or More Kindergarten Students Named
Incorrectly for the Letter on the Flash Card

Letter on the Flash Card	Letter Said	Number of Errors by Style					Totals
		Man.	Cur.	Ita.	D'Ne.	Typ.	
b	d	22	-	17	25	17	81
	e	-	8	-	-	-	8
	p	6	-	-	-	-	6
	h	-	5	-	-	-	5
d	b	25	18	20	17	23	103
	e	-	6	-	-	-	6
	g	-	5	-	-	-	5
	p	-	-	-	5	-	5
g	p	-	11	-	5	-	16
	q	-	5	-	-	6	11
l	i	50	-	50	-	38	138
	one	12	-	11	-	22	45
	j	-	-	-	44	-	44
	e	-	19	-	-	-	19
	g	-	5	-	-	-	5
m	-	-	-	-	-	-	-
n	m	-	57	-	-	-	57
	h	5	-	7	-	5	17
p	b	-	-	-	-	5	5
q	p	23	10	32	29	42	158
	g	6	10	-	5	-	21
	nine	-	-	5	-	-	5
u	w	-	38	-	-	-	38
	n	8	-	-	8	8	24
	m	-	13	9	-	-	22
v	n	-	20	-	-	-	20
	m	-	10	-	-	-	10
	u	-	5	-	-	-	5
	y	-	-	-	5	-	5

Note. Maximum number = 69.

- Not misnamed by five or more students.

The highest incidence of error by the 69 students for each of the styles was: the manuscript l named as i (50 times), the cursive n named as m (57 times), the

italic l named as i (50 times), the D'Nealian l named as i (44 times) and the typeset g named as p (42).

For the following styles and letters, no letter was misnamed by five or more students: cursive and italic g, manuscript, cursive, italic, D'Nealian, and typeset m, D'Nealian n, manuscript, cursive, italic, D'Nealian, and typeset p, manuscript, italic, and D'Nealian y.

Comparison of Matching and Reading Data

Students made the highest number of errors on the letter l when the errors of all the styles on both the Matching Letter Styles Test and reading flash cards (see Table 11, p. 65 and Table 14, p. 69) were considered. Students made the lowest number of errors on the letter m when the errors of all the styles on both the Matching Letter Styles Test and reading flash cards (see Table 10, p. 62 and Table 13, p. 67) were considered.

For cursive style, students made the highest number of errors on n. Sixty-six of the sixty-nine students chose m from the distractors on the Matching Letter Styles Test. Fifty-seven of the sixty-nine students misnamed n as m when reading flash cards.

For italic style, students made the highest number of errors on g on the Matching Letter Styles Test. Students made the highest number of errors on l on the reading flash cards.

For D'Nealian style, students made the highest number of errors on l on both the Matching Letter Styles Test and reading flash cards. Sixty-three of the 69 students chose j from the distractors on the Matching Letter Styles Test. Forty-four of the students named j when shown the D'Nealian l on a flash card.

Teachers' Perception of Confusing Letters

The letters b, d, g, l, m, n, p, q, u, and y were identified by kindergarten teachers, based on their experience, as being the letters kindergarten students confuse. Below is a rank order from the greatest (1) to the least (10) number of times these letters were identified by teachers (see Table 17).

On the Matching Letter Styles Test, students were asked to select and mark, from four typeset letters, the letter that was the same as the letter handwritten in manuscript, cursive, italic, and D'Nealian style. The letters, b, d, g, l, m, n, p, q, u, and y, identified by the teachers were tested. On Table 17, the rank order from the greatest (1) to the least (10) missed letter for each style is shown.

Students were asked to read the same small letters identified by the teachers from flash cards. Sets of flash cards were reproduced: in typeset, handwritten in manuscript, cursive, italic, and D'Nealian styles. On Table 17, the rank order from the greatest (1) to the least (10) missed

letter for each style is shown.

Table 17

Rank Order of Letters Identified by Teachers and
Missed by Students

Rank	Teachers	Rank of Students' Errors				Rank of Students' Errors				
		Matching Letter Styles Test				Reading Flash Cards				
		Man.	Cur.	Ita.	D'N.	Man.	Cur.	Ita.	D'N.	Typ.
1	b	g	n	g	l	l	n	l	l	q
2	d	q	l g v	l	g	g	v	q	q	l
3	p	d	u	q	q	q	b	d	b	g d
4	q	p	b	b	p	d	u	g l d	g	b d
5	n	b	d	d	b	b	q	u	u	u
6	v g	l n	g	u	d	u	p	b g	n	v
7	u	v	p	n	u	n	m	n	p	n
8	m	u	m	p	n	p v		v	v	p
9	l	m		v	v	m		p	m	m
10				m	m			m		
a	z	.204	.102	.357	.357	.306	.102	.000	.357	.000
	p =	.838	.919	.721	.721	.760	.919	1.	.721	1.
b		.567	.086	.067	.073	.009	.213	.030	.171	.061
	p =	.044	.406	.427	.421	.490	.277	.467	.319	.434

a Results from the Wilcoxon matched pairs signed rank test.

b Results from the Spearman coefficient of rank correlation.

After the letters were listed in rank order, it did not appear that the teachers had identified the letters that students most frequently missed. The researcher used a Wilcoxon matched pairs signed rank test and a Spearman correlation test to determine if there were differences.

The Wilcoxon matched pairs signed rank test was used on the rank order, as shown in Table 17, to determine if there were differences between the number of times these letters were identified by teachers as being letters kindergarten students would confuse and the number of errors actually made by the students on the Matching Letter Styles Test. The z scores of .204, .102, .357, and .357 with p values of .838, .919, .721, and .721 for manuscript, cursive, italic, and D'Nealian styles (listed respectively) did not reach the .05 level of significance. Teachers could accurately identify, according to this test, the letters students would confuse.

The same test was used to determine if there were differences between the letters teachers' identified and the number of errors made by the students when reading the letters from flash cards. The z scores of .306, .102, .000, .0357, .000 with p values of .760, .919, 1.0, .721, and 1.0 for manuscript, cursive, italic, D'Nealian handwriting styles, and typeset (listed respectively) did not reach the .05 level of significance. According to this test, teachers did accurately identify the letters students would miss.

When the rank order was tested using the Spearman correlation, the results were in conflict with the results from the Wilcoxon matched pairs signed rank.

The rank order, as shown on Table 17, was tested using

the Spearman correlation to determine if there were significant differences between the number of times the letters tested were identified by teachers as being letters kindergarten students would confuse and the number of errors made by the students on the Matching Letter Styles Test.

The scores from the calculation of the Spearman rank order correlation were $r = .567, .086, .067, \text{ and } .073$ with p values of $.044, .406, .427, \text{ and } .421$ for manuscript, cursive, italic, and D'Nealian handwriting styles (listed respectively). The rank order of letters as identified by teachers was significantly different from the rank order of the number of errors made by students when students were asked to match cursive, italic, and D'Nealian style letters to typeset. The rank order of letters as identified by teachers was not significantly different from the rank order of the number of errors made by students when students were asked to match manuscript.

The rank order, as shown in Table 17, was tested to determine if there were differences in the number of times the letters were identified by teachers as being letters kindergarten students would confuse and the number of errors made by the students reading from flash cards. The scores calculated using the Spearman rank order correlation were $r = .009, .213, .030, .171, .061$ with p values of $.490, .277, .467, .319, .434$ for manuscript, cursive, italic, D'Nealian handwritten styles, and typeset (listed respect-

ively). From the data, it was shown that the rank order as identified by teachers was different from the rank order of the errors students made when reading flash cards in typeset and handwritten in manuscript, cursive, italic, and D'Nealian styles.

From the results of the analysis of the data using the Spearman, it was shown that the rank order of the letters tested as identified by teachers was different from the rank order of the errors students made with the exception of the errors made by students matching manuscript style to typeset. The $r = .567$ barely meets the .564 required for a significant association to exist in a positive direction at the .05 level.

From the results of the Spearman correlation to test the rank order, as shown in Table 17, it was shown that, with the exception to the rank order of the errors students made when matching manuscript to typeset on the Matching Letter Styles Test, the rank order of the letters teachers identified was different from the rank order of the letters students missed.

The low $N=10$ may account for the results of the tests applied.

Summary

All hypotheses were rejected at $<.01$ level of significance. There was a significant difference between the

kindergarten students' scores for matching handwritten manuscript, cursive, italic, and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles test.

In the post hoc analysis of the data from the Matching Letter Styles Test, it was shown that students scored as well when matching italic style to typeset as when matching manuscript style to typeset. The students scored significantly higher when matching manuscript and italic styles to typeset than they did when matching D'Nealian or cursive style to typeset. Students' mean scores for matching D'Nealian style to typeset were higher than their mean scores for matching cursive style to typeset. Based on these data, students were able to match manuscript and italic styles to typeset better than D'Nealian and cursive styles. Students were able to match D'Nealian style to typeset better than cursive style. In all cases, students scored significantly lower when matching cursive style letters than when matching manuscript, italic, or D'Nealian style letters to typeset.

There was a difference between kindergarten students' scores for reading typeset letters and handwritten letters in manuscript, cursive, italic, and D'Nealian, as measured by reading flash cards.

In the post hoc analysis of the data from reading flash cards, it was shown that mean scores of the students for reading typeset, italic, D'Nealian, and manuscript style letters were significantly higher than their mean

scores for reading cursive style letters. Based on these data, students were able to read typeset, italic, D'Nealian, and manuscript style letters equally well, but better than letters written in cursive style.

There were main effect differences between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards.

In the post hoc analysis, of the data from the Matching Letter Styles Test and reading flash cards, it was shown that students were able to match typeset letters to handwritten letters better than they could read typeset and handwritten letters from flash cards.

There were main effect differences between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian as measured by the Matching Letter Styles Test and reading from flash cards.

In the post hoc analysis, it was shown that when the scores for reading and matching were considered together students scored significantly higher on manuscript, italic, and D'Nealian than they did on cursive style.

In all analyses, students scored significantly lower when matching cursive style letters to typeset and when reading letters written in cursive style than they did when matching manuscript, italic and D'Nealian style to typeset or reading letters in typeset and written in manuscript, italic and D'Nealian style.

Students in this study wrote b and d like the manuscript, italic, and D'Nealian models of b and d significantly more times than they wrote b and d like the cursive models. Manuscript, italic, and D'Nealian were equally as easy for the kindergarten student to write.

From the analyses of the data from this study, students matched handwritten manuscript and italic style letters to typeset equally well. Students read typeset and handwritten manuscript, italic, and D'Nealian style letters from flash cards equally well. Students produced handwritten letters in manuscript, italic, and D'Nealian the same number of times like the models.

These students could not match handwritten cursive letters to typeset, read cursive letters from flash cards, or produce handwritten letters like the models of cursive as well as the other styles tested.

CHAPTER V

DISCUSSION AND SUMMARY

The author feels the selection of a style of handwriting should be based on sound instructional theory, the legibility and speed with which the style can be written, and the ease with which the beginning reader can associate typeset and handwritten letters. Reading and writing are related because both are used for written communication. Throughout the literature, writers concurred that one of the reasons for teaching manuscript was that it more nearly resembled the print in books; so, primary children who learn to write manuscript learn only one graphic representation of the alphabet for reading and writing. No studies were found to support the contention that manuscript more nearly resembled the print in books for the young child. The purpose of the author of this study was to investigate the ability of kindergarten students to do the following: (a) to match handwritten manuscript, cursive, italic, and D'Nealian style letters to typeset; (b) to read typeset letters and handwritten manuscript, cursive, italic, and D'Nealian style letters; (c) to investigate the relationship of reading to matching ability.

In the research, the investigator attempted to identify differences in the kindergarten students' performance for the styles of letters and in the ability to match and read.

In 1984, 69 students in four kindergarten classes from different schools in Great Falls, Montana, were assessed. The experimental procedures of the study included asking the students to do the following: (a) to select and mark, from four typeset letters, the letter that was the same as the handwritten letter in manuscript, cursive, italic, or D'Nealian style using a Matching Letter Styles Test; (b) to write the small letters b and d like the model of manuscript, cursive, italic, and D'Nealian styles b and d; and (c) to read flash cards reproduced in typeset and handwritten in manuscript, cursive, italic, and D'Nealian styles.

There were four general hypotheses proposed. In the first hypothesis, it was stated that there would be no difference between the kindergarten students' scores for matching handwritten manuscript, cursive, italic and D'Nealian letter styles to typeset, as measured by the Matching Letter Styles Test. By a statistical analysis, it was shown that these kindergarten students could match manuscript and italic style letters to typeset better than D'Nealian and cursive styles. Students could also match D'Nealian style letters better than they could match cursive style letters to typeset.

According to the results of this study, kindergarten students could match manuscript and italic letter styles to typeset equally well. The results of this study indicated that for these kindergarten students manuscript did not resemble the print in books more than italic with regard to matching handwritten styles to typeset.

In the second general hypothesis, it was stated that there would be no difference between the kindergarten students' scores for reading typeset letters and handwritten letters, as measured by reading from flash cards. By a statistical analysis, it was shown that kindergarten students could read italic, D'Nealian, manuscript and typeset style letters better than cursive style letters.

According to the results of this study, students read italic, D'Nealian, manuscript, and typeset equally well. The results of this study indicated that for these students manuscript did not seem to resemble the print in books more than the other styles with regard to reading letters from flash cards.

In the third general hypothesis, it was stated that there would be no main effect difference between kindergarten students' reading and matching scores, as measured by the Matching Letter Styles Test and reading from flash cards. Kindergarten students in this study had scores significantly higher for matching than for reading.

An interpretation can be offered at this point regarding

the third hypothesis. Matching is a visual discrimination skill that children practice almost from birth. Verbal recall comes much later in development. For this reason, it may be easier for kindergarten students to match letters than to read letters because the student does not need to recall the letter name for matching.

In the fourth general hypothesis, it was stated that there would be no main effect difference between kindergarten students' reading and matching scores for manuscript, cursive, italic, and D'Nealian letter styles, as measured by the Matching Letter Styles Test and reading from flash cards. When reading and matching mean scores were considered together, mean scores for italic, manuscript, and D'Nealian styles were significantly higher than the mean score for cursive style.

Interaction was not significant at the level of acceptance. If there was an interaction between the styles and matching and reading, this analysis did not reveal one.

According to the results of this study, students matched italic and manuscript styles to typeset equally well and students could read manuscript, italic, D'Nealian, and typeset equally well. The results of this study indicated that for the kindergarten students manuscript did not seem to more nearly resemble the print in books with regard to matching handwritten style letters to typeset and reading handwritten style letters from flash cards.

When students were asked to write the b and d like the handwritten models, 97% of the the italic letters was considered to be like the italic model, 95% of the manuscript letters was considered to be like the manuscript model, 84% of the D'Nealian letters was considered to be like the D'Nealian model and 25% of the cursive letters was considered to be like the cursive model. Students reproduced the manuscript, italic, and D'Nealian letter styles significantly more times like the model than they reproduced the cursive letter style like the model.

In the analysis of the data, it was revealed that kindergarten students scored significantly lower on cursive style than on the other styles on all tests. Students scored significantly lower on matching cursive style to typeset. Students scored significantly lower when reading cursive style letters from flash cards. Significantly fewer students wrote the cursive b and d like the model.

Significant differences, in favor of manuscript, were not found for students' scores for matching, reading, or writing. Students were able to match manuscript and italic style letters to typeset equally well. Students were able to read manuscript, italic, D'Nealian, and typeset letters equally well from flash cards. Students wrote b and d as many times like the model whether writing manuscript, italic, or D'Nealian. The analysis of the data in this study indicated that manuscript did not seem to resemble

the print in books any more than the other styles. It appeared that making a choice to teach manuscript cannot be based on the resemblance of manuscript to typeset.

Properties of Writing

If the style for beginning writing, excluding cursive, cannot be selected on the basis of providing an advantage for learning to read the print in books, then other considerations bear on the decision as to the the style of handwriting to be taught. A style of writing might then be chosen based on the properties of writing. The author would like to suggest that slant, interruption, uniformity, joining, and simplicity are the relevant properties.

Slant is the degree the writing leans from the vertical. The faster one writes the more the writing leans in the direction of movement. Early experiments by Woodworth and McAllister to discover the most natural letter slant for handwriting were prompted by reports from Germany and France that cursive writing might cause curvature of the spine and eyestrain in students (Dougherty, 1917). Woodworth (1899) and McAllister (1900) concluded that the most natural slant for writing was between 5 and 15 degrees from the vertical.

Interruption in the natural flow of writing is caused when the pencil is lifted and must be repositioned. Handwriting could be defined as the rhythmic movement of the hand across

the page leaving lines and figures that express ideas. The rhythm is more natural and flowing when the letters are formed with few interruptions. Each time the pencil is lifted in the formation of a letter, a new movement (stroke) is required. Lifting the pencil breaks the rhythm. The writer must determine where in "outer space" to begin the second stroke, as well as, in what direction to move.

Uniformity in the width of the letters, historically based on the width of the o, prevents confusion. Uniform width gives the writer less to learn and remember when forming the letters. The width of the letters should be examined in styles of writing to determine if the letters a, b, c, d, e, g, h, k, n, p, q, r, s, u, v, x, y, and z are the same width as the o.

Joining letters results when speed prevents the lifting of a pencil or pen between letters. Not all letters need to be joined, because there must be pauses in the movement of writing to allow the hand to rest. The eye and hand need to be realigned for writing to continue. The joining of letters should be optional to the writer.

Simplicity of letter forms may be a key to legibility, as well as to writing. In this study, the kindergarten students scored significantly lower on cursive style writing in all tests. It is the author's opinion that the low scores might be attributed to the loops and flourishes that confused the students when reading, matching and writing.

The loops and flourishes may have made the letter forms more difficult to produce.

A discussion of the results of this study for manuscript, cursive, italic and D'Nealian letter styles with reference to the properties mentioned follows.

Manuscript Handwriting Style

Authors of current books for teaching of language arts concur that one of the reasons for teaching manuscript is that it more nearly resembles the print in books, so primary children learn only one graphic representation of the alphabet for reading and writing (Anderson and Lapp, 1979; Coody and Nelson, 1982; Dehaven, 1979; Hennings, 1982; Marcus, 1977; Norton, 1980; Petty, Petty and Becking, 1981; Rubin, 1974; Savage 1977). Hay (1965) challenged the ability of young children to recognize letters in different styles. Manuscript models do not support the Roman typeset used for reading, according to Lehman (1976).

Students in this study were able to match italic and manuscript style letters to typeset equally well and better than D'Nealian and cursive styles on the Matching Letter Styles Test. When reading flash cards, there was no difference in the students' ability to read manuscript, italic, and D'Nealian style, and typeset. However, students did not read flash cards written in cursive style as well.

When students were asked to write the letters b and

d, 95% of the 44 samples was like the manuscript model. This may indicate that most kindergarten students can reproduce the manuscript letters.

In the results of this study, it was indicated that for the kindergarten students, manuscript style writing did not more nearly resemble the print in books. Manuscript, italic, and D'Nealian appeared to resemble the print in books equally when the data from reading flash cards were considered. Manuscript and italic appeared to resemble the print in books equally when the data from matching the handwritten letter to typeset using the Matching Letter Styles Test were considered.

Properties of Manuscript Style

Manuscript style is written vertically, with no slant. Woodworth (1899) and McAllister concluded that the most natural slant for writing was between 5 and 15 degrees. Manuscript style does not fit the recommended slant. This may cause manuscript to be more difficult to write.

Because the letters are formed by combining circles and straight lines, pencil lifts are required to produce the letters. Each time the pencil is lifted in the formation of a letter, a new stroke is required. Lifting the pencil breaks the rhythm. The writer must determine where in "outer space" to begin the second stroke, as well as, in what direction to move. The interruption of movement required

to write the manuscript letters may cause this style to be more difficult to write.

The letters in the manuscript style are based on the width of the o and are uniform in width. The uniformity of the manuscript letters may cause manuscript to be less difficult to write.

The small letters in manuscript style writing are not joined. Joining letters results when speed prevents the lifting of a pencil or pen between letters. Joining is not optional to the writer. The lack of optional joining may make manuscript style less desirable.

The manuscript letters are not burdened with decorative additions. The simplicity of the manuscript letter forms may have influenced the opinion that manuscript more nearly resembled the print in books. The simplicity of the manuscript letters, may make manuscript less difficult to write.

From the analysis of the data in this study, it was not shown that manuscript more nearly resembled the print in books for the kindergarten student. The small number of students sampled and the testing of only the letters b, d, g, l, m, n, p, q, u, and y make findings inconclusive. More research is needed. All the letters could be tested with a wider range of students to determine if manuscript does more nearly resemble the typeset.

According to the properties of writing suggested by the author, manuscript style may not be the best writing

style to teach. Consideration should be given to child development. A more thorough examination is suggested including all the capital and small letters.

Cursive Handwriting Style

Cursive, based on copperplate engraving, might be considered the first standardized style of handwriting in the United States. Cursive was introduced in the late 1800's in response to the industrial revolution. Until the introduction of manuscript in 1921, cursive was taught to all students from the beginning.

Cursive, according to the results of this study was the hardest to match to typeset, the hardest to read, and the hardest to write by the kindergarten students in this study. Students had significantly lower scores in cursive on the Matching Letter Styles Test and reading flash cards. Only 25% of the students could reproduce the letters b and d like the model.

On the Matching Letter Style Test, 48.8% of all the errors was made when students matched cursive style to typeset. Of the total errors made by the students on the Matching Letter Styles Test, 20.4% was made when students matched D'Nealian style to typeset, 16.3% when students matched manuscript style and 14.5% when students matched italic style to typeset.

When reading from flash cards, students made 31.5%

of the total errors when reading cursive style letters. Of the total error made when reading flash cards, 17.7% was made when reading manuscript style, 17.5% when reading typeset, 16.5% when reading D'Nealian style, and 16.3% when reading italic style.

On reading flash cards, the largest percent of no response was made with the cursive style. Of the total no response to reading flash cards, 38.2% was made with cursive style, 19.5% was made with typeset, 15.7% was made with manuscript style, 15.7% was made with D'Nealian style, and 10.9% was made with italic style.

From the results of this study, cursive could not be recommended as a style to teach young children. Reading and writing are the graphic symbols used to express language. Because the students scored significantly lower with the cursive in all tests in this study, it would seem that cursive writing might not enhance reading ability at the early stages. In addition, the inability of the students to reproduce the cursive b and d like the cursive model might indicate that it would not be as suitable to teach young children because it is more difficult to write. It is the opinion of the researcher that the loops and flourishes of the cursive make it difficult to write as well as read. Further study is recommended to determine if it is in fact the loops and flourishes that make cursive more difficult to read, as well as write.

Properties of Cursive Style

Cursive style is written at about 30 degrees slant. Woodworth (1899) and McAllister concluded that the most natural slant for writing was between 5 and 15 degrees from the vertical. Cursive style does not fit the recommended slant.

There are no interruptions in the movement when forming the cursive letters. Cursive small letters are made without lifting the pencil.

The cursive small letters are difficult to analyze for uniformity in width because of the entrances, or beginning strokes, and exits, or ending strokes. The letters lack uniformity with regard to the width of the *o*. The author feels ascenders (the top portion of the small letter that extends above *x* height, as in the letters *b* and *l*) and descenders (the bottom portion of the small letter that extends below the writing line, as in the letters *g* and *y*) are disproportionately long. The loops of the ascenders extending above the waistline and of the descenders extending below the writing line are one and a half times *x* height. Historically ascenders and descenders were equal to, or less than, *x* height. The lack of uniformity in the small letter forms and the ascenders and descenders may make cursive style more difficult to write.

All letters are joined in cursive styles with the

exception of the italic cursive style. Continuous joining of the letters in cursive style is not optional. There are no pauses in the movement of writing to allow the hand to rest. The continuous joining of letters within words may make cursive more difficult to write.

In the cursive writing style, loops, entrances, and exits are added to the basic letter forms. It is the author's opinion that these additions may be confusing to young children. To the young child, the loops may be confused for the letter itself. More research is needed to determine to what degree children are able to discern the loops on the cursive style letters from the letter.

The analyses of the data in this study did not support teaching cursive to young children. To the kindergarten students in this study, cursive style was the hardest to match to typeset, the hardest to read, and fewer students wrote the cursive letters b and d like the models. This indicated that it was the hardest to write. Cursive should be questioned even as a terminal writing. Cursive style, because of the loops and flourishes added to the basic letter forms, is more difficult to write at any age.

The practice of teaching a round, vertical, unjoined manuscript style in primary grades with a transition to an elliptical, slanted, continuously joined cursive should be discontinued. Concerns have been voiced about teaching children two very different styles of writing. Learning

two different forms certainly requires time and the transition may interfere with the development of children's ability in written composition (DeHaven, 1979); Fairbank, 1979; Hildreth, 1960; Lehman, 1976; Plattor and Woestehoff, 1967; Robinson, 1980; Templin, 1960; Western, 1977).

The author's conclusion, based on the results of this study, is that cursive is not an appropriate style to teach to young children. To eliminate a transition, consideration should be given to discontinuing the practice of teaching cursive style writing.

Italic Handwriting Style

Italic was introduced about 1921 by Margaret Wise, but the letter models were changed by the teachers to the manuscript form. In 1932, Alfred Fairbank developed italic models for children based on the writing of the 16th century. Italic met with wide acceptance in Europe, but not until the last twenty years has it gained recognition in the United States.

On the Matching Letter Styles Test, from a possible score of ten, students' mean score was 7.957 for matching italic style letters to typeset. The scores for matching the other styles to typeset were 7.696, 7.101 and 3.159 for manuscript, D'Nealian and cursive, respectively. Students could match italic and manuscript style letters to typeset better than they could match D'Nealian and cursive styles.

Students read italic, manuscript, D'Nealian style, and typeset better than cursive style letters.

On both the Matching Letter Styles Test and for reading flash cards, students made the least percentage of errors on italic style. The percentages of the total errors made by the students on the Matching Letter Styles Test for each of the styles were: italic, 14.5%; manuscript, 16.3%; D'Nealian, 20.4%; cursive, 48.8%. The percentages of the total errors made by the students reading flash cards for each of the styles were: italic, 16.3%; D'Nealian 16.5%; typeset 17.5%; manuscript, 17.7%; cursive 31.5%.

Students gave the least percentage of no response when reading the italic letters from flash cards. The percentages of the no response made by the students reading flash cards for each of the styles were: italic, 10.9%; manuscript, 15.7%; D'Nealian, 15.7%; typeset, 19.5%, cursive, 38.2%.

The highest percentage of the letters reproduced like the models of b and d was in the italic letters. Ninety-seven percent of the 44 letters written was judged to be like the model. The percentages of letters judged to be like the b and d for each of the styles were: italic, 97%; manuscript, 95%; D'Nealian, 84%; cursive, 25%.

There were no errors for the italic m on the Matching Letter Styles Test.

In the analysis of the data, it was revealed that

to the kindergarten students in this study, it appeared that italic style letters resembled typset, or print in books, to the same degree that manuscript style letters did.

Properties of Italic Style

Italic is written at the recommended slant of 5 to 15 degrees. The natural slant for writing recommended by Woodworth (1899) and McAllister (1900) may make italic easier to write.

Writing italic does not require pencil lifts. According to Fairbank (1979) the teaching of manuscript ignores the lesson taught by Renaissance history, namely that the Roman letter (as the manuscript) is one written with pen-lifts and that its fluent counterpart is italic. Italic evolved from a need for fast writing. The lack of interruption in the formation of the letters in italic style writing may cause italic to be less difficult to write.

The italic letters are based on the width of the *o*. This is in part due to the fact that the italic is a classic style which has been written for nearly 500 years. The uniformity in the italic small letters may cause this style to be less difficult to write.

Not all letters are joined. Joining of letters within words is optional. Joining may be developmental. The author has observed skilled handwriting students are more

likely to join than students that are less mature in the skill of writing.

The italic letters are not burdened with decorative additions. There are no loops. The simplicity of the italic letter forms may make italic style easier to write.

According to the properties of writing suggested by the author, italic style appears to be a viable alternative to teaching manuscript in the early grades. The terminal italic cursive writing is a simplified form which does not contain the loops and flourishes of other cursive styles. There is no transition from italic print to italic cursive. Further study might be done to verify if the simpler form of italic cursive would be advantageous as a terminal writing style for the older student.

D'Nealian Handwriting Style

D'Nealian was developed by Donald N. Thurber and published by Scott Foresman Company in 1978. The D'Nealian manuscript letter forms for beginning writers are slightly oval and slanted rather than round and vertical as in the traditional manuscript. Exits are added to these manuscript letters.

Students read the D'Nealian letters from flash cards as well as they read manuscript, italic, and typeset. Students read manuscript, italic, D'Nealian, and typeset better than they read cursive.

On the Matching Letter Styles Test, students scored

significantly lower on D'Nealian than on manuscript and italic. Students scored significantly higher on manuscript, italic, and D'Nealian than on cursive.

When students were asked to write b and d from the D'Nealian models, 41 of the 44 students wrote b like the model. Thirty-three of the 44 students wrote the d like the model. The D'Nealian d has an exit added that may be confusing for kindergarten students to write.

Properties of D'Nealian Style

D'Nealian is slanted 15 degrees. This is consistent with the recommendation of Woodworth (1899) and McAllister (1900). The slant of D'Nealian may make it easier to write.

There are few interruptions in the formation of the D'Nealian small letters. The natural flow of writing may make D'Nealian easier to write.

D'Nealian small manuscript letters are not uniform in width. This may make the manuscript letters more difficult to write. If D'Nealian cursive were to be considered as the terminal writing, it should be noted that the D'Nealian cursive models on the back of the text have twelve width groups ranging from .65 to 1.9 cm. The lack of uniformity in the width of the D'Nealian letter forms may make D'Nealian more difficult to write.

D'Nealian manuscript letters are not joined. Exits are added to the manuscript letters, but the exits are

not added for joining as is normally the practice. D'Nealian cursive writing follows the same patterns as all other cursive writing with the exception of italic cursive. Continuous joining is required between the letters within a word. Joining is not optional to the writer. The continuous joining of the D'Nealian cursive style may make D'Nealian cursive more difficult to write.

It is the opinion of the researcher that the exits added to the D'Nealian manuscript letters are confusing to the kindergarten student. Exits may distract from the basic letter form for the young student making it more difficult for the students to distinguish the letter. In this study, the high frequency of confusion of the D'Nealian letter l for the letter j might be explained by the addition of the exit on the D'Nealian manuscript l. Further research, using all the letters rather than the ten chosen for this study, is needed to determine if the exits are confusing.

According to the properties of writing suggested by the author, D'Nealian style may not be the best writing style to teach. A more thorough examination is suggested including all the capital and small letters.

Students' Errors in Matching and Reading Letter Styles vs Teachers' Prediction of Errors

The letters b, d, g, l, m, n, p, q, u, and y were identified by kindergarten teachers, based on their experience,

as being the letters kindergarten students confuse. In looking at the rank order of letters that teachers identified and the rank order of the actual errors students made for each style on the Matching Letter Styles Test and when reading flash cards, a question was raised in the mind of the researcher. It did not appear that the teachers had identified the letters that students most frequently missed. In Chapter IV, the rank orders were statistically analyzed, using the Wilcoxon matched pairs signed rank test and the Spearman rank correlation to determine if there were differences. The results of the tests were conflicting.

The analysis of the results of the Wilcoxon matched pairs signed rank test showed that teachers could accurately identify the letters students would confuse.

The analysis of the results of the Spearman correlation test showed that, with the exception of the rank order of the errors students made when matching manuscript to typeset on the Matching Letter Styles Test, the rank order of the letters teachers identified was different from the rank order of the letters students missed.

The low $N=10$ may account for the results of the tests applied. No conclusions can be reached from the conflicting statistical analysis of the rank order. More research is needed to conclude if teachers can identify letters students confuse.

Based on their experience, teachers were asked to identify the letters kindergarten students confused. The questionnaire used to solicit these data (see Appendix B) was printed in typeset. This raised the question--would teachers have identified the same letters had the questionnaire been presented in the handwriting styles?

When the researcher was analyzing errors, there appeared to be an additional inconsistency in errors that was possibly related to whether the students were matching the handwritten style to typeset or reading from flash cards.

A comparison of the percentages of errors for the letters receiving the highest number of errors on the Matching Letter Styles Test to the percentages of the same errors students made on the reading flash cards to the percentages of teachers that identified those letters caused the author to question: (a) if the features, the round or elliptical shapes, the entrances and exits, the loops, the height, etc., may cause different letters in different styles to be confusing to kindergarten students, (b) if the questionnaire, printed in typeset, influenced the teachers' perception of letters that confuse kindergarten students, and (c) if matching handwritten letters to typeset produces different results than reading letters from flash cards.

On Table 18, the letters with the highest frequency of error for each style made by the students matching the handwritten style to typeset on the Matching Letter Styles

test were compared to the errors on the same letter made by the students reading flash cards.

On the Matching Letter Styles Test, 52% of the students mismatched the manuscript style *g* as the typeset *g*. When reading the manuscript *g* from a flash card, 3% of the students said *g*. Twelve of the 23 teachers surveyed, or 52%, identified *g* as confused with *g*. The observation of the teachers appeared to be accurate when students were matching manuscript *g*. The observation of the teachers did not appear to be accurate when students were reading manuscript *g* from flash cards.

Table 18

Comparison of Reading Errors to Letters with the Highest
Frequency of Error on the Matching Letter Styles Test

Style	Test	Letter Tested	Incorrect Response	Frequency of Error
Manuscript	Matching	<i>g</i>	<i>q</i>	36
	Reading	<i>g</i>	<i>q</i>	2
Cursive	Matching	<i>n</i>	<i>m</i>	66
	Reading	<i>n</i>	<i>m</i>	57
Italic	Matching	<i>g</i>	<i>q</i>	34
	Reading	<i>g</i>	<i>q</i>	2
D'Nealian	Matching	<i>l</i>	<i>j</i>	63
	Reading	<i>l</i>	<i>j</i>	44

Note. Maximum error = 69.

On the Matching Letter Styles Test, 96% of the students mismatched the cursive *n* as the typeset *m*. When reading the cursive *n* from a flash card 83% of the students said *m*. Thirteen of the teachers surveyed, or 56%, identified *n* as confused with *m*. It did not appear that teachers were perceptive in predicting this error with regard to cursive *n*.

On the Matching Letter Styles Test, 49% of the students mismatched the italic *g* as the typeset *g*. When reading the italic *g* from a flash card, 3% of the students said *g*. This error was identified by 52% of the teachers surveyed. The observation of the teachers appeared to be accurate when students were matching the italic *g* to typeset. The observation of the teachers did not appear to be accurate when students were reading the italic *g* from flash cards.

On the Matching Letter Styles Test, 92% of the students mismatched the D'Nealian *l* as the typeset *j*. When reading the D'Nealian *l* from a flash card, 64% of the students said *j*. Of the teachers surveyed, 17% of the teachers identified this error. The observation of the teachers did not appear to be accurate with regard to the D'Nealian *l* for matching the D'Nealian *l* to typeset or for reading the D'Nealian *l* from flash cards.

Similar results were found when the percentages of errors for the letters receiving the highest number of errors made by the students reading flash cards were compared

to percentages of errors made on the same letter on the Matching Letter Styles Test and to the percentages of teachers that identified those letters as confusing.

On Table 19 the letters with the highest frequency of error for each style made by the students reading flash cards are compared to the errors on the same letter made by the students matching the handwritten style to typeset on the Matching Letter Styles Test.

Table 19

Comparison of Errors on the Matching Letter Styles Test
with the Highest Frequency of Error for
Reading Flash Cards

Style	Test	Letter Tested	Incorrect Response	Frequency of Error
Manuscript	Reading	l	i	50
	Matching	l	i	8
Cursive	Reading	n	m	57
	Matching	n	m	66
Italic	Reading	l	i	50
	Matching	l	i	31
D'Nealian	Reading	l	j	44
	Matching	l	j	63

Note. Maximum error = 69.

When reading the manuscript l from a flash card, 72% of the students misnamed i. On the Matching Letter Styles Test, 12% of the students mismatched the manuscript style

l with as the typeset i. Of the teachers surveyed, 57% predicted this error. It appeared that the observation of the teachers may not be accurate with regard to the manuscript l.

When reading the cursive n from a flash card, 83% of the students misnamed m. On the Matching Letter Styles Test, 96% of the students mismatched the cursive n with the typeset m. Of the teachers surveyed, 52% predicted this error. It appeared that teachers were not perceptive in predicting the errors with regard to cursive n.

When reading the italic l from flash cards, 72% of the students in this study misnamed i. On the Matching Letter Styles Test, 45% of the students mismatched the italic l with the typeset i. Of the teachers surveyed, 57% identified this error. It appeared that teachers were not perceptive in predicting this error with regard to italic l.

When reading the D'Nealian l from flash cards, 64% of the students in this study misnamed j. On the Matching Letter Styles Test, 92% of the students mismatched the D'Nealian l with the typeset j. Of the teachers surveyed, 17% identified this error. It appeared that teachers were not perceptive in predicting this error with regard to D'Nealian l.

The conflicting statistical analysis of the rank order of the letters that teachers identified and the rank order

of the letters students missed raised questions in the mind of the researcher. The questions raised by the analysis of teacher perception indicates to the author the need for research to establish: (a) if the features of different styles may cause different letters to be confusing to kindergarten students, (b) if typeset or different handwriting styles influence teachers' perception concerning the letters that would be confusing to kindergarten students, and (c) if matching handwritten letters to typeset produces the same results by letter as reading from flash cards.

Population Differences

There appeared to be some academic and economic differences between the students at Meadow Lark and the students at Whittier. Meadow Lark students in grades 4, 5, and 6 scored highest of the sixteen elementary schools on the Iowa Test of Basic Skills in the 1983-84 tests. Whittier students in grades 4 and 6 (there was no fifth grade at Whittier) scored the lowest of the sixteen schools.

Of the four schools in the study, the lowest percentage of students receiving free lunch of the sixteen schools was at Meadowlark. The highest percentage of students receiving free lunch was at Whittier. It would appear that students from Meadow Lark School may come from a more affluent environment.

From the results from the Matching Letter Styles Test,

when those two schools were compared, it was shown that kindergarten students at Meadow Lark received higher scores for matching manuscript and italic style letters to typeset than for D'Nealian and cursive. Students' scores for matching D'Nealian style to typeset were higher than scores for matching cursive style to typeset. Kindergarten students at Whittier scored higher on matching manuscript, italic and D'Nealian style to typeset than on matching cursive style.

Students with higher achievement and from a more affluent society may match D'Nealian style to typeset differently than students with lower achievement and from a less affluent society. The number of cases and inconclusive data to support that the students were different in Meadow Lark from the students in Whittier make it inappropriate to draw a conclusion. However, there is an indication that further research is needed to determine if academic achievement and economic status have a relationship to kindergarten students' ability to match letters. It is possible that students from more affluent environments discriminate letters differently than students in lower economic environments. The possibility may exist that students with higher achievement ability discriminate letters differently than students with lower achievement ability.

When students from Meadow Lark and Whittier were compared on reading flash cards, kindergarten students at Meadow

Lark read manuscript letters better than typeset and typeset better than cursive style letters. The scores for reading italic and D'Nealian style letters were not statistically different from the scores for manuscript or for typeset. Kindergarten students at Whittier read typeset, manuscript, italic, and D'Nealian style better than cursive style letters.

Students from higher academic achievement levels and more affluent environment may perceive letters differently. Further research would be needed to substantiate if there are differences in the way students with varying academic abilities and environments are able to read different letter styles.

It could be that different styles of handwriting would be more suitable for certain populations depending on the background of the students. It could be that discrimination skills should be taught to some students prior to the introduction of letters for reading and writing.

Recommendations for Further Research

This study should be repeated. The kindergarten students that participated in the study may not have been representative of the population.

Models for manuscript based on Zaner-Bloser manuscript models, cursive based on Palmer cursive models, italic based on Alfred Fairbank models, and D'Nealian based on D'Nealian manuscript models (Appendix A) were used in this

study. There are slight differences in the letter forms for other cursive, manuscript, and italic models. These differences might influence the results. Further research is recommended using other cursive, manuscript, and italic models.

Only the letters b, d, g, l, m, n, p, q, u, and y were tested in this study. These letters were selected based on a questionnaire. The questionnaire asked kindergarten teachers to identify letters kindergarten students confused based on the teachers' experience. Further research is recommended using all the small letters.

Students in this study were able to match handwritten letters to typeset better than they were able to read handwritten letters from flash cards. Some questions arise as to why this was the case. Further research is recommended to determine why students are apparently able to match handwritten letters to typeset better than they are able to read handwritten letters from typeset.

The author suggested that selecting a style of writing could be determined by assessing the properties of handwriting styles. These properties were arbitrarily chosen based on the experience of the author. The properties of writing may need clearer definition and those properties should be tested for accuracy. In establishing the properties as described in this study, the author did not take into account the development of the child. A quantative factor

analysis needs to be devised that would measure the difficulty of the writing and the difficulty of the writing with regard to maturation.

The author feels the cursive small letters may be confusing to kindergarten students because of the loops and flourishes added to the basic letter forms. The observation was reported that the ascenders and descenders of the small letters are disproportionately long. Research is needed to establish if the author's observations are accurate.

The author feels the exits added to D'Nealian small manuscript letters may have influenced the kindergarten students' ability to match D'Nealian style letters to typeset. Testing all the D'Nealian style letters with exits against the D'Nealian manuscript letters with the exits removed might help determine if this observation was accurate.

The conflicting statistical analysis of the rank order of the letters that teachers identified and the rank order of the letters students actually missed raised these questions: (a) if the features of different styles may cause different letters to be confusing to kindergarten students, (b) if typeset or different handwriting styles influence teachers' perception concerning the letters that would be confusing to kindergarten students, and (c) if matching handwritten letters to typeset produces the same results by letter as reading from flash cards. Further research would be needed to answer these questions.

Students from higher academic achievement levels and more affluent environments may perceive letters differently. Further research would be needed to substantiate if there are differences in the way students with varying academic abilities and environment perceive letters in various styles.

Summary

The analyses of the data from this study suggests that manuscript did not resemble the print in books more than the other styles for the young child. Students in the study were able to match manuscript style no better than they were able to match italic style to typeset letters. The students were able to read manuscript, italic, D'Nealian style letters, and typeset letters equally well. Therefore, teaching manuscript because it more nearly resembles the print in books is not a legitimate reason for selecting manuscript.

Students in this study wrote b and d like the handwritten manuscript, italic, and D'Nealian models of b and d significantly more times than they wrote b and d like the cursive models. Manuscript, italic, and D'Nealian may be equally as easy to write.

The evidence of this study suggests that cursive is not a good selection of a style of writing to teach to the young child. The kindergarten students scored significantly lower on cursive style than on the other styles

on all tests. Students scored significantly lower on matching cursive style to typeset. Students scored significantly lower when reading cursive style letters from flash cards. Significantly fewer students wrote the cursive b and d like the cursive model.

The research to support teaching manuscript, italic, or D'Nealian handwriting is not conclusive. The author showed by the analyses based on the properties of writing that italic is the best alternative. It is the author's opinion, based on this study, other research, experience, and the review of the literature, that italic handwriting style should receive serious consideration. Italic handwriting is easy to learn, easy to write, and easy to read. Because there is no transition from italic print to italic cursive, less time is needed and there is no interruption with the development of children's ability in written communication.

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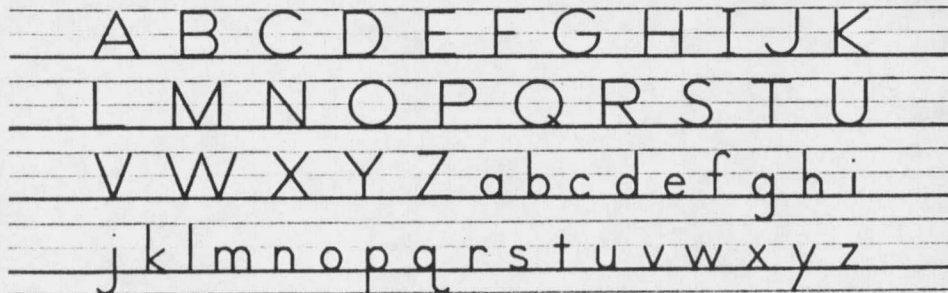
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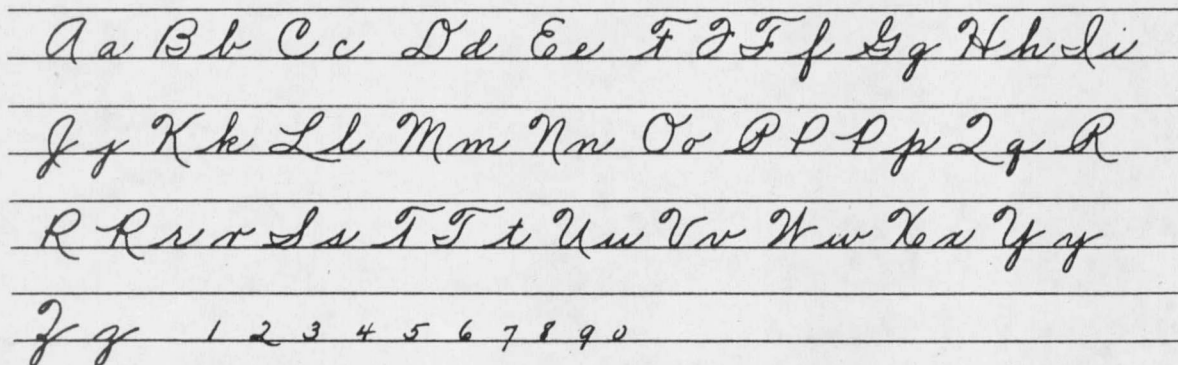
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APPENDICES

APPENDIX A



Models of Zaner-Bloser manuscript from Barbe, Walter B., Lucas, Virginia H., Hachney, Clinton W., & McAllister, Constance. Creative Growth in Handwriting. (2nd ed.) Columbus, Ohio: Zaner-Bloser, Inc., 1979.



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Aa Bb Cc Dd Ee Ff Gg
 Hh Ii Jj Kk Ll Mm Nn
 Oo Pp Qq Rr Ss Tt Uu
 Vv Ww Xx Yy Zz

Models of italic print from Stone, Charlotte & Fairbank, Alfred. Beacon Writing: A Course in Italic Book Two. Portland, OR: The Alcuin Press, 1978.

a b c d e f g h i
 j k l m n o p q r
 s t u v w x y z

A B C D E F G H I
 J K L M N O P Q R
 S T U V W X Y Z

Models of D'Nealian manuscript from Thurber, Donald N. D'Nealian Handwriting. Palo Alto, CA: Scott, Foresman and Company, 1978.

²⁴ abcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZ

Models of Palatino typeset from Volk & Husley Mergenthaler. VIP Typeface Catalog 2. New York: Van Nostrand Reinhold Company, 1980

APPENDIX B

MATCHING LETTER STYLES TEST

PART I

Item	Style	Letter	Distractors				
1.	cursive	d	d	b	q	p	
2.	D'Nealian	v	v	u	y	w	
3.	italic	p	p	q	b	g	
4.	D'Nealian	u	m	v	u	n	
5.	manuscript	v	u	w	v	y	
6.	D'Nealian	g	q	p	d	g	
7.	manuscript	n	m	u	n	h	
8.	italic	u	n	h	v	u	
9.	manuscript	g	b	g	q	d	
10.	cursive	m	m	v	h	w	
11.	D'Nealian	p	q	b	d	p	
12.	cursive	q	g	p	d	q	
13.	D'Nealian	n	n	m	h	u	
14.	italic	q	d	g	q	p	
15.	cursive	p	g	p	d	q	
16.	italic	b	q	b	d	p	
17.	manuscript	m	w	m	n	u	
18.	italic	v	w	y	u	v	
19.	D'Nealian	m	m	h	v	u	
20.	italic	l	i	q	l	j	

MATCHING LETTER STYLES TEST

PART II

Item	Style	Letter	Distractors			
1.	manuscript	u	h	w	u	v
2.	D'Nealian	q	g	b	q	p
3.	italic	g	g	q	d	p
4.	manuscript	d	p	b	q	d
5.	italic	d	q	d	b	p
6.	manuscript	b	d	b	p	q
7.	italic	n	h	u	m	n
8.	cursive	n	n	u	m	h
9.	cursive	u	u	h	v	m
10.	D'Nealian	l	j	q	i	l
11.	D'Nealian	d	p	q	d	b
12.	italic	m	u	h	n	m
13.	manuscript	p	b	g	p	q
14.	cursive	v	v	y	u	w
15.	D'Nealian	b	q	d	p	b
16.	cursive	g	d	p	b	g
17.	manuscript	l	l	q	i	j
18.	manuscript	q	p	q	g	b
19.	cursive	l	i	q	l	j
20.	cursive	b	b	d	q	p

Years of teaching experience _____

Years of experience in kindergarten _____

Circle the letter/letters in each row that kindergarten children, from your experience, tend to confuse with the first letter in the row.

Comments:

a	a b c d e f g h i j k l m n o p q r s t u v w x y z
b	a b c d e f g h i j k l m n o p q r s t u v w x y z
c	a b c d e f g h i j k l m n o p q r s t u v w x y z
d	a b c d e f g h i j k l m n o p q r s t u v w x y z
e	a b c d e f g h i j k l m n o p q r s t u v w x y z
f	a b c d e f g h i j k l m n o p q r s t u v w x y z
g	a b c d e f g h i j k l m n o p q r s t u v w x y z
h	a b c d e f g h i j k l m n o p q r s t u v w x y z

i	abcdefghijklmnopqrstuvwxyz
j	abcdefghijklmnopqrstuvwxyz
k	abcdefghijklmnopqrstuvwxyz
l	abcdefghijklmnopqrstuvwxyz
m	abcdefghijklmnopqrstuvwxyz
n	abcdefghijklmnopqrstuvwxyz
o	abcdefghijklmnopqrstuvwxyz
p	abcdefghijklmnopqrstuvwxyz
q	abcdefghijklmnopqrstuvwxyz
r	abcdefghijklmnopqrstuvwxyz
s	abcdefghijklmnopqrstuvwxyz
t	abcdefghijklmnopqrstuvwxyz
u	abcdefghijklmnopqrstuvwxyz
v	abcdefghijklmnopqrstuvwxyz
w	abcdefghijklmnopqrstuvwxyz
x	abcdefghijklmnopqrstuvwxyz
y	abcdefghijklmnopqrstuvwxyz
z	abcdefghijklmnopqrstuvwxyz

MATCHING LETTER STYLES TEST PART I

Name _____ Date _____

School _____ Teacher _____

- | | | | | | |
|----|----------|---------|-----|----------|---------|
| 1. | <i>d</i> | d b q p | 7. | n | m u n h |
| 2. | v | v u y w | 8. | u | n h v u |
| 3. | p | p q b g | 9. | g | b g q d |
| 4. | u | m v u n | 10. | <i>m</i> | m v h w |
| 5. | v | u w v y | 11. | p | q b d p |
| 6. | g | q p d g | 12. | <i>q</i> | g p d q |

13.

<i>n</i>	n m h u
----------	----------------

17.

<i>m</i>	w m n u
----------	----------------

14.

<i>q</i>	d g q p
----------	----------------

18.

<i>v</i>	w y u v
----------	----------------

15.

<i>p</i>	g p d q
----------	----------------

19.

<i>m</i>	m h v u
----------	----------------

16.

<i>b</i>	q b d p
----------	----------------

20.

<i>l</i>	i q l j
----------	----------------

p

b

b

b

MATCHING LETTER STYLES TEST PART II

Name _____ Date _____

School _____ Teacher _____

- | | | | | | |
|----|---|---------|-----|----------|---------|
| 1. | u | h w u v | 7. | n | h u m n |
| 2. | q | g b q p | 8. | <i>n</i> | n u m h |
| 3. | g | g q d p | 9. | <i>u</i> | u h v m |
| 4. | d | p b q d | 10. | <i>l</i> | j q i l |
| 5. | d | q d b p | 11. | <i>d</i> | p q d b |
| 6. | b | d b p q | 12. | <i>m</i> | u h n m |

p

p

p

p

d b p q

h

20.

g q d p

b

16.

i l b i

h

19.

q d p b

q

15.

q g b d

q

18.

w y u w

n

14.

i l b i

i

17.

d b g q

p

13.

I have compared the Zaner-Bloser manuscript, Palmer cursive, D'Nealian manuscript, and italic models to the letters written by Betty Duvall on the flash cards and the Matching Letter Styles Test and find them to be a satisfactory representation.

Elnora A. Old Coyote
Dr. Elnora Old Coyote

May 1983
Date

M. C. Jolland
First Grade Teacher

May 1983
Date

Alice E. Hemphill
Curriculum Coordinator

May 24, 1983
Date

TYPE CORR
CORRELATION FOR VALLEY VIEW MATCHING LETTER STYLES TEST
(MANUSCRIPT)*****

CASES READ = 17

VARIABLE	1	2
MEAN (17)=	8.765	8.824
STD DEV =	1.437	1.286
SKEWNESS =	-2.309	-1.662
KURTOSIS =	8.319	5.709
MAXIMUM =	10.00	10.00
MINIMUM =	4.000	5.000
CORRELATION=	.8889	
P-VALUE =	.0000	

SPEARMAN RANK CORRELATIONS:

CORRELATION= .8009

P-VALUE = .0000

(CURSIVE)*****

CASES READ = 17

VARIABLE	1	2
MEAN (17)=	4.353	4.706
STD DEV =	1.618	1.649
SKEWNESS =	.5006	.5720
KURTOSIS =	1.996	2.451
MAXIMUM =	7.000	7.000
MINIMUM =	2.000	1.000
CORRELATION=	.7908	
P-VALUE =	.0000	

SPEARMAN RANK CORRELATIONS:

CORRELATION= .6808

P-VALUE = .2629E -2

(ITALIC)***** (D'NEALIAN)*****

CASES READ = 17

VARIABLE	1	2
MEAN (17)=	8.824	9.118
STD DEV =	.9510	.6966
SKEWNESS =	-.5427	-.1464
KURTOSIS =	2.530	2.175
MAXIMUM =	10.00	10.00
MINIMUM =	7.000	8.000
CORRELATION=	.5993	
P-VALUE =	.1100E -1	

CASES READ = 17

VARIABLE	1	2
MEAN (17)=	8.000	7.824
STD DEV =	1.414	1.425
SKEWNESS =	-.2733	-1.286
KURTOSIS =	1.727	4.034
MAXIMUM =	10.00	9.000
MINIMUM =	6.000	4.000
CORRELATION=	.5584	
P-VALUE =	.1982E -1	

SPEARMAN RANK CORRELATIONS:

CORRELATION= .5974
P-VALUE = .1133E -1

SPEARMAN RANK CORRELATIONS:

CORRELATION= .6152
P-VALUE = .8576E -2

TYPE CORR2
CORRELATION FOR MATCHING LETTER STYLES VALLEY VIEW
FOR FACTORS--- MANUSCRIPT, CURSIVE, ITALIC, D'NEALIAN

CASES READ = 68

VARIABLE	1	2
MEAN (68)=	7.485	7.368
STD DEV =	2.289	2.533
SKEWNESS =	-.8725	-.9628
KURTOSIS =	2.534	2.601
MAXIMUM =	10.00	10.00
MINIMUM =	2.000	1.000
CORRELATION=	.9137	
P-VALUE =	.0000	

SPEARMAN RANK CORRELATIONS:

CORRELATION= -.2943
P-VALUE = .1484E -1

B>

APPENDIX C

LEWIS AND CLARK SCHOOL

STUDENT	READING					MATCHING			
	MAN.	CUR.	ITA.	D'N.	TYP.	MAN.	CUR.	ITA.	D'N.
John	7	1	8	6	6	8	1	8	8
Jeff	7	0	6	5	5	7	3	9	6
Kathleen	8	2	8	6	6	7	3	8	8
Kelly	7	3	7	9	6	9	2	7	7
Erin	7	3	6	6	7	9	3	10	7
Anna	4	1	5	4	4	5	3	8	5
Jason	1	0	1	1	1	2	2	4	2
Shannon	9	4	8	8	8	9	4	10	7
Peter	7	1	6	7	6	10	3	9	9
Jesse	7	3	6	5	6	9	2	9	6
Scott	9	2	8	8	8	9	3	10	9
Bradley	5	1	7	6	6	6	2	5	5
Timothy	7	2	8	8	7	10	4	8	8
Jocelyn	9	3	7	10	8	10	4	10	10
Sandy	5	0	5	4	6	4	2	5	5
Rico	9	3	10	9	9	10	4	9	9
Brent	7	2	6	5	5	5	2	7	6
Keith	5	1	4	7	4	6	3	10	5

MEADOW LARK

STUDENT	READING					MATCHING			
	MAN.	CUR.	ITA.	D'N.	TYP.	MAN.	CUR.	ITA.	D'N.
Shane	4	1	4	4	4	7	3	7	7
Dean	7	0	6	7	5	8	3	9	8
Ehren	4	1	3	2	2	10	2	8	7
Jenny	6	2	3	9	4	9	5	9	8
Tiffani	9	3	8	7	10	9	4	9	8
Kelli	4	1	3	4	3	9	4	7	7
Cory	4	1	4	4	4	6	2	9	7
Neal	6	0	6	5	5	7	4	8	8
Polly	8	4	8	9	4	9	4	7	8
Kyle	5	1	5	7	5	8	3	6	5
Ron	6	1	7	6	7	10	5	10	9
Holly	7	1	7	7	6	9	4	8	8
Sydne	8	0	6	7	7	5	1	4	5
Mathew	5	2	4	3	4	8	2	8	7
Karyl	3	0	2	2	2	5	3	7	5
Christopher	2	1	3	3	2	9	3	9	7
Judd	3	1	4	4	2	10	3	10	8

SACAJAWEA

STUDENT	READING					MATCHING			
	MAN.	CUR.	ITA.	D'N.	TYP.	MAN.	CUR.	ITA.	D'N.
Willy	3	1	3	5	4	7	4	8	8
Jessica	6	2	4	7	5	7	3	9	8
Martin	7	0	6	4	4	8	3	8	6
Damon	4	1	6	3	6	8	5	9	8
Michael	4	1	4	3	3	10	3	8	9
Jennifer	7	1	8	7	6	6	4	8	6
Geri	8	2	9	10	8	7	3	9	9
Kevin	4	2	4	5	4	9	3	7	8
Seth	4	2	4	3	3	9	3	9	8
Mathew	3	1	3	2	4	7	3	8	6
Jason	6	0	6	6	6	9	3	9	8
Lisa	5	0	9	9	6	8	4	7	6
Tracy	1	0	1	1	1	5	2	6	4
Jill	3	0	3	3	2	7	4	8	7
Kelcie	6	2	6	6	7	8	2	8	7
Seneca	4	0	4	3	3	5	3	7	8
Christina	3	1	4	2	4	6	2	8	7
Michael	5	1	5	6	4	8	4	9	7

WHITTIER

STUDENT	READING					MATCHING				
	MAN.	CUR.	ITA.	D'N.	TYP.	MAN.	CUR.	ITA.	D'N.	
Amy	7	3	8	7	8	8	3	9	7	
Vincent	10	2	9	9	8	9	4	9	8	
Mark	8	2	6	8	8	9	3	8	9	
Vanessa	7	3	9	7	8	9	4	9	9	
Kenneth	1	5	5	5	5	9	2	8	8	
Misty	2	2	2	2	2	4	4	4	4	
Jackie	7	1	6	6	5	9	3	10	9	
Melissa	6	2	4	7	5	8	3	7	7	
Laura	8	2	7	7	8	9	2	8	8	
Bradley	8	2	7	7	7	5	5	8	8	
Debora	6	1	7	7	6	8	3	9	8	
Gerald	4	2	3	4	5	6	2	4	2	
Clarissa	1	0	1	1	2	7	4	8	8	
Glenwood	1	0	1	0	1	7	3	7	4	
Dalles	1	1	1	1	3	7	5	7	9	
Brian	6	3	6	5	6	10	5	8	8	

APPENDIX D

READING DATA

Name _____ Date _____

TYPEFACE

b	b	b	b	b
d	d	d	d	d
g	g	g	g	g
l	l	l	l	l
m	m	m	m	m
n	n	n	n	n
p	p	p	p	p
q	q	q	q	q
u	u	u	u	u
v	v	v	v	v

MATCHING LETTER STYLES TESTPART I

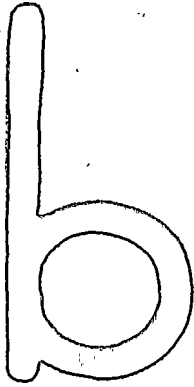
<u>MANUSCRIPT</u>	<u>CURSIVE</u>	<u>ITALIC</u>	<u>D'NEALIAN</u>
5	1	3	2
7	10	8	4
B	12	14	6
17	15	16	11
		18	13
		20	19

PART II

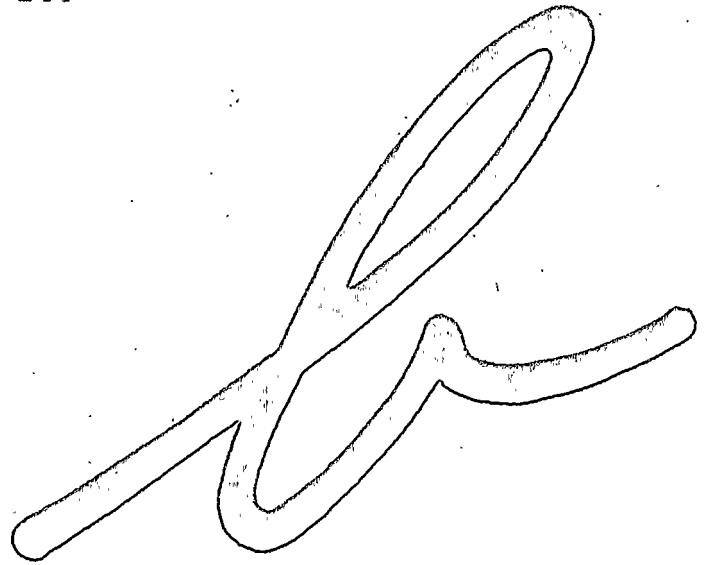
1	8	3	2
4	9	5	10
6	14	7	11
13	16	12	15
17	19		
18	20		

ORDER OF PRESENTATION

1. manuscript, cursive, italic, D'Nealian
2. cursive, italic, D'Nealian, manuscript
3. italic, D'Nealian, manuscript, cursive
4. D'Nealian, manuscript, cursive, italic
5. manuscript, italic, d'nealian, cursive
6. italic, D'Nealian, cursive, manuscript
7. D'Nealian, cursive, manuscript, italic
8. cursive, manuscript, italic, D'Nealian
9. manuscript, D'Nealian, cursive, italic
10. D'Nealian, cursive, italic, manuscript
11. cursive, italic, manuscript, D'Nealian
12. italic, manuscript, D'Nealian, cursive
13. manuscript, cursive, D'Nealian, italic
14. cursive, D'nealian, italic, manuscript
15. D'Nealian, italic, manuscript, cursive
16. italic, manuscript, cursive, D'Nealian
17. manuscript, D'Nealian, italic, cursive
18. italic, cursive, manuscript, D'Nealian
19. cursive, manuscript, D'Nealian, italic
20. manuscript, italic, cursive, D'Nealian
21. italic, cursive, D'Nealian, manuscript
22. cursive, D'Nealian, manuscript, italic
23. D'Nealian, manuscript, italic, cursive
24. D'Nealian, italic, cursive, manuscript



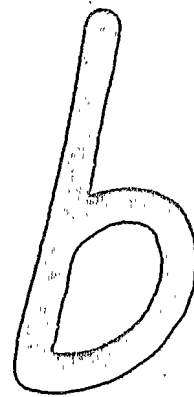
manuscript



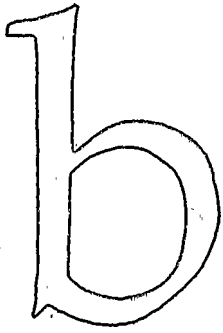
cursive



italic



D'Nealian



typeset

APPENDIX E

TYPE VAL1
 VALLEY VIEW MATCHING LETTER STYLES MULTIPLE COMPARISONS

IDENT	MEANS	
2	4.333	A
4	8.056	B
1	8.778	C
3	8.889	C

TRY	N	MEANS
1	18	8.778
2	18	4.333
3	18	8.889
4	18	8.056
OVERALL	72	7.514

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	80.24			
TREATMENTS	3	250.2	83.38	97.54	.0000
ERROR	51	43.60	.8548		
TOTAL	71	374.0			

TYPE SACM
 SACA JAWEA MATCHING LETTER STYLES MULTIPLE COMPARISONS

IDENT	MEANS	
2	4.059	A
4	7.824	B
3	8.529	C
1	9.000	C

TRT	N	MEANS
1	17	9.000
2	17	4.059
3	17	8.529
4	17	7.824
OVERALL	68	7.353

ANALYSIS OF VARIANCE:					
SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	16	65.03			
TRTMENTS	3	257.9	85.96	119.2	.0000
ERROR	48	34.62	.7212		
TOTAL	67	357.5			

TYPE VALR
 VALLEY VIEW READING MULTIPLE COMPARISONS

IDENT	MEANS	
3	1.222	A
4	5.444	B
1	5.556	B
2	5.667	B
5	5.944	B

TRT	N	MEANS
1	18	5.556
2	18	5.667
3	18	1.222
4	18	5.444
5	18	5.944
OVERALL	90	4.767

ANALYSIS OF VARIANCE:					
SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	271.7			
TREATMENTS	4	285.2	71.29	36.94	.0000
ERROR	68	131.2	1.930		
TOTAL	89	688.1			

B>TYPE SACR

SACAJAWEA READING DATA MULTIPLE COMPARISONS

IDENT MEANS

3	2.176	A
4	7.294	B
5	7.765	CB
2	8.000	C
1	8.176	C

TRT	N	MEANS
1	17	8.176
2	17	8.000
3	17	2.176
4	17	7.294
5	17	7.765
OVERALL	85	6.682

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	16	67.62			
TRTMENTS	4	438.9	109.7	106.5	.0000
ERROR	64	65.91	1.030		
TOTAL	84	572.4			

One-factor Experiments with Repeated Measurements (Ferguson, 318, 263):

Mean squares	Expectation of mean squares
Subjects, s_r^2	$\sigma_e^2 + C\sigma_a^2$
Treatments, s_c^2	$\sigma_e^2 + \sigma_{ab}^2 + R\sigma_b^2$
Interaction, s_{rc}^2	$\sigma_e^2 + \sigma_{ab}^2$

$$[16.3] \text{ ROWS} \quad \frac{1}{C} \sum_{r=1}^R T_{r.}^2 - \frac{T^2}{N}$$

$$[16.4] \text{ COLUMNS} \quad \frac{1}{R} \sum_{c=1}^C T_{.c}^2 - \frac{T^2}{N}$$

$$[16.5] \text{ INTERACTION} \quad \sum_{r=1}^R \sum_{c=1}^C X_{rc}^2 - \frac{1}{C} \sum_{r=1}^R T_{r.}^2 - \frac{1}{R} \sum_{c=1}^C T_{.c}^2 + \frac{T^2}{N}$$

$$[16.6] \text{ TOTAL} \quad \sum_{r=1}^R \sum_{c=1}^C X_{rc}^2 - \frac{T^2}{N}$$

Two-factor Experiments with Repeated Measurements (Ferguson, 285, 321):

ROWS

$$[17.1] \quad \frac{1}{nCL} \sum^R T_{r...}^2 - \frac{T^2}{N}$$

COLUMNS

$$[17.2] \quad \frac{1}{nRL} \sum^C T_{.c..}^2 - \frac{T^2}{N}$$

LAYERS

$$[17.3] \quad \frac{1}{nRC} \sum^L T_{..l.}^2 - \frac{T^2}{N}$$

$R \times C$ INTERACTION

$$[17.4] \quad \frac{1}{nL} \sum^R \sum^C T_{rc..}^2 - \frac{1}{nLC} \sum^R T_{r...}^2 - \frac{1}{nKL} \sum^C T_{.c..}^2 + \frac{T^2}{N}$$

$R \times L$ INTERACTION

$$[17.5] \quad \frac{1}{nC} \sum^R \sum^L T_{r.l.}^2 - \frac{1}{nLC} \sum^R T_{r...}^2 - \frac{1}{nRC} \sum^L T_{..l.}^2 + \frac{T^2}{N}$$

$C \times L$ INTERACTION

$$[17.6] \quad \frac{1}{nR} \sum^C \sum^L T_{.cl.}^2 - \frac{1}{nLR} \sum^C T_{.c..}^2 - \frac{1}{nRC} \sum^L T_{..l.}^2 + \frac{T^2}{N}$$

$R \times C \times L$ INTERACTION

$$[17.7] \quad \begin{aligned} & \frac{1}{n} \sum^R \sum^C \sum^L T_{rcl.}^2 - \frac{1}{nL} \sum^R \sum^C T_{rc..}^2 - \frac{1}{nC} \sum^R \sum^L T_{r.l.}^2 - \frac{1}{nR} \sum^C \sum^L T_{.cl.}^2 \\ & + \frac{1}{nCL} \sum^R T_{r...}^2 + \frac{1}{nRL} \sum^C T_{.c..}^2 + \frac{1}{nRC} \sum^L T_{..l.}^2 - \frac{T^2}{N} \end{aligned}$$

WITHIN CELLS

$$[17.8] \quad \sum^R \sum^C \sum^L \sum^n X_{rcl.}^2 - \frac{1}{n} \sum^R \sum^C \sum^L T_{rcl.}^2$$

TOTAL

$$[17.9] \quad \sum^R \sum^C \sum^L \sum^n X_{rcl.}^2 - \frac{T^2}{N}$$

APPENDIX F

TYPE LEWM
 ***** LEWIS & CLARK MATCHING *****

FIRST CASE = 1.000 1.000 8.000

CASES READ = 72

FOR VARIABLE 3

MEAN (72)= 6.292

FACTOR = 1

TRT	N	MEANS
1	18	7.500
2	18	2.778
3	18	8.111
4	18	6.778

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	166.6	9.801		
1	3	312.4	104.1	76.00	.0000
RESIDUAL	51	69.87	1.370		

FACTOR = 1

IDENT MEANS

2	2.778	A
4	6.778	B
1	7.500	CB
3	8.111	C

TYPE MADM
 ***** MEADOW LARK MATCHING *****

FIRST CASE = 1.000 1.000 7.000

CASES READ = 68

FOR VARIABLE 3
 MEAN (68) = 6.618

FACTOR = 1
 TRT N MEANS
 1 17 8.118
 2 17 3.235
 3 17 7.941
 4 17 7.176

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	16	83.06	5.191		
1	3	267.8	89.27	115.3	.0000
RESIDUAL	48	37.18	.7745		

FACTOR = 1

IDENT	MEANS	
2	3.235	A
4	7.176	B
3	7.941	C
1	8.118	C

TYPE SACM
 ***** SACAJAWEA MATCHING *****

FIRST CASE = 1.000 1.000 7.000

CASES READ = 72

FOR VARIABLE 3

MEAN (72)= 6.486

FACTOR = 1

TRT	N	MEANS
1	18	7.444
2	18	3.222
3	18	8.056
4	18	7.222

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	42.74	2.514		
1	3	262.4	87.46	109.1	.0000
RESIDUAL	51	40.87	.8015		

FACTOR = 1

IDENT	MEANS	
2	3.222	A
4	7.222	B
1	7.444	B
3	8.056	C

TYPE WHITM
 ***** WHITTIER MATCHING *****

FIRST CASE = 1.000 1.000 8.000

CASES READ = 64

FOR VARIABLE 3
 MEAN (64) = 6.531

FACTOR = 1
 TRT N MEANS
 1 16 7.750
 2 16 3.437
 3 16 7.687
 4 16 7.250

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	15	95.44	6.362		
1	3	206.6	68.85	45.61	.0000
RESIDUAL	45	67.94	1.510		

FACTOR = 1

IDENT	MEANS	
2	3.437	A
4	7.250	B
3	7.687	B
1	7.750	B

TYPE MATCOM
 ***** MATCHING COMBINED SCORES OF FOUR SCHOOLS *****

FIRST CASE = 1.000 1.000 7.000

CASES READ = 276

FOR VARIABLE 3
 MEAN (276) = 6.478

FACTOR	=	1
TRT	N	MEANS
1	69	7.696
2	69	3.159
3	69	7.957
4	69	7.101

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	68	391.9	5.763		
1	3	1040.	346.6	314.1	.0000
RESIDUAL	204	225.1	1.104		

FACTOR = 1

IDENT	MEANS	
2	3.159	A
4	7.101	B
1	7.696	C
3	7.957	C

B>

TYPE LEWR
 ***** LEWIS & CLARK READING *****

FIRST CASE = 1.000 5.000 6.000

CASES READ = 90

FOR VARIABLE 3

MEAN (90)= 5.444

FACTOR = 1

TRT	N	MEANS
5	18	6.000
1	18	6.667
2	18	1.778
3	18	6.444
4	18	6.333

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	243.0	14.30		
1	4	306.7	76.67	86.12	.0000
RESIDUAL	68	60.53	.8902		

FACTOR = 1

IDENT	MEANS	
2	1.778	A
5	6.000	B
4	6.333	CB
3	6.444	CB
1	6.667	C

TYPE MEADR

***** MEADOW LARK READING *****

FIRST CASE = 1.000 5.000 4.000

CASES READ = 85

FOR VARIABLE 3

MEAN (85)= 4.235

FACTOR = 1

TRT N MEANS

5 17 4.471

1 17 5.353

2 17 1.176

3 17 4.882

4 17 5.294

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	16	202.9	12.68		
1	4	207.4	51.85	35.69	.0000
RESIDUAL	64	92.99	1.453		

FACTOR = 1

IDENT MEANS

2 1.176 A

5 4.471 B

3 4.882 CB

4 5.294 CB

1 5.353 C

FIRST CASE = 1.000 5.000 8.000

TYPE SACR

***** SACAJAWEA READING *****

FIRST CASE = 1.000 5.000 4.000

CASES READ = 90

FOR VARIABLE 3

MEAN (90)= 3.933

FACTOR = 1

TRT	N	MEANS
5	18	4.444
1	18	4.611
2	18	.9444
3	18	4.944
4	18	4.722

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	17	209.6	12.33		
1	4	203.4	50.84	36.54	.0000
RESIDUAL	68	94.62	1.391		

FACTOR = 1

IDENT	MEANS	
2	.9444	A
5	4.444	B
1	4.611	B
4	4.722	B
3	4.944	B

TYPE WHITR
 ***** WHITTIER READING *****

FIRST CASE = 1.000 5.000 8.000

CASES READ = 80

FOR VARIABLE 3
 MEAN (80) = 4.575

FACTOR	=	1
TRT	N	MEANS
5	16	5.437
1	16	5.187
2	16	1.937
3	16	5.125
4	16	5.187

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	15	376.0	25.06		
1	4	140.0	35.01	19.53	.0000
RESIDUAL	60	107.6	1.793		

FACTOR = 1

IDENT	MEANS	
2	1.937	A
3	5.125	B
1	5.187	B
4	5.187	B
5	5.437	B

TYPE READCOM
 ***** READING COMBINED SCORES OF FOUR SCHOOLS ***

FIRST CASE = 1.000 5.000 4.000

CASES READ = 345

FOR VARIABLE 3
 MEAN (345)= 4.551

FACTOR = 1
 TRT N MEANS
 5 69 5.087
 1 69 5.464
 2 69 1.449
 3 69 5.362
 4 69 5.391

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
BLOCKS	68	1146.	16.86		
1	4	835.3	208.8	150.3	.0000
RESIDUAL	272	377.9	1.389		

FACTOR = 1

IDENT	MEANS	
2	1.449	A
5	5.087	B
3	5.362	B
4	5.391	B
1	5.464	B

FIRST CASE = 1.000 1.000 4.000

CASES READ = 552

FOR VARIABLE 3
MEAN (552)= 5.447

FACTOR	=	1
TRT	N	MEANS
1	276	4.417
2	276	6.478

FACTOR = 1

FACTOR	=	2
TRT	N	MEANS
1	138	6.580
2	138	2.304
3	138	6.659
4	138	6.246

IDENT	MEANS	
1	4.417	A
2	6.478	B

FOR TREATMENT COMBINATIONS:

TRT	N	MEANS
1 1	69	5.464
2 1	69	7.696
1 2	69	1.449
2 2	69	3.159
1 3	69	5.362
2 3	69	7.957
1 4	69	5.391
2 4	69	7.101

FACTOR = 2

IDENT	MEANS	
2	2.304	A
4	6.246	B
1	6.580	B
3	6.659	B

ANALYSIS OF VARIANCE:

SOURCE	DF	S.S.	M.S.	F-VALUE	P-VALUE
1	1	586.5	586.5	173.6	.0000
2	3	1831.	610.3	180.7	.0000
12	3	19.31	6.437	1.905	.1260
RESIDUAL	544	1838.	3.378		

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PROGRAM DESIRED (OR HELP, NEWS, STOP*) = CSQ1

TESTS FIT OF SAMPLE DATA TO HYPOTHESIZED MULTINOMIAL.

NUMBER OF CLASSES(K=2* TO 20)= 3

DEGREES OF FREEDOM (K-1*) =

INPUT HYPOTHESIZED PROPORTIONS & SAMPLE COUNTS:

H0 PROP: .333 .333 .333

COUNTS : 43 42 41

CHISQ(2)= .5384E-01
 P-VALUE = .9740

RESTART WITH SAME CONTROL (YES OR NO*) = YES

H0 PROP: .333 .333 .333

COUNTS : 41 43 33

CHISQ(2)= 1.471
 P-VALUE = .4838

TESTS FIT OF SAMPLE DATA TO HYPOTHESIZED MULTINOMIAL.

NUMBER OF CLASSES(K=2* TO 20)= 4

DEGREES OF FREEDOM (K-1*) =

INPUT HYPOTHESIZED PROPORTIONS & SAMPLE COUNTS:

H0 PROP: .25 .25 .25 .25

COUNTS : 43 14 42 41

CHISQ(3)= 16.86
 P-VALUE = .1094E-02

RESTART WITH SAME CONTROL (YES OR NO*) = YES

H0 PROP: .25 .25 .25 .25

COUNTS : 41 8 43 33

CHISQ(3)= 24.86
 P-VALUE = 0.000

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