THE EFFECT OF VARIOUS WRITING TOOLS ON
THE HANDWRITING LEGIBILITY OF FIRST GRADE
CHILDREN

By

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A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF EDUCATION

UNIVERSITY OF FLORIDA
1981
It gives me great pleasure and a deep sense of satisfaction to dedicate this volume to my loving and wonderful mother, Mrs. Aubra Jane Haynie. Throughout my life, she has given so freely of her time and energy, faith and emotional support in all my endeavors. This study makes her dream a reality.

I wish to express sincere gratitude to my husband, Art, and my three children, Arthur, Cynthia and David, for all the patience and tolerance they have shown with household chaos and turmoil during my many months of study.
ACKNOWLEDGEMENTS

I would like to thank my supervisory committee: Dr. Linda L. Lamme for her patient guidance in the development of this study, her wisdom as a teacher and for her true friendship; Dr. William Hedges for his kindness and support in the data analysis and for his faith in me as a student; Dr. Dorene Ross for her help in conceptualizing and critiquing the study; Dr. Evelyn Wenzel who has consistently conveyed a feeling of genuine enthusiasm in the development of the study; Dr. Cecil Mercer who has given time and support for the study.

This research would not have been possible without the professional support of the first grade teachers who so patiently and conscientiously made daily use of the writing tools in their classrooms for a full semester.

My aide, Mrs. Marilyn Shaw, helped me keep my sanity and sense of humor by contributing above and beyond the call of duty in maintaining continuity in my S.L.D. class while I was mentally preoccupied with research.

I would like to acknowledge the contributions of Zaner-Bloser Publishing Company and Hoyle Industries. Zaner-Bloser furnished the primary mechanical pencils, rating scales and standardized sentences; their research funds through the University of Florida paid for raters and felt-tip pens. Hoyle Industries supplied the triangular grips.
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ABSTRACT OF DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF EDUCATION

THE EFFECT OF VARIOUS WRITING TOOLS ON THE HANDWRITING LEGIBILITY OF FIRST GRADE CHILDREN

By

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June, 1981

Chairperson: Dr. Linda L. Lamme
Major Department: Curriculum and Instruction

This study investigated the effects of various writing tools on handwriting legibility of first grade children. Writing tools used were: large primary pencils, standard #2 pencils, standard #2 pencils with triangular pencil grips attached, Zaner-Bloser small primary pencils, and Bic fine line felt-tip pens. This study examined these questions: 1) Does the writing tool effect the legibility of manuscript of beginning writers? 2) Which writing tools contribute to greater legibility in beginning writers? 3) Is sex a factor in the legibility of a particular tool? 4) Is handedness a factor in the legibility of a particular tool?

Two groups were used. The sample (N=525) to determine effect of sex and tool was from a population of 35 first grade classes in Lake County, Florida. These classes were randomly selected from 42 teachers who volunteered from a population of 60. Another subsample (N=150) was made up of all left-handers (N=75) from the 35 classrooms.
plus an equal number of right-handers in each treatment group for analysis of handedness, sex and tool.

The 5 writing tools were randomly distributed to intact classes with 7 classes using each tool. From the beginning of school until the week before Christmas vacation, all students used a designated writing tool for all writing assignments. Teachers had the option of using the tool throughout the day. At the end of the study, all children copied a standardized sentence, "The quick red fox jumped over the lazy brown dog." Teachers completed a questionnaire concerning individual teaching methods and attitudes about the assigned tool.

Four raters were trained in using 1 Evaluation Scale - Manuscript by Zaner-Bloser until they reached 90% agreement. Each paper was scored by two raters on these items: letter formation, vertical strokes, spacing, alignment and proportion and line quality. Each item was scored as "satisfactory" or "needs to improve" to yield individual scores between 0-5. Raters were retrained during the rating process when reliability began dropping below .90. Raters had .86 agreement and .92 reliability at the end of the study.

The design of the study is based on the posttest only and used 5 treatment groups representing the 5 writing tools. With each treatment group, students were further grouped according to sex and handedness. All groups received the same posttest. To determine significance among and between groups, the data were analyzed two ways. To determine significance of sex and tool, a 5 x 2 analysis of variance was used. A 5 x 2 x 2 analysis of variance was used with the subsample of all left-handers and randomly selected right-handers for an analysis of handedness, sex and tool.
Data analysis reported four major findings. No statistically significant differences (p < .05) were found among tools. No statistically significant differences (p < .05) were found between sexes. No statistically significant differences (p < .05) were found between right- and left-handers. Statistically significant results (p ≤ .0001) were found among individual classes within each group of tools.

Findings of this study suggest that tools, sex and handedness have no significant effect on handwriting legibility of first grade children. There are other factors in the teaching-learning process which do have a significant impact on legibility and make a significant difference between classes. Findings imply that no one writing tool seems to be superior at the first grade level. Therefore, teachers need not restrict beginning writers to the use of primary pencils, but rather allow children to select preferred tools and use professional judgment to match tools to children for specific purposes. Further research is needed to explore the great variation among teachers within tool groups.
CHAPTER I
INTRODUCTION

Rationale

In recent years there has been increased interest in the writing act but little research has been done to determine how the writing tools affects legibility. Research provides no evidence which supports the use of the beginner's pencil as an initial writing tool for children (Krzesni, 1971). Other handwriting tools such as regular pencils, ballpoint pens and felt-tip pens have proven to be at least as satisfactory as primary pencils and, in some cases, superior to the primary pencil (Krzesni, 1971; Smith, 1977; Tawney, 1967; Wiles, 1943).

The traditional tool used in the primary grades is the large primary pencil. Educators have justified the use of this tool by citing young children's lack of fine muscle coordination but this practice seems based on tradition and subjective evaluation.

Because handwriting tools are used daily by so many young children and because a variety of tools are available from which teachers and administrators can select, it is important to have objective evidence concerning the merits of available writing tools. Assuming that the writing tool can enhance the writing product, it would be appropriate to determine an optimum writing tool (Anderson, 1965; Askov, Otto and Askov, 1970; Horn, 1967).
Statement of the Problem

Does the use of a particular writing tool affect the handwriting legibility of beginning writers? This study addresses this question by examining legibility of manuscript writing done by first grade children at the end of the first semester after they have been using specific writing tools for daily assignments. Five different writing tools were randomly assigned by classrooms to 35 classes so that seven classes were assigned each tool. The writing tools were: large primary pencils, standard #2 pencils, standard #2 pencils with triangular grips attached, Zaner-Bloser small primary pencils and Bic fine line felt tip pens. The following questions were examined:

1. Did the writing tool affect the handwriting legibility of beginning writers and if so, which?
2. Was sex a factor in the legibility of a particular tool?
3. Was handedness a factor in the legibility of a particular tool?

Definition of Terms

Legibility refers to the "readability" or quality of handwriting. It incorporates: (1) letter formation, (2) spacing, (3) alignment and proportion, (4) slant and (5) quality of line. In this study, legibility is measured by a handwriting scale, Evaluation Scale—Manuscript by Zaner-Bloser.

Handwriting Scale refers to samples of writing at various quality levels used to rate the legibility of handwriting. This study uses standardized scales developed by Zaner-Bloser.

Primary pencil is a writing tool which has a diameter larger than the standard pencil and has a writing point of thick, soft graphite.

Zaner-Bloser small primary pencil is a mechanical pencil which has the diameter of the standard pencil, the thick, soft writing point of
the large primary pencil and a shaped area for proper finger placement. The pencil contains replaceable lead which is ejected by turning the pencil tip.

Felt-tip pen is a porous tipped writing tool which dispenses ink and has the diameter of a regular pencil. This study uses the blue felt-tip pen produced by Bic Pen Company.

Trained raters are individuals who have received 4 hours of training in the use of the Zaner-Bloser manuscript handwriting scales and can compare legibility of handwriting samples (with interrater agreement of .86 and interrater reliability of .92) as measured by 1 Evaluation Scale—Manuscript.

The #2 pencil is a standard pencil traditionally used by most adults. Triangular grip refers to a plastic triangle adaptor with three cushiony outer edges and a hole which accommodates the pencil. The triangular grip used in this study is produced by Hoyle Industries.

Pilot Work

A four-week pilot study using felt-tip pens in one first grade classroom was conducted in the spring of 1980. This was done to answer several questions:

1. Will the ink in felt-tip pens last long enough in daily use to be a financially feasible writing tool?
2. Will children leave tops off, allowing pens to dry out unnecessarily?
3. Will children use the felt-tip pen as a toy, marking on themselves and other objects?
4. Will the ink wash out of clothing?

The classroom teacher who participated in the pilot study stated there were a few problems. For example, the children tended to play with and
chew on the caps for the first few days. The teacher found it necessary to spend extra time reinforcing the habit of placing the cap on the end of the pen when writing and re-covering the writing end when children finished using the pen. One child temporarily lost the privilege of using the pen when he began drawing on himself. The ink "bled through" to the back of the writing paper so that only one side of the paper could be used. Other anticipated problems did not arise. The investigator experimented with ink stains and determined that the ink stains did wash out of most fabrics. The pens were used daily and the entire set was still useable at the end of four weeks. After completion of the pilot study, the classroom teacher was enthusiastic about the use of the felt tip pen as a writing tool.

**Organization of the Study**

First grade teachers in Lake County Public Schools were invited to participate in the present study. Thirty-five classes were randomly selected from the forty-two teachers who volunteered from a population of sixty. The following writing tools were randomly assigned to the classrooms: large primary pencils, standard #2 pencils, standard #2 pencils with triangular pencil grips attached, Zaner-Bloser small primary pencils and Bic fine line felt-tip pens. Each tool was used exclusively for all handwriting lessons within seven classes.

Except for different writing tools used, this study involved no change in teaching methods, texts or materials. Students were identified by sex and handedness. All students within each class used the class's randomly assigned writing tool for all writing lessons during the first semester of the 1980-81 school year.

Handwriting samples were obtained for comparative analysis of legibility. One week prior to Christmas vacation, each child copied a sample
sentence in manuscript, using the assigned writing tool. Each student was given a model of the sentence from which to copy. The teacher read the sentence to the class and urged students not to hurry but to do their best writing. (Specific teacher instructions can be found in Appendix C.) The sentence which students copied was: "The quick red fox jumped over the lazy brown dog." From the total group of 798 samples, 525 samples were randomly selected for legibility analysis; 105 samples were from each of the groups and 15 from each classroom within each group. All samples done by left-handed children were also analyzed.

Four trained raters evaluated handwriting legibility using the Zaner-Bloser Evaluation Scale - Manuscript. Two raters rated each sample and a mean score was obtained.

To determine the impact of handwriting tool upon legibility, the data were analyzed two ways. A 5 x 2 analysis of variance was used to determine whether there were any significant sex differences in handwriting legibility for any tool. A 5 x 2 x 2 analysis of variance was used with another subsample of all left-handers and an equal number of randomly selected right-handers in each treatment group for analysis of handedness, sex and tool.

**Limitations of the Study**

No attempt was made to standardize or control teacher methods for teaching handwriting and no standard writing text was required. Therefore, a variety of teaching methods was used among classes with a varying amount of emphasis placed on writing skills. To clarify and explain individual teacher differences, each teacher was asked to fill out a questionnaire (Appendix C) asking the amount of time and purposes for which the children used the assigned tool. The use of 7 classrooms in each group and random assignment of classes partially controlled for the effect of individual differences among teachers.
Children's previous writing experience and readiness activities affect legibility. This study has not identified those students who were enrolled in kindergarten in order to compare them with those without kindergarten experience. Public school kindergartens are available in Lake County and a majority of the children attend. Children are not systematically assigned to classes. Classes are heterogeneous and presumably the number of children with preschool experience were evenly distributed among the groups. The half-year duration of the study likewise limited the impact of prior experience.

The use of handwriting scales to evaluate handwriting legibility has limited reliability (Anderson, 1965; Askov, Otto and Askov, 1971; Feldt, 1962). Helwig et al. (1976) reported a more reliable procedure to measure manuscript formation but their study measures approximately four letters per minute, an approach which would not be practical for measuring a large number of writing samples. To achieve maximum reliability in this study, three procedures were adopted. Raters were trained using samples similar to those they would be judging until their inter-rater reliability was consistently 90% before they began rating. During rating sessions, they scored papers independently. The investigator spot-checked scores on every ten papers and when reliability began to fall below .90, took time out for retraining on other papers.

The handwriting scale used a rating of 0-5 for levels of legibility, scoring "satisfactory" or "unsatisfactory" on five elements. Because the upper level of the scale was designed to measure the superior quality of handwriting and because the subjects in the study had been receiving formal handwriting instruction for less than four months, few students were able to write legibly enough to obtain a "satisfactory" rating in all areas. This resulted in a smaller range of variance between samples.
If the raters had been less stringent in their rating or if the scale had provided a wider range of measurement, findings might have shown significant differences among tools. However, it must be noted the variance was great enough to show highly significant differences among classes within each tool group.

The Hawthorne effect may have some influence on the final writing product. If students were aware that they were participating in a study and using a handwriting tool other than they would normally use, this could affect the quality of writing. To minimize the Hawthorne effect, handwriting tools were randomly assigned at the beginning of the school year and all students within a particular classroom used the same writing tool for all formal handwriting lessons for the entire semester. The prolonged use of a particular writing tool should minimize the effect of being novel. The Hawthorne effect appears to have had no influence because no significant differences were found among groups.

Because tools were randomly assigned and a large population was used, the results of this study can be generalized to other populations if the first graders from the randomly selected classrooms in this Florida county are typical of other first graders to whom results were generalized.

Organization of the Dissertation

Chapter II puts the present concern with legibility in historical perspective and examines legibility as it is affected by a variety of factors, including writing tools. Chapter III describes the present study and the procedures used to determine the affect of writing tools on handwriting legibility of first grade children. Chapter IV analyzes the results and Chapter V draws tentative conclusions based on the findings.
CHAPTER II
REVIEW OF LITERATURE

An Overview

Because literature about handwriting has many facets, the present review has included only materials which, in someway, deal with legibility and/or writing tools. Historical literature has been included to provide perspective to the present interest in legibility. The validity of teaching handwriting has been explored to justify examining legibility. Other factors which have been studied to determine their impact on legibility include writing tools, writing paper, the role of readiness, methods of teaching and evaluation, posture and hand movement, handedness, sex and intelligence. Therefore, all these elements have been included in the review of literature.

Historical Review

Literature dealing with the historical development of handwriting can be divided into several categories. These include: early man's efforts to provide a visual record, the kinds of writing tools developed through the ages, interest in legibility and methods of instruction.

Through the ages, man has been concerned with recording his ideas in permanent form. All forms of graphic inscription come from the human need to communicate and express ideas. Although transition time from pictography to writing is not precisely known, true writing has been traced back to the fourth millennium B.C. with alphabetic writing developing during the second millennium B.C. Until Gutenberg's invention of the
printing press, handwriting was the principal means by which ideas were transmitted and preserved (Otto, 1969:211).

Ideas were written on all kinds of objects and materials and a variety of instruments were used. Fairbank (1970) described how the Mesopotamians used the triangular reed for the cuneiform. Egypt, Rome, and classical Greece used the reed for recording on papyrus. A stylus formed from ivory bone or metal was used to scratch the surface of waxed tablets. Bronze pen nibs were made by the Romans and a few examples are preserved in museums today.

Modern man has developed a variety of writing instruments. The quill pen was used for centuries as the usual writing tool of scholars. The steel pen evolved in the 1700's and the split cylinder pen as well as the metal dip pen were developed early in the 19th century. Bramah invented a machine for making pen nibs from cut-up quills; pen nibs were later made from tortoise shell with diamond, ruby and gold points. Perry is credited with making the first steel slit-pen with a hole at the base of the slit. These were manufactured by machine around 1822 (Fairbank, 1970).

Efforts to design a successful fountain pen which contains a reservoir of ink were made as early as the 1600's. A complicated reservoir pen was made in 1809 by Polsh. The forerunner of the modern fountain pen was a quill reservoir pen patented in 1819 by James Henry Lewis (Fairbank, 1970). Successor to the fountain pen is the ball-point pen which is the most popular instrument used by adults today. The ball-point pen, introduced in 1896, was perfected in the late 1940's. The felt tip pen has only recently been perfected as a satisfactory writing instrument. Virtually no research has been conducted to determine its usefulness as a writing instrument for initial instruction. (Axtell, 1964).
Webster (1964) states that Ancient Egyptians and Romans used pencils which were made of lead. The "lead" pencils now in use contain graphite, not lead, because it is softer and makes a darker line than lead.

Scholars have long been concerned about legibility or "readability" of writing. The Italian Renaissance in the fourteenth century led to important changes in the fifteenth century. Classical Latin literature was copied by humanists. Petrarch and Salutati were critical of Gothic writing and adopted a clearer style of writing (Fairbank, 1970). More than forty years ago Luella Cole wrote:

Everywhere I have gone I have found handwriting the worst taught, the most neglected and least understood subject in the elementary school. (Cole, 1938, p. 606)

Freeman (1954) maintained that the quality of handwriting in schools is inferior to that of a generation ago. Another study takes a different view. Erlebacher and Herrick (1960) compared handwriting of 677 sixth graders with the Ayres Scale which was published in 1912 and concluded there was little or no difference in media legibility with the original samples used for standardizing the scale.

Handwriting instruction in the school traditionally consisted exclusively of adult cursive script, the only kind of handwriting used. In 1913 Edward Johnston suggested using a simplified Roman alphabet for beginning handwriting instruction. This method spread to America in the early 1920's and became the predominant method used in the primary grades, with a later shift to cursive (Deighton, 1971). An alternative approach, the use of late Roman cursive, has been advocated by a group in English schools (Briem, 1979). A controversy has existed concerning the appropriate style to use with beginning writers. Some (Briem, 1979) recommend italic, adding to the major controversy of whether to begin with manuscript and shift to
shift to cursive at a later date, begin with cursive or use manuscript exclusively throughout the child's years. Conflicting findings have been reported but research suggests that in most cases legibility is not affected no matter which style is taught (Bolen, 1965; Goetch, 1935). Regardless of theoretical debates, manuscript is nearly universal in the United States for initial handwriting instruction.

Validity of Teaching Handwriting

Some educators question placing an emphasis on handwriting. They believe that diverting instructional time from fundamental thoughts and expression and investing it in mechanical matters of handwriting is not justified.

With current availability of typewriter, dictation machines and telephone devices, questions have been raised concerning need of continuing handwriting practices. (Powell, 1976, p. 81)

Technology has speeded an expanded communication but this has brought on an equal expansion for the need of handwriting. Even in giant enterprises there are situations in which sophisticated machines cannot replace the convenience of handwritten messages (Deighton, 1971). An estimated million letters a year end up in the dead letter office of the United States Post Office because of illegibilities. Millions of dollars a week are lost by businessmen through errors due to illegible writing, causing scrambled orders, lost time, missent deliveries and clerical mistakes (Burns, 1968).

Therefore, until such time as machines which print from the human voice are so universal that every individual has one, there is a practical need to help individuals become skilled, legible handwriters. More information is needed on how best to help youngsters learn the art of handwriting.
Factors Affecting Legibility

Writing Tools

The role of writing tool has not been considered an important one in educational research. There is little educational and psychological knowledge available to serve as a basis for designing an effective tool for children to use when they begin to learn to write. Most of the design knowledge is related to promotion and sales, not to the instrument as an educational tool (Herrick, 1961). Investigations which have been done can be separated into surveys of kinds of tools used and experimental studies of the effectiveness of these tools.

The Wisconsin Survey (Arnold, 1951) found writing tools used in handwriting programs within schools ranked in the following order: adult pencil, beginner's pencil (large), fountain pen, chalk, crayon, ball-point pen, pen holder and nib, the mechanical pencil. The survey compared the use of tools both in and out of the writing class, reported the adult type pencil is the most frequently used tool in both cases. There was a greater use of the fountain pen and ball-point pen outside writing classes and the mechanical pencil and pen holder with steel nib were the least used both in and out of writing classes. To update these findings, Herrick (1963) reported that the pen holder and nib had ceased to be used except in rare cases, being replaced by the fountain pen and ball-point pen.

Fountain Pens

Early studies examined the effectiveness of various pens. Wittaker (1934) compared the relative effectiveness of steel pens and fountain pens for legibility and speed in a fourth grade class. Over a forty-week period, she found fountain pens produced better writing quality and were
preferred as a writing tool by the students. Otto's (1948) study confirmed Wittaker's findings. Herrick (1954) reported fountain pens were the preferred writing tool for handwriting lessons in grades 5 through 8 but the ball-point pen was generally the most popular writing pen.

**Ball-Point Pens and Felt-Tip Pens**

Research on the effectiveness of ball-point and felt-tip pens is sparse. Only two studies have examined their use with primary children.

Tawney's (1967) study of 66 first graders examined the year-long writing progress of students using the ball-point pen compared with primary pencil as a beginning writing tool. She reported the performance was significantly better for the pen group than the pencil group. Subjects for this study were obtained from four classrooms, were grouped chronologically in younger and older groups with each age group using each tool. Pairs of students were matched by sex and beginning handwriting scores. To measure handwriting achievement, writing tests were administered five times during the year. The instrument, *The Guiding Growth in Handwriting Scale for Grade One, Manuscript Writing* by Frank N. Freeman of the Zaner-Bloser staff, was used to compare first and last scores. Three judges used the instrument to assign a score for each sample. Judges received training prior to ranking writing papers. Judges then independently scored each paper to obtain a criterion score which was the mean of the three judges' scores. Interrater reliability was not checked during the scoring of the samples. The writer of the study also served as a judge, leaving the possibility of bias in the scoring procedure. The ball-point pen used in the study had a special gripping surface and a larger than average ball-point. It is questionable whether results with the use of the specially constructed pen could be generalized to the traditional, frequently used style of ball-point
pen. The small number of subjects used in the study limits the extent to which findings might be generalized to other populations. The Hawthorne effect on students, teachers and judges cannot be ignored.

Krzesni (1971) did a one-day study with 120 third grade children. Using spelling and story-writing tasks to determine the effect of pencils, ball-point pens and felt-tip pens as well as two types of paper, he found the performance of third graders increased up to 33% when they used ball-point or felt-tip pens. When asked to state their preference, students overwhelmingly preferred the felt-tip pens to both ball-point and pencils. In evaluating this study, several weaknesses can be observed. The Hawthorne effect must be considered because the writing paper and writing tools were randomly assigned within each individual classroom, causing some students to receive a novel or different writing tool and/or writing paper than that to which they were accustomed. To determine performance in the object-story writing exercise, the dependent variable was the number of letters the subjects wrote. The 33% increase in performance with ball-point and felt-tip pen indicated these students wrote more words but not necessarily with increased legibility. The study reported no significant difference in performance, or correctly spelled words, among the groups for the spelling task.

Findings from these two studies indicate the ball-point pen and felt-tip pen may be viable writing tools for the beginning writer. Since felt-tip pens are rapidly replacing ball-point pen in society, their use needs additional study.

**Pencils**

Pencil size has been of interest to educators for many years. Most teachers now use a pencil of medium size with a large lead, usually described as "primary pencil" or "beginner's pencil" at the kindergarten
through second grade, changing to adult size pencil in third grade (Dreighton, 1971). But research supplies no evidence to support the use of the beginner's pencil instead of the adult pencil (Herrick, 1945).

Wiles' (1943) year-long study of 833 first graders showed no evidence to support using a beginner's pencil instead of the adult sized pencil as a beginning writing tool. This important work used a large number of subjects and controlled for several factors: tools, groups of students using the tools, experience of teachers, subject matter and methods of teaching handwriting. The study examined the effectiveness of three pencil sizes (7.4, 8.6 and 9.8 mm diameter) and three widths in spacing for writing papers. Achievement tests were administered in December, March and May. Handwriting was checked for form, fluency, alignment, spacing of letters and size in relation to space and slant, hand pressure. These qualities were compared with a specially constructed rating scale. To balance groups before weighing test results, scores obtained in September were used. Samples were eliminated from pupils whose chronological ages, mental ages and test scores on handwriting readiness caused imbalance among group means and standard deviation. Also eliminated were samples from children who were repeating grade 1, left-handed pupils or those with temporarily disabled right hands, pupils with uncorrected eye defects, and pupils who had received prior instruction in private kindergarten. The long-range scope of the study, careful control of variables and large number of subjects all add to the validity of Wiles' findings that handwriting tools had little effect on handwriting achievement. The present study adds support to these findings.

Herrick (1954) supported Wiles' findings. He conducted a study to discover the characteristics of preferred print tools such as shape, thickness, weight, center of gravity, point of grip, angles of inclination
and rotation by both children and adults. His study showed both children and adults prefer a round pencil which is less than half an inch in diameter with the weight of gravity between 2 and 3 inches from the tip.

Smith (1977) compared handwriting legibility at the kindergarten level with primary pencil, adult size pencil and small primary pencil with Hoyle's E-Z grip adaptor. Comparing samples of 51 children over a nine week period, she concluded the adult size pencil demonstrated superiority over the other two writing tools. Post test data from her study revealed 100% of the group using adult sized pencil achieved a score of "fairly legible" as compared with 82% of the children in the remaining two groups. The control group, using the primary pencil, indicated the widest range of improvement (55% scored "fairly legible" on the pretest and 82% on the post test). To conduct the experiment, children were randomly assigned to one of the three groups. Two teachers and two aides conducted the study. Teaching tools, materials and teaching methods were held constant with the three groups. Identical pre and post tests consisted of copying seven letters and five numerals. Ratings were obtained by comparing with a specially constructed evaluation scale which provided a six point scale of legibility. Three first grade teachers were used as raters. The investigation did not discuss whether inter-rater reliability was established prior to the actual scoring of individual samples; inter-rater reliability was not checked during the study nor at the end. Because no mention was made of a mean score between raters, it would be assumed that one teacher assigned a value or score for each sample, a reporting method less reliable than using more than one rater. The investigator stated the study was conducted over a nine week period but did not specify what time during the year it took place. If the study were conducted in the spring, after children had become accustomed to the traditional primary pencil, the
Hawthorne effect must be given even greater consideration than if the three tools were studied at the beginning of writing instruction. The small group and short duration of the study limit the effectiveness of its findings. Results from this study support Wiles's (1943) study. Both indicate little justification for providing beginning writers with a handwriting tool other than those used in daily life.

Attachments are available which may be added to the writing tool to alter the position in which the tool is held. Zaner-Bloser produces a writing frame which serves as an aide for the left-handed child to prevent the hooked position of the hand when writing (Barbe, no date, a). The company has stated the frame is also beneficial for the left-handed teacher who is teaching the right-handed child. Hoyle Industries distribute a triangular pencil grip which slips over the pencil to help the child hold the pencil with a proper grip.

The small number of pencil studies which have been conducted offer conflicting evidence. Either pencil size does not make a difference (Wiles, 1943) or adult pencils are more effective in producing legible writing (Smith, 1977). No research is available concerning the use of the writing frame and only one minor study investigated the use of the pencil grip (Smith, 1977).

Ball-point pens and felt-tip pens may be superior to pencils of all sizes (Krzesni, 1971; Tawney, 1967). Little research has been done to measure their comparative effectiveness.

Research on writing tools can be summarized as follows:

(1) The primary pencil and regular size pencils are the most popular tools in primary classrooms.

(2) Young children prefer felt-tip pens when given a choice.
(3) Writing tools rarely affect legibility and if they do, it is to the detriment of the most commonly used tools, primary pencils and standard pencils.

Studies comparing tools are invariably hampered by inadequate design and the Hawthorne effect. No large study has investigated the impact of tools on initial handwriting instruction in the past 38 years. Since tool technology has changed radically in that time, what is needed is a large scale study where pencils are compared with modern writing tools.

Writing Paper

Comparatively little research is available concerning the most appropriate writing paper to be used in primary grades. There are conflicting findings among those who have examined the effect of writing paper on legibility.

Wiles (1943) pioneered the field with a year long study of writing tools in combination with various widths of paper. Using 833 subjects, this work compared handwriting legibility of first graders at three different periods of the school year. He reported the size of the pencil, width of spaces on writing paper and combination of tools had little effect on handwriting achievement. The large number of subjects, careful control of variables and long range investigation add strength to Wiles' findings.

Halpin and Halpin (1976) questioned the use of special paper for beginning handwriting. The following kinds of paper were examined: wide writing spaces (one inch) with open ends, wide writing spaces (one inch) with closed ends, narrow writing spaces (one-half inch) with open ends, narrow writing spaces (one-half inch) with closed ends. Using Quant's criteria for legibility, handwriting samples from 44 white kindergarten children were analyzed. These investigators concluded that neither width
of writing space nor writing spaces with closed ends improve letter placement. They stated the use of special paper for beginning writers is an unnecessary practice. Because the study used a small number of subjects, it is questionable whether findings could be generalized to other populations.

Krzesni (1971) examined the effect of different writing tools and paper on the performance of 120 third graders. He presented spelling and story-writing tasks to students using college ruled paper (11x8½ inches with 3/8 inches between the lines) and plain white typing paper of the same size. He reported there was no significant difference between performance when lined paper instead of unlined paper was used. He did note that when lines were used, the child's writing was neater with respect to horizontal spacing and that children used rulers at times to draw guide lines as a compensation for the unlined paper. Krzesni obtained handwriting samples on lined and unlined paper in a one-day study. The investigation would have been stronger if students had used one type of paper for a prolonged period to determine the long range effect of lined and unlined paper on handwriting legibility.

A recent study by Leung and others (1979) compared the accuracy of handwriting on large-spaced and normal spaced paper. To measure legibility of 143 samples, transparencies developed by Helwig and others (1976) were used. They reported that first grade students produce more accurate letter strokes with large spaced paper (3.4 cm space) than when normal sized paper (1.6 cm space) is used. They also found suburban students produced significantly more accurate manuscript letter strokes than urban students. This study provided justification for continued use of large spaced paper for first graders. Prior to the study, students had been using beginning writing paper with space size which ranged
between 2.3 cm to 2.6 cm. Children had been trained and experienced in writing letters which were smaller than the large copy sample but larger than the small copy sample. This experiment tested young children's ability to enlarge or decrease the size of familiar letter shapes. First grade students may be able to make the transition to an enlarged letter size more easily than they can make the transition to a reduced size. Results might have been different if students had practiced over a period of time with writing paper which had large or smaller spacing as was done in the Wiles (1943) and Halpin and Halpin (1976) studies.

Because wide spaced paper is so commonly used at the first grade level, most writing samples gathered for the present study were on large spaced paper (1 inch). Four teachers preferred the narrower spaced paper normally used by second grade students (3/4 inch). Because most studies indicate width of spacing does not affect legibility and because the present study stipulated that no program alterations other than writing tool would be required of participating teachers, each classroom used the paper preferred by individual teachers. In all cases, handwriting samples for the evaluation were obtained on paper with spacing used in daily writing lessons.

Readiness

The importance of readiness for the act of writing cannot be over-emphasized. Handwriting is being increasingly introduced to children at younger ages. This emphasis on early training in formal writing skills forces a child to write before he/she has perceptual development and motor skills necessary to master the skills (Wright, 1975).

The teacher who builds an environment where children reason and talk is arranging greater opportunities for conceptual development. (Lucas, no date)
Hammill and Bartel (1975) reported that a measurement of writing readiness skills should include an evaluation of visual motor integration, laterality, handedness, tactile skills.

There appear to be six prerequisite skill areas for handwriting: small muscle development, eye-hand coordination, holding a writing tool, basic strokes, letter perception and orientation to printed language. (Lamme, 1979, p. 20)

Lamme's (1979) article discussed a wide variety of appropriate activities to develop these prerequisite skills. She recommended markers and felt-tip pens as beginning writing tools because they require little pressure and obtain bright colors.

Maria Montessori (Orem, 1965) provided three stages or "periods" for the direct preparation for learning to write: (1) exercise to develop the muscular mechanism necessary for holding and using the writing tool, (2) exercises to establish the visual-muscular image of the alphabet letters and establishment of the "muscular memory" of the movements necessary for writing, (3) exercises for the composition of the letters.

The Barbe-Lucas Handwriting Skill-Guide Check List: Readiness is one useful tool in evaluating writing readiness for young children. It measures growth in handwriting readiness concepts, mechanical skills involving modality and writing, functional skills and the creative process of thinking. The Barbe-Lucas Handwriting Skill-Guide Check List: Manuscript-Level One was designed for use at the first grade level, measures growth in basic manuscript concepts, mechanical skills of modality, writing, self-evaluation, functional use of manuscript and the creative use of manuscript.

In summary, there is a consensus of opinion among most early childhood educators that young children should acquire necessary prerequisite skills before being introduced to the formal teaching of handwriting.
Further, some handwriting tools appear to be preferable over others for the acquisition of handwriting readiness.

**Teaching Methods**

The goal of handwriting instruction is to develop a useful tool for a lifetime of acquiring other knowledge and communication, as well as dealing with that knowledge in creative ways. (Lucas, no date, p. 3)

Literature dealing with teaching methods can be grouped into three areas: what to teach, how to teach, evaluation of what has been taught.

Most studies which deal with what kind of writing style should be taught contrast manuscript and cursive. The effectiveness of italic and modified script have more recently been investigated.

Advocates of cursive as a beginning writing style (Cruickshank et al, 1961; Early, 1973; Otto and Rarick, 1969) argue its advantages: each word consists of one continuous line to provide total form of the word rather than fragmentation of its elements; it has rhythm; it prevents directional problems; and it avoids transfer difficulties. Gray's (1979) research in England supports the use of late Roman cursive with ball-point pen.

An opposing view advocating manuscript (Anderson, 1966; Jackson, 1971) stressed that manuscript is easier to learn and more closely resembles the printed form used in reading. There is no need to learn cursive according to this theory.

Dinneen (1979) reported that italic writing is as legible as non-italic at the first and second grade level while Berry (1961) reported improved legibility with the use of italic in grades 1-8. Quant's (1946) important and comprehensive study of legibility factors showed that simplified letter forms are more legible. Joseph and Mullins (1970) recommended a modified script for use with perceptually handicapped children.
The argument has existed for many years, but, in general, it does not seem to matter which style is taught because students who tend to write one style legibly tend to write another style legibly (Foster, 1957).

Otto and Rarick (1969) looked at the relationship between transition time from manuscript to cursive and the reading, spelling and handwriting performance of 4th and 6th graders. These investigators concluded that transition time is less important than the kind of instruction provided. According to this study, early transition time is associated with greater legibility and late transition time is associated with speed in writing.

The decision of transition time in handwriting instruction creates more disagreement than any other aspect of handwriting. To determine which style is taught at what level, a national survey (Barbe, no date, b) of elementary supervisors showed most primary grade teachers start with manuscript and transfer to cursive during 2nd or 3rd grade. Thirty-six percent reported transition occurred at the 2nd grade. Lamme and Ayris (1978) found that only 20% of Florida teachers make the transition at 2nd grade, making 3rd grade the predominant transition time.

Discussing how to teach, Barbe and Lucas (1974) stated handwriting can best be taught by:

1. Teaching letter formation with a thorough multisensory approach because this provides the best opportunity for kinesthetic teaching.

2. Clearly stating specific goals for each lesson for effective planning and evaluation.

3. Using creative writing as a logical extension of handwriting instruction.

4. Individualized instruction. There is a sequence to handwriting but not all students are ready at the same time.
Clay (1975) took an opposing stance concerning programmed sequence in teaching handwriting:

I doubt whether there is a fixed sequence of learning through which all children must pass and this raises further doubts in my mind about the value of any sequenced programs for reading or writing which proceed from an adult's logical analysis of the task and not from an observation of what children are doing and the points at which they . . . are becoming confused. (Clay, p. 7)

Herrick and Okada (1963) reported in a nationwide study that only 7% of schools studied used a planned diagnostic and remedial program of handwriting even though several studies (Fauke and others, 1973; Helwig and others, 1976; Newland, 1932; Rondinello, 1963) indicate this is the most appropriate method of teaching.

A diagnostic remedial program (Boyle, 1963) presented at the 4th, 5th and 6th grades, comparing handwriting achievement of 312 students, concluded the diagnostic remedial program achieves a greater mastery of handwriting skills than does a commercial program and is more effective at eliminating errors in size, slant and letter formation. This investigation indicated that proof reading is not effective in improving quality unless students have instruction in eliminating specific errors.

Horton (1969) supported Boyle's findings, advocating the use of a diagnostic-remedial program of handwriting on an individualized basis as well as a developmental program of group instruction at the intermediate level.

Tagatz and others (1969), examining the effect of three approaches to handwriting instruction with 3rd and 4th graders, also concluded that individualized approaches which emphasize diagnosis and remediation of specific difficulties may best be employed in primary grades.

Newland (1932) isolated the four types of difficulties in letter formation which cause over half of all illegibilities made in handwriting
at any age. Horton (1969) analyzed illegibilities in cursive handwriting of 1,000 6th graders to report that relatively few malformations account for a high number of illegibilities. Both studies concluded that developmental and corrective instruction should be highly specific and involve diagnosis and remediation of problems particular to the child.

The effect of stressing perceptual skills was examined by several studies. Furner (1967) combined handwriting with perceptual development, using Hebb's theories of learning as a basis for her work. A year-long study of 726 first graders (324 experimental and 402 control), using verbalization as a guide in kinesthetic practice for self evaluation was compared with a commercial method. Findings of this study indicated the experimental group had better quality writing with fewer formation errors even though the control group wrote faster. Despite the fact that this study maintains teachers can more effectively teach beginning writers through verbalization of handwriting procedures, it does not explain why students who used a commercial method developed greater speed in handwriting.

Marshall (1978) studied 97 kindergarteners over a 3½ month period, reported that specific instruction in motor movement can improve the quality of manuscript written by kindergarten children when using printscript letters of the alphabet.

Sommer (1967) viewed handwriting as a training in visual discrimination rather than a problem of motor control. She used a programmed instruction with 2nd, 3rd, 4th and 5th graders to enable learners to discriminate forms, points in space, forms on points in space and to impose forms on points in structured and unstructured space. She found the use of programmed writing very effective at 2nd
and 3rd grades but conflicting findings indicate this approach may not be effective at 4th and 5th grades.

The frequently quoted study by Askov and Greff (1976) compared copying vs. tracing as the most effective type of handwriting practice. Kindergartners and 2nd graders used exercises in tracing or copying 10 shorthand forms from memory. Both grades revealed that the copying treatment groups showed higher post test scores. Results of this study supported findings of an earlier study by Hirsch and Niedermeyer (1973) which used a different tracing strategy. Herrick and Okada's (1963) report of national handwriting teaching practices reported that copying is the teacher's preferred teaching method.

Birch and Lefford (1967) found the opposite to be true. Using geometric forms for children, ages 5-11, to copy, they reported tracing was the easiest task, dot-to-dot grids next in complexity and freehand drawing most difficult. Although geometric forms instead of letters were used, this study implied that children can best be taught handwriting by tracing and/or connecting dots. No provision was made to measure performance of various IQ levels despite the fact that Townsend (1951) found the ability to copy geometric forms showed higher correlation with mental age than chronological age. This study measured only the difficulty of the task and did not include future mental recall of the specific shape as did Askov and Greff (1976) and as would be necessary for evaluation of handwriting instruction.

Colvin (1979) compared two methods of teaching beginning manuscript: (1) segmented stroke, (2) primary beginning point with left to right progression in continuous stroke. She used only letters which were constructed differently. She reported fewer errors in the continuous stroke method, fewer errors in merging stroke, beginning and ending
points of stroke, line placement, incorrect size, reversal of slanted strokes. He found that students tend to use the continuous line strokes even when they have been instructed in the use of the segmented method.

Ehik (1976) studied three approaches to teaching manuscript in kindergarten: concept treatment, teacher mediated treatment, Zaner-Bloser handwriting program. She reported no significant difference among the three groups in the ability to differentiate among the letters and no significant differences among the first graders in their actual writing. However, students who participated in the concept treatment showed a more positive attitude and teachers rated this program higher than the other two. The Hawthorne effect may have been a contributing factor in the attitudinal differences in the approaches because teachers were aware of the planned differences in teaching methods.

To summarize the research of handwriting instruction, there is no conclusive evidence to support a specific writing style and no universally appropriate time to make a transition to cursive. Whether or not a sequential program is used, students need: (1) individualized instruction which diagnoses specific problems and (2) a multi-sensory program which develops motor and perceptual skills. Since no studies were found which linked handwriting tools to teaching methods, no control is made in the present study for teaching method other than the random assignment of tools to classes.

Evaluation of Handwriting

With very few exceptions, programs of handwriting in the public schools have been designed to instruct but not to measure the growth of that instruction. Perhaps the fault lies in the scales. (Anderson, 1965, p. 45)

Evaluation in the instructional process is done to improve legibility. Evaluation for research is done to measure the quality of
legibility. The purpose of evaluation for research is to ultimately affect the instructional process.

In handwriting evaluation, specific qualities have been found which affect legibility. Quant (1946) identified five characteristics of handwriting quality: (1) letter formation, (2) spacing, (3) alignment, (4) slant and (5) quality of line. To test these factors of handwriting legibility, he used eye movement of readers to find how each factor affected legibility. Some of his findings included:

1. No one characteristic of handwriting exists separately from others; all are interrelated in the handwriting process.
2. Letter formation is the most important factor.
3. Emphasis on handwriting instruction should be on the use of simplified letter forms.
4. Alignment is not of major importance.
5. Regularity of slant is more important than the amount of slant.
6. The weight of line is not important for legibility.
7. Handwriting has social value only as it provides a more or less permanent record which can be read by someone.

In addition to Quant's five characteristics of legibility, Barbe (Zaner-Bloser, 1979) also included proportion as a quality to be measured.

A study which examined the development of illegibilities from lower grades to adulthood (Newland, 1932) found that errors in writing only four letters, a, e, r and t account for almost half of the illegibilities made by all groups. Only four types of difficulties in letter formation were responsible for more than half of the illegibilities. This research indicated that remedial efforts which are directed at a few errors would result in improvement in legibility.
Educators do not unanimously agree on the most effective method of evaluating handwriting. The evaluation process can be done by another individual or by the writer, himself/herself.

Self evaluation has been found to be an effective tool. Johns (1976), working with 22 first graders, concluded from an analysis of handwriting samples that students are able to measure and record their own letter strokes; when students are trained to recognize correctly formed strokes, they display increased accuracy of letter formation. He reported that both self-recording and public charting of performance improves accuracy in letter formation.

Another study supported Johns' findings. Jones, Trapper and Cooper (1977) studied 22 first graders for one semester. By using overlays, students were trained to self-record letter strokes and improve handwriting legibility. Findings of the study strongly suggest this is a practical procedure for primary age children to obtain objective and immediate feedback for handwriting instructions.

The most frequently used method of evaluation is through the use of scales. Anderson traced the history of the development of handwriting scales (Anderson, 1966). Thorndike published the first scale in 1910, using the criterion for judgment as 'general merit'. Freeman's first scale in 1915 itemized five specific factors for evaluation. When this scale was revised in 1959, the criterion was general excellence and did not evaluate specific factors. The Ayres Scale (1912) is still used with several commercial systems of handwriting today. The West Scale, developed in 1956, incorporated speed with quality-legibility for evaluation. Herrick and Erlebacher (1963) developed a large set of writing samples to provide a master scale in a continuum of writing quality. A comprehensive list of published handwriting scales was discussed in Burns (1968).
Helwig and others (1976) developed a set of transparencies to measure three ranges of deviation of students' samples from model letters. Use of this evaluation tool yielded higher inter-rater agreement even when untrained raters were used. A mean of 7.46 strokes per minute were measured by untrained raters. Despite the reliability of this tool, the time involved in comparing a large set of samples would make its use impractical.

The Zaner-Bloser First Grade Evaluation Scale-Manuscript provides five specimens which are the average of each rank of first grade writing. A score of 0 to 5 is obtained by indicating satisfactory or unsatisfactory in the following areas: letter formation, vertical strokes, spacing, alignment and proportion, and line quality. This scale is a commonly used evaluation tool; it has been the evaluation tool used in other handwriting studies (Furner, 1967; Wright & Wright, 1976), and raters can be trained in its use to obtain an acceptable level of inter-rater agreement. For these reasons, the Zaner-Bloser First Grade Evaluation Scale-Manuscript was selected as an appropriate legibility scale for the present study.

Although educators do not agree on the most appropriate method of evaluating handwriting, there is a commonly recognized need to objectively measure handwriting proficiency in order to more effectively increase legibility. There is also a consensus that a scale is the best method and that two raters are better than one.

Posture and Hand Movement

Literature indicates the most frequently studied dimensions of handwriting movement are: hand movement, velocity, rhythm and pressure phenomenon (Anderson, 1965). Deighton (1971) stressed the importance of body position in daily handwriting practice. He stated that handwriting
requires coordination of eye and hand and muscular control of hand and arm movements. The eyes must continuously be focused near point of production.

Croutch (1969) maintained that basic difficulties in handwriting are frequently centered around posture. He believed that incorrect posture and incorrect paper placement may be contributing factors in poor handwriting for left-handed children. He stated that correct body posture in writing can help prevent eye defects which may occur later in the student.

Kahn (1969) found that improper posture had a negative effect on both reading and writing. His photographic study with an unspecified number of children indicated a relationship between poor pencil grip, poor writing posture and certain visual problem. He recommended using an attached pencil grip because it would serve as a constant reminder of proper grip and would make it almost impossible to hold the pencil incorrectly. He provided an interesting note concerning the placement of fingers on the writing tool. Within the group of children he observed, practically all near-sighted children held their pencil no more than a quarter of an inch from the tip and almost all children with learning difficulties used some form of bizarre grip.

Early work by Frank N. Freeman (1936) led to the development of a handwriting movement that combined finger and arm movement rather than exclusive finger and arm control. C. H. Judd (1911) demonstrated that an appropriate combination of finger and arm control would produce a writing style which could be used for prolonged periods of time with less fatigue. This hand movement has remained the predominant method of writing to the present day (Anderson, 1966).
One study (Marshall, 1978) investigated the relationship between sequential instruction in motor movements and the quality of manuscript done by kindergartners who have no diagnosed learning disability. Six kindergarten classes received 40 sessions of sequential instruction in the kinds of motor movement of arm, hand and fingers which are utilized in writing. The experimental group showed a significant superiority over the control group in writing legibility of manuscript letters.

Some educators have expressed an interest in how a writing tool is gripped. Herrick's (1954) study reported that the point of grip averages 1.22 inches from the writing point. Tawney (1967) found that children do not grip the ball point pen as tightly as the pencil.

Enstrom (1962), studying left-handedness, examined the relative efficiency of various approaches to writing with the left hand. Using a camera and a sketch pad in order to determine likenesses and differences among the various techniques of gripping the writing tool, he found 15 classifiable variations. He divided these variations into two groups: writing hand below writing line adjustments and the "hooked" position with the writing hand covering writing. Samples from 1,103 subjects were judged on quality, speed, neatness and "healthful body position." The hand position for the left-handed writer which he rated as superior is not the one commonly taught as an adjustment for left-handed students. The drawings which accompany this study should be helpful to teachers who provide handwriting instruction for left-handed children.

The chief understanding in solving the vision and leverage problems for teachers is that from the very beginning, regardless of method or style of writing taught, (a) the fingers must be back on the pencil, (b) the pupil should be placed in a desk that is below normal in height, and (c) the paper must be turned clockwise extra far to further aid both vision and arm leverage. For the lefty, this is the "little turn that makes the big difference!" (Enstrom, 1966, p. 868)
Herrick and Otto (1960) used electronic instrumentation, a grip transducer pen, to study barrel pressure without unduly disturbing the handwriting act. The study used subjects in grades 4, 6 and college and examined the patterns of pressure or force between fingers used in gripping the writing tool. The investigation found that force variation was more closely related to legibility and speed in writing than was absolute pressure point. High point pressure tended to be accompanied by high grip pressure and low point pressure tended to be accompanied by low grip pressure. Findings tended to support the notion that the dominant pressure finger may also be the "steering" finger during the act of writing.

Callewaert (1947), a Belgian physician, advocated an alternative method of gripping the writing tool. He maintained that writer's cramp is a faulty motor habit which occurs in the hyperkinetic and emotional individual; it can be overcome through treatment and re-education and can be partially prevented by using a position and method which emphasizes a free and relaxed movement. Although most of his studies were clinical rather than experimental, he contended the "round" method of handwriting is physiologically superior to the most frequently used grip because there is less cramping. To use this grip, the palm of the hand faces down as one places the barrel of the tool on the web between the index and middle finger, bends the hand slightly backward in a canted position, and gently grasps the barrel of the tool with the distal end of the thumb, index finger and the lateral part of the middle finger.

Otto and others (1966) examined the use of the "round" method; their results yielded no support for Callewaert's theory. The researchers stated that even though the subjects had no previous experience
with the use of the modified grip, both speed and legibility were at acceptable levels and the transfer to this modified group would not be a difficult one and it could be readily adopted.

An entirely different view of variations in writing posture was offered in a study by Levy and Reid (1976). Seventy-three subjects were classified by handedness, sex and hand orientation in writing. Using two tachistoscopic tests of lateralization, they indicated that the direction of cerebral lateralization could be determined by the subject's handedness and hand position when writing. Subjects who used a normal writing position had the linguistically specialized hemisphere of the brain which was opposite to the dominant writing hand while the visuospatially specialized hemisphere and dominant writing hand were on the same side; subjects who used an inverted or "hooked" position were found to have reversed specialization of brain function.

Devices are available to alter grip. Zaner-Bloser manufactures a small primary pencil which is a mechanical pencil that has the diameter of the standard pencil and the shaped gripping area which aids in proper finger placement. Attachments are available which may be added to the writing tool to alter the position in which the tool is held. The Zaner-Bloser writing frame which serves as an aid for the left-handed student and the Hoyle triangular pencil grip have been previously discussed. Two of these grip-altering devices are used in the present study because of the importance research has attributed to grip in initial handwriting instruction.

In summary, handwriting legibility is affected by the way the writing tool is held and by the position assumed by the writer. Eye-hand coordination, muscular control and perhaps even brain dominance affect the posture and hand movement in the writing process. For writers who
need assistance in obtaining an appropriate grip, attachments are available which can be attached to the writing tool. One such attachment, the triangular grip, is studied in the present research project.

**Handedness**

Of all pupils in public schools who have been neglected or subjected to poor or inadequate instruction, the pupil who insists upon using the left hand for handwriting leads the list. (Enstrom, 1962, p. 234)

The Latin word for left-handedness is "sinister," implying something wrong or evil. Left-handedness is not something new. The Book of Judges tells that 700 left-handed men were found in an army of 26,000 (Freeman, 1960). Handedness should be recognized as normal because it is a natural trait. Yet, it is not mentioned in educational literature until 1915.

The number of left-handed students has been stated to be 10% (Cole, 1946), 8.2% (Carrother, 1947), 5% (Hildreth, 1947), and 11.1% (Enstrom, 1962). This would mean that there is probably at least one left-handed child in most classrooms, possibly two or three. Enstrom (1962) indicated the number of left-handed children has increased in recent years. This may be because parents and educators are becoming more accepting concerning this phenomenon.

In general, right-handed students are not considered superior to their left-handed peers (Enstrom and Enstrom, 1971; Marshall, 1978; Smith and Reed, 1962; Trankell, 1956). Groff (1964), matching right- and left-handed children from grades 4-6, found only one significant difference. Right-handed girls in sixth grade had higher mean ratings in handwriting legibility than left-handed girls in the same grade. He concluded this did not demonstrate a general superiority of right-handed writers.
A few studies support the opposing view. An early work by Guilford (1936) indicated right-handed students were superior on measures of handwriting speed and quality. Horton (1969), analyzing handwriting of 1,000 sixth graders, found that boys malform more letters than girls, left-handed boys make nearly one half of the letters in an illegible manner, and this group has more difficulty in producing legible handwriting than any other group. Lewis (1969) reported left-handed children make more reversals and inversion errors but found no significant differences in the total number of errors.

Orton (1937), a neuropathologist, believed the speech center in the brain is closely connected to the center which controls the dominant hand. According to his theory, when a child is forced to make a change-over to the other hand, it will confuse the control of the speech activities, causing stuttering and stammering.

Garrison (1938) disputed Orton's theory. He reported a study of schools in Elizabeth, New Jersey, which reduced left-handedness from 250 cases to 66 and clearly demonstrated that reversal in handedness for writing seldom results in stuttering or other speech defects.

Cole (1939), analyzing the maladjustments shown by left-handed pupils, discovered that their emotional attitude is affected by the distress over being different.

Enstrom's (1962) landmark study of 1,103 left-handed students examined efficiency of various approaches to writing with the left hand. He found fifteen classifiable variations which can be divided into two groups: one group keeps the writing hand below the writing line; the other group keeps the writing hand over the writing in a hooked position. This study is more thoroughly discussed in the sub-section, Posture and Hand Movement.
Some interesting theories for teaching left-handed children are presented by Cole (1939). She recommended gripping the writing tool 1 or 1½ inches from the end and using a back-handed slant for writing. She suggested an unusual but interesting alternative to prevent smudging: write upside down with a right-handed slant. This method has been ridiculed but never researched.

One can summarize the research in handwriting of left-handers by saying that handedness may have a small impact upon legibility. Studies such as the present one which investigate the impact of other variables on legibility need to isolate handedness in their data analyses to account for differences in legibility which might be attributable to handedness.

**Sex**

Many studies dealing with handwriting legibility do not examine the factor of sex as a variable. Others report sex is not a significant factor (Leung, 1979; Smith and Reed, 1959).

A number of studies have found that, in general, handwriting of girls is more legible than that of boys (Jackson, 1971; Strickling, 1974; Wright and Wright, 1976). An early work by Broom (1929) reported that untrained observers can distinguish sex of writers in two out of three cases. Horton (1969) found boys malform more letters than girls and left-handed boys have more difficulty with legibility than any other group. Marshall's (1979) examination of motor movements and how they affect the quality of kindergarten children's writing reported superiority of girls over boys. Furner (1967), using a program of verbalization to increase perception of letter awareness, reported that writing of first grade girls is superior in both speed and quality. A comparison of italic and non-italic writing in the first and second grades (Dinneen, 1979) found that italic and non-italic are equally
legible in all factors of legibility and rate of production; differences which do exist favor girls. Otto and Rarrick's (1969) study of transition time of writing styles reported a significant difference in legibility due to sex.

Conflicting views exist concerning speed of writing. Strickling (1974) and Reed and Smith (1962) found sex is not a significant factor in speed. Others found girls write significantly faster than boys (Furner, 1967; Groff, 1963).

Since at least some studies claim that sex influences legibility, the present study included sex as a variable to be analyzed.

Intelligence

Intelligence does not seem to be a major factor in legibility (Boyle, 1963; Jackson, 1971; Strickling, 1974). Lewis (1964) determined first grade level mental maturity is more closely related to writing errors before than after instruction; IQ, after instruction, is not significantly related to writing errors.

Rarick and Harris (1963) investigated speed of bright, average and slow sixth graders under different writing conditions. They report that the brightest and average group produce faster writing samples under conditions calling for fast writing. Studying 25 retardates, Love (1965) found that retardates write more slowly but they have a higher quality of handwriting than normal students, according to the Ayres Scale (1912).

Because research does not consider intelligence as a significant factor in legibility, the present study does not use intelligence as a variable for analysis.
Summary

Handwriting has received comparatively little investigation by researchers but it has been given increased interest in recent years (Anderson, 1966). The advent of automation and increased technology has brought on an expansion in the need for legible handwriting because there are situations when machines cannot replace the need for handwritten messages. To produce adults who use legible handwriting, educators need to identify, in the early years of the education process, factors which affect legibility. When classroom teachers actively participate in gathering research data, they may become more interested in the total handwriting process. This study utilizes 35 classroom teachers.

Physical features of the writer may affect legibility. Some investigators have determined sex may be a contributing factor (Horton, 1969; Jackson, 1971; Strickling, 1974). Others suggest handedness may play a main role in legibility (Guilford, 1936; Horton, 1969). Therefore, this study includes both sex and handedness as variables to be examined. Intelligence does not seem to be a significant factor (Boyle, 1963; Jackson, 1971; Love, 1965; Strickling, 1964) so this study does not include intelligence as a variable.

Handwriting legibility is affected by a number of other factors. Some of these include posture and hand movement, writing surface and methods of teaching and evaluation. Investigators have identified specific qualities that determine the level of legibility (Newland, 1932; Quant, 1946). Posture and hand movement during the writing process play a role in legibility (Callewaert, 1947; Herrick and Otto, 1960; Kahn, 1969). The large number of subjects used in this study would make this variable a difficult one to measure. Conflicting findings indicate spacing on
paper may (Leung, 1979) or may not (Halpin and Halpin, 1976; Krzesni, 1971; Wiles, 1943) be a factor in legibility. Because wide spaced paper is the predominant paper used in first grade, most writing samples were obtained using this paper. Because most research indicated size of writing space was not a factor and because this study did not specify the kind of paper to be used, four teachers used a narrow spaced paper throughout the study. Samples for evaluation were obtained on the kind of paper used daily by the students.

How handwriting is taught and evaluated affects the final product. The large population used in the present study and random selection of subjects randomized the effect of teaching as a variable. In addition, the teacher variable was studied independently to see if there were more differences within one tool group than between tool groups.

The evaluation process can be done through self-evaluation (Johns, 1976; Jones and other, 1977), with the use of scales (Feldt, 1962; Rondinella, 1963) or with plastic overlays (Helwig and others, 1976). Although the use of overlays is highly reliable, it is too time consuming for use with a large group of samples. The use of scales is the predominant method of evaluation. The Zaner-Bloser First Grade Evaluation Scale - Manuscript was selected for this study because it yields a score from the scale of 0 to 5 which is easily measured with minimum training of raters. Interrater reliability can be determined with its use.

Surprisingly little research is available concerning the effect of handwriting tool on legibility, especially when one considers that handwriting tools are in daily use in all classrooms. Use of the large primary pencil in the earlier grades is based on the philosophy that small muscle coordination is not fully developed. Wiles (1943) and Herrick (1954) found no evidence to support the use of beginner's pencil rather than an
adult sized one. Smith (1977) determined the adult pencil may be more appropriate. Alternative writing tools may be superior for young children (Krzesni, 1971; Tawney, 1967). Attachments have been recommended to improve grip but little standardized research is available to determine their effectiveness (Smith, 1977). Because of sparse research concerning the comparative effectiveness of a variety of writing tools, this study examines the following tools as they are used in first grade classes: large primary pencils, standard #2 pencils, standard #2 pencils with triangular pencil grips attached, Zaner-Bloser small primary pencils and Bic fine line felt-tip pens.
CHAPTER III
PROCEDURES

Subjects

The subjects for this study were from Lake County, Florida, and included all first grade children (N=798) in 35 classrooms randomly selected from 42 first grade teachers who agreed to participate. Total population of first grade teachers was 60. A letter and a survey sheet were sent to each of the first grade teachers in Lake County Schools. A copy of the letter and survey sheet are included in Appendix A. From the volunteers who responded to the survey sheet, the 35 classes were randomly selected. Class size averaged 22.8 students.

Five kinds of writing tools were randomly assigned to these classes. The writing tools were divided in this way:

- 7 classes (N=148) wrote with large primary pencils.
- 7 classes (N=158) wrote with standard #2 pencils.
- 7 classes (N=187) wrote with standard #2 pencils with triangular pencil grips attached.
- 7 classes (N=155) wrote with the Zaner-Bloser small primary pencils.
- 7 classes (N=150) wrote with the Bic fine line felt-tip pens.

To be certain that all participating teachers understood the purpose of the study and would agree to use the tools in daily writing lessons as requested, an explanatory letter and Verification of Participation form were sent to these teachers. They signed and returned the Verification of Participation form. A copy of the letter and form are in Appendix B.
The 1970 United States Census report stated that 57% of total Lake County population lived in unincorporated areas. There are, however, seven townships within the county. Lake County Board of Public Instruction has not compiled information identifying the number of students classified as rural and urban. An estimation of population distribution can be drawn from transportation information. Approximately 64% of K-12 students are transported by bus to school. These students live two or more miles from school; in many cases, this means they live outside the city limits and could be considered rural. Total first grade enrollment at the end of the first month of the 1980-81 school year was 1,222 students. Racial distribution of these pupils is not available. However, according to the last annual report data available (1978-79), the total school population was approximately 78% white, 21% black, with the rest being Hispanic, Southeast Asian and American Indian. Using free and reduced lunch applications as an indicator, 47% of first grade students are classified as economically deprived. Using scores on a pre-reading skills battery and selecting students who scored at the 23rd percentile or below, 26% of first grade students are classified as educationally disadvantaged by school administrators.

**Sampling Process**

All teachers who participated in the study continued to use their usual methods of handwriting presentation. Except for different handwriting tools used, no changes in teaching methods, texts or materials were required. At the end of the study a questionnaire was distributed to participating teachers to determine what methods they used. The form is in Appendix C. A summary of these teaching methods can be found in Chapter IV.
All students within each classroom used the randomly assigned writing tools for all writing lessons during the first semester of the 1980-81 school year. The tool could also be used as desired throughout the rest of the day but teachers were not required to assign it except for formal writing lessons.

A handwriting sample was obtained from each student at the end of the semester. Students were identified by sex and handedness. From the total group of 798 samples, 105 were randomly selected for legibility analysis from each of the groups of writing tools, 15 from each classroom, making a total of 525 samples. These samples consisted of papers from 253 females and 272 males. In addition, from the total population, all samples done by left-handers (N=75) were analyzed.

Data Collection

This study compares and contrasts manuscript handwriting legibility as affected by the five handwriting tools after they have been used for a semester. Handwriting samples were obtained for comparative analysis of legibility. One week prior to Christmas vacation, each child copied a sample sentence in manuscript, using his or her randomly assigned writing tool. Each student was given a model of the sentence from which to copy. By having the sentence in front of them rather than on the board, the children did not have to deal with shift in far and near vision and did not have to make a transition from vertical to horizontal writing. Having a model to copy eliminated dictation errors, spelling problems and reduced error to copying. The teacher read the sentence to the class to be sure each child understood what was to be copied and urged students not to hurry but to do their best writing. The sentence which the students copied was, "The quick red fox jumped over the lazy brown dog."
To standardize the process of obtaining the sample sentence, each teacher was furnished with precise instructions. A copy of this instruction sheet and a copy of the standardized sentence are included in Appendix D.

Most teachers used standard primary paper but a few teachers used paper with slightly narrower spacing which is usually referred to as "second grade writing paper." Students were furnished with sentences which corresponded in size to the paper which they normally used. Both sets of samples have been included in Appendix D.

**Raters**

Four raters who were not informed about the purpose of the study were trained by the investigator to evaluate handwriting legibility with the use of the Zaner-Bloser First Grade Evaluation Scale - Manuscript. A copy of this scale is included in Appendix D. Handwriting examples are in Appendix E. The raters spent approximately four hours in training until percentage of agreement equalled 90 percent. This was calculated by dividing the number of identically scored papers by total number of papers scored. During training, the four raters rated the same paper and discussed why they assigned a particular score to that paper.

Rating was done with each rater independently rating papers in a randomly assigned order. Students' scores were computed by having two raters rate each paper independently. Sex and handedness were also recorded for each sample. During the rating, reliability was checked using ten papers for every fifty papers rated. If agreement slipped below 90 percent, rating was discontinued momentarily and raters retrained on samples not used in the study. Mean interrater percentage of agreement was .86 by the end of the study as shown in Table 1. Agreement means perfect agreement. Mean interrater reliability (determined by a Pearson Product Moment Correlation) was .92 as shown in Table 2.
Two of the raters were experienced teacher's aides, one was a college senior with a major in special education and the fourth was a college senior who was majoring in business administration.

Examples of the handwriting samples and rating cards have been included in Appendix E.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>INTERRATER AGREEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rater</td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>1.0</td>
</tr>
<tr>
<td>B</td>
<td>1.0</td>
</tr>
<tr>
<td>C</td>
<td>1.0</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>INTERRATER RELIABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rater</td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>1.0</td>
</tr>
<tr>
<td>B</td>
<td>1.0</td>
</tr>
<tr>
<td>C</td>
<td>1.0</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Hypotheses

Analysis of variance procedures were used to examine the following hypotheses:

\[ H_1 \text{ There will be no significant difference in legibility due to tools (}.05). \]

\[ H_2 \text{ There will be no significant difference in legibility due to sex (}.05). \]
There will be no significant difference in legibility due to handedness (.05).

There will be no significant interaction between tools and sex (.05).

There will be no significant interaction between tools and handedness (.05).

There will be no significant interaction between sex and handedness (.05).

There will be no significant interaction between tools, sex and handedness (.05).

Design

The design of the study is based on the Posttest-Only Design which is outlined in Campbell and Stanley (1963, p. 25). It is extended to five treatment groups. Classes were randomly assigned to treatment groups, representing the five writing tools:

\[ X_1 = \text{primary pencil} \]
\[ X_2 = \#2 \text{ pencil} \]
\[ X_3 = \#2 \text{ pencil with triangular grip} \]
\[ X_4 = \text{Zaner-Bloser pencil} \]
\[ X_5 = \text{Bic felt-tip pen} \]

Within each treatment group, students were further grouped according to sex and handedness. All groups received the same post-test. Table 3 illustrates these treatment groups.
Table 3

<table>
<thead>
<tr>
<th>POSTTEST-ONLY DESIGN</th>
<th>0_1</th>
<th>0_2</th>
<th>0_3</th>
<th>0_4</th>
<th>0_5</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>x_1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>x_2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>x_3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>x_4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>x_5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Posttest-Only Design is appropriate for this study because first grade students are just beginning to write, making a pre-test non-crucial. Differences in handwriting skills due to previous writing experiences have been controlled by randomly assigning classes for treatment and because classes are heterogeneously grouped. This design also eliminates the problem of mortality over a four month period of time.

**Analysis of Data**

Because some studies indicate there are variances in handwriting legibility between sexes and between left-handed and right-handed students (Guilford, 1936; Horton, 1969: Jackson, 1971), sex and handedness are studied in the analysis of variance.

To determine the significance among and between groups, the data were analyzed two ways. To determine significance of sex and tool, a 5 x 2 analysis of variance was used with randomly selected samples, as shown in Table 4. A 5 x 2 x 2 analysis of variance was used with another subsample of all left-handers and an equal number of randomly selected right-handers in each treatment group for analysis of handedness, sex and tool, as shown in Figure 1. Tools, sex and handedness are all discrete variables rather than continuous; thus, analysis of variance is the commonly accepted method of data analysis. The .05 level of
significance was used in accepting or rejecting the null hypotheses. The data were analyzed using the Statistical Package for the Social Sciences (SPSS).

Table 4

TREATMENT GROUPING BY SEX

<table>
<thead>
<tr>
<th>Tools</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$ (primary pencil)</td>
<td>male</td>
</tr>
<tr>
<td>$X_2$ (#2 pencil)</td>
<td>female</td>
</tr>
<tr>
<td>$X_3$ (#2 pencil, grip)</td>
<td>female</td>
</tr>
<tr>
<td>$X_4$ (Zaner-Bloser pencil)</td>
<td>female</td>
</tr>
<tr>
<td>$X_5$ (Bix felt-tip pen)</td>
<td>female</td>
</tr>
</tbody>
</table>

Figure 1. Analysis of variance
CHAPTER IV
PRESENTATION OF DATA AND ANALYSIS OF RESULTS

Results of Handwriting Analyses

The data presented below have been analyzed in accordance with statistical procedures outlined in Chapter III. All hypotheses were tested through analysis of variance. Means and standard deviations were compared by using Duncan's Multiple Range tests. The null hypotheses tested and the outcomes of the analyses were as follows.

Hypothesis 1

There will be no significant difference in legibility due to tools (.05).

Inspection of Table 5 indicates that the F value of .79 is not statistically significant. Therefore, null Hypothesis 1 is not rejected on the basis of the data obtained. Results of the analysis of variance of tools and sex are summarized in Table 5. Means and standard deviation for comparison of handwriting legibility by individual tools are shown in Table 6. These analyses test for the main effect of writing tools on handwriting legibility of first grade children.
Table 5

TOOL AND SEX ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source Variation</th>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool</td>
<td>4</td>
<td>12.06</td>
<td>3.02</td>
<td>.79</td>
</tr>
<tr>
<td>Classes Within Tool</td>
<td>30</td>
<td>109.03</td>
<td>3.63</td>
<td>4.21*</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.44</td>
<td>1.44</td>
<td>1.67</td>
</tr>
<tr>
<td>Tool, Sex</td>
<td>4</td>
<td>4.11</td>
<td>1.02</td>
<td>1.19</td>
</tr>
<tr>
<td>Error</td>
<td>485</td>
<td>418.29</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>524</td>
<td>544.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*statistically significant (p < .0001)

Table 6

COMPARISON OF HANDWRITING LEGIBILITY BY TOOL

<table>
<thead>
<tr>
<th>Tool</th>
<th>X</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Primary Pencil)</td>
<td>N=105</td>
<td>1.88</td>
</tr>
<tr>
<td>2 (#2 pencil)</td>
<td>N=105</td>
<td>2.17</td>
</tr>
<tr>
<td>3 (#2 pencil, grip)</td>
<td>N=105</td>
<td>2.22</td>
</tr>
<tr>
<td>4 (Zaner-Bloser pencil)</td>
<td>N=105</td>
<td>1.88</td>
</tr>
<tr>
<td>5 (Bic felt-tip pen)</td>
<td>N=105</td>
<td>1.91</td>
</tr>
<tr>
<td>Total</td>
<td>N=525</td>
<td>2.01</td>
</tr>
</tbody>
</table>
Hypothesis 2

There will be no significant difference in legibility due to sex (.05).

Inspection of Table 5 indicates that the F value of 1.67 is not statistically significant. Therefore, null Hypothesis 2 is not rejected on the basis of the data obtained. Means and standard deviation for comparison of handwriting legibility between sexes are shown in Table 7. These analyses examine the main effect of sex on handwriting legibility.

Table 7

<table>
<thead>
<tr>
<th>COMPARISON OF HANDWRITING LEGIBILITY BETWEEN SEXES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean and Standard Deviation</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>N=253</td>
</tr>
<tr>
<td>Total N=525</td>
</tr>
</tbody>
</table>

Hypothesis 3

There will be no significant difference in legibility due to handedness (.05).

Inspection of Table 8 indicates that the F value of .34 is not statistically significant. Therefore, null hypothesis 3 is not rejected on the basis of the data obtained. Results of the analysis of variance of tools, sex and handedness are summarized in Table 8. It should be noted that this study was composed of a slightly different population, comparing 75 left-handers with an equal number of right-handers. Results are similar to those of the larger study even though the calculations
are not identical. Means and standard deviations for comparison of handwriting legibility of the left-handed sample by handedness are shown in Table 9. These analyses test for the main effect of handedness on handwriting legibility of first grade children; these analyses indicate that handedness is not a statistically significant factor.

Table 8

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool</td>
<td>4</td>
<td>4.45</td>
<td>1.11</td>
<td>.81</td>
</tr>
<tr>
<td>Classes within tool</td>
<td>29</td>
<td>47.41</td>
<td>1.63</td>
<td>1.97*</td>
</tr>
<tr>
<td>Hand</td>
<td>1</td>
<td>.28</td>
<td>.28</td>
<td>.34</td>
</tr>
<tr>
<td>Tool, hand</td>
<td>4</td>
<td>.16</td>
<td>.04</td>
<td>.05</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>.01</td>
<td>.01</td>
<td>.02</td>
</tr>
<tr>
<td>Tool, sex</td>
<td>4</td>
<td>1.18</td>
<td>.30</td>
<td>.36</td>
</tr>
<tr>
<td>Hand, sex</td>
<td>1</td>
<td>.17</td>
<td>.17</td>
<td>.21</td>
</tr>
<tr>
<td>Tool, hand, sex</td>
<td>4</td>
<td>1.44</td>
<td>.36</td>
<td>.43</td>
</tr>
<tr>
<td>Error</td>
<td>101</td>
<td>83.8</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>149</td>
<td>138.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*statistically significant (p < .007)
<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>SD</td>
<td>X</td>
</tr>
<tr>
<td>N=75</td>
<td>2.13</td>
<td>N=75</td>
</tr>
<tr>
<td>.95</td>
<td>.99</td>
<td></td>
</tr>
</tbody>
</table>

Total N=150

Hypothesis 4

There will be no significant interaction between tools and sex (.05).

Inspection of Table 5 indicates that the F value of 1.19 is not statistically significant. Therefore, null hypothesis 4 is not rejected on the basis of the data obtained. Results of the analysis of variance of tools and sex are summarized in Table 5. A comparison of legibility of sex by individual tool is shown in Table 10. A comparison of legibility of sex by individual tool in the smaller handedness sub-sample is shown in Table 11. These findings indicate that the choice of writing tools does not significantly affect the handwriting legibility of either boys or girls at the first grade level.
Table 10

COMPARISON OF HANDWRITING LEGIBILITY
BY SEX AND TOOL

Mean and Standard Deviation

<table>
<thead>
<tr>
<th>Tool</th>
<th>Female</th>
<th></th>
<th>Male</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>SD</td>
<td>$\bar{X}$</td>
</tr>
<tr>
<td>1</td>
<td>N=47</td>
<td>2.14</td>
<td>1.66</td>
<td>N=58</td>
</tr>
<tr>
<td>2</td>
<td>N=49</td>
<td>2.13</td>
<td>.80</td>
<td>N=56</td>
</tr>
<tr>
<td>3</td>
<td>N=55</td>
<td>2.36</td>
<td>.94</td>
<td>N=50</td>
</tr>
<tr>
<td>4</td>
<td>N=45</td>
<td>1.91</td>
<td>.91</td>
<td>N=60</td>
</tr>
<tr>
<td>5</td>
<td>N=57</td>
<td>2.01</td>
<td>1.02</td>
<td>N=48</td>
</tr>
<tr>
<td></td>
<td>N=253</td>
<td></td>
<td></td>
<td>N=272</td>
</tr>
<tr>
<td>Total</td>
<td>N=525</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 11

COMPARISON OF HANDWRITING LEGIBILITY
LEFT-HANDED SAMPLE BY TOOL AND SEX

Mean and Standard Deviation

<table>
<thead>
<tr>
<th>Tool</th>
<th>Female</th>
<th></th>
<th>Male</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{X}$</td>
<td>SD</td>
<td>$\bar{X}$</td>
</tr>
<tr>
<td>1</td>
<td>N=16</td>
<td>2.19</td>
<td>.98</td>
<td>N=24</td>
</tr>
<tr>
<td>2</td>
<td>N=15</td>
<td>2.13</td>
<td>.72</td>
<td>N=21</td>
</tr>
<tr>
<td>3</td>
<td>N=11</td>
<td>2.27</td>
<td>.82</td>
<td>N=13</td>
</tr>
<tr>
<td>4</td>
<td>N=6</td>
<td>2.25</td>
<td>.61</td>
<td>N=20</td>
</tr>
<tr>
<td>5</td>
<td>N=11</td>
<td>1.82</td>
<td>1.17</td>
<td>N=13</td>
</tr>
<tr>
<td>Total</td>
<td>N=59</td>
<td></td>
<td></td>
<td>N=91</td>
</tr>
</tbody>
</table>
Hypothesis 5

There will be no interaction between tools and handedness.

Inspection of Table 8 indicates that the F value of .05 is not statistically significant. Therefore, null hypothesis 5 is not rejected on the basis of the data obtained. Results of the analysis of variance of tools and handedness are shown in Table 8. Mean and standard deviation for a comparison of handwriting legibility by sex and individual tool are shown in Table 12. These findings indicate that the choice of writing tool does not significantly affect the handwriting legibility of either left-handers or right-handers at the first grade level.

Table 12

<table>
<thead>
<tr>
<th>Tool</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>N=20</td>
<td>2.08</td>
</tr>
<tr>
<td>2</td>
<td>N=18</td>
<td>2.33</td>
</tr>
<tr>
<td>3</td>
<td>N=12</td>
<td>2.38</td>
</tr>
<tr>
<td>4</td>
<td>N=13</td>
<td>2.08</td>
</tr>
<tr>
<td>5</td>
<td>N=12</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Total N=75  Total N=75
Hypothesis 6

There will be no significant interaction between sex and handedness (.05).

Inspection of Table 8 indicates that the F value of .21 is not statistically significant. Therefore, null hypothesis 6 is not rejected on the basis of the data obtained. Analysis of variance is summarized in Table 8. Means and standard deviation for comparison of handwriting legibility by sex and handedness are shown in Table 13. These findings indicate that the interaction between sex and handedness is not statistically significant.

Table 13

<table>
<thead>
<tr>
<th>Handwriting Legibility</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} )</td>
<td>SD</td>
</tr>
<tr>
<td>Left</td>
<td>2.24</td>
<td>1.00</td>
</tr>
<tr>
<td>Right</td>
<td>2.00</td>
<td>.73</td>
</tr>
<tr>
<td>Total</td>
<td>2.13</td>
<td>.88</td>
</tr>
</tbody>
</table>
Hypothesis 7

There will be no significant interaction between tools, sex and handedness (.05).

Inspection of Table 8 indicates that the F value of .43 is not statistically significant. Therefore, null hypothesis 8 is not rejected on the basis of the data obtained. Analysis of variance of the interaction between tools, sex and handedness is summarized in Table 8. Means and standard deviations for comparison of handwriting legibility by sex, handedness and individual tools are shown in Table 14. These findings indicate that, at the first grade level, the choice of writing tool does not have a significant affect on handwriting legibility on either sex, whether the writer is right-handed or left-handed.
<table>
<thead>
<tr>
<th>Tool</th>
<th>Female Left</th>
<th>Female Right</th>
<th>Male Left</th>
<th>Male Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N=7</td>
<td>N=9</td>
<td>N=13</td>
<td>N=11</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 2.43</td>
<td>$\bar{X}$: 2.00</td>
<td>$\bar{X}$: 1.88</td>
<td>$\bar{X}$: 1.77</td>
</tr>
<tr>
<td></td>
<td>SD: 1.17</td>
<td>SD: .83</td>
<td>SD: 1.13</td>
<td>SD: 1.13</td>
</tr>
<tr>
<td>2</td>
<td>N=8</td>
<td>N=7</td>
<td>N=10</td>
<td>N=11</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 2.19</td>
<td>$\bar{X}$: 2.07</td>
<td>$\bar{X}$: 2.45</td>
<td>$\bar{X}$: 1.04</td>
</tr>
<tr>
<td></td>
<td>SD: .70</td>
<td>SD: .79</td>
<td>SD: .55</td>
<td>SD: .75</td>
</tr>
<tr>
<td>3</td>
<td>N=6</td>
<td>N=5</td>
<td>N=6</td>
<td>N=7</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 2.59</td>
<td>$\bar{X}$: 1.90</td>
<td>$\bar{X}$: 2.17</td>
<td>$\bar{X}$: .75</td>
</tr>
<tr>
<td></td>
<td>SD: .92</td>
<td>SD: .55</td>
<td>SD: .71</td>
<td>SD: .17</td>
</tr>
<tr>
<td>4</td>
<td>N=4</td>
<td>N=2</td>
<td>N=9</td>
<td>N=11</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 2.13</td>
<td>$\bar{X}$: 2.50</td>
<td>$\bar{X}$: 2.06</td>
<td>$\bar{X}$: 1.01</td>
</tr>
<tr>
<td></td>
<td>SD: .63</td>
<td>SD: .71</td>
<td>SD: .84</td>
<td>SD: .67</td>
</tr>
<tr>
<td>5</td>
<td>N=6</td>
<td>N=5</td>
<td>N=6</td>
<td>N=7</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 1.83</td>
<td>$\bar{X}$: 1.47</td>
<td>$\bar{X}$: 1.80</td>
<td>$\bar{X}$: 1.03</td>
</tr>
<tr>
<td></td>
<td>SD: 1.47</td>
<td>SD: .84</td>
<td>SD: 1.67</td>
<td>SD: 1.03</td>
</tr>
<tr>
<td>Total</td>
<td>N=31</td>
<td></td>
<td>N=28</td>
<td>N=44</td>
</tr>
<tr>
<td></td>
<td>$\bar{X}$: 2.05</td>
<td></td>
<td>$\bar{X}$: 1.23</td>
<td></td>
</tr>
</tbody>
</table>
Teacher Differences

There are highly significant differences between classes within tools as shown in Table 5 and Table 8. Tables 15-19 provide an analysis of variance for individual tools. Inspection of Table 15 indicates that the F value of 5.46 is statistically significant (p < .01) for tool 1, the primary pencil. Table 16 indicates the F value of 5.74 is statistically significant (p < .01) for tool 2, #2 pencil. Table 17 indicates the F value of 3.01 is statistically significant (p < .01) for tool 3, #2 pencil with triangular grip. Table 19 indicates the F value of 3.78 is statistically significant (p < .01) for tool 4, Zaner-Bloser primary pencil. Table 19 indicates the F value of 3.36 is statistically significant (p < .01) for tool 5, Bic felt-tip pen. Mean and standard deviation for comparison of handwriting legibility among classes for each tool are shown in Table 20. The variance within the same tool using group exceeded variance between groups. These findings indicate that some factor(s) other than writing tool, sex and handedness account for the highly significant differences in handwriting legibility between individual classes at the first grade level.
Table 15

ANALYSIS OF VARIANCE
BY CLASS - TOOL 1
LARGE PRIMARY PENCIL

<table>
<thead>
<tr>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>29.16</td>
<td>4.86</td>
<td>5.46*</td>
</tr>
<tr>
<td>Error</td>
<td>98</td>
<td>87.23</td>
<td>.89</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>116.39</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant (p < .0001)

Table 16

ANALYSIS OF VARIANCE
BY CLASS - TOOL 2
STANDARD #2 PENCIL

<table>
<thead>
<tr>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>26.23</td>
<td>4.37</td>
<td>5.74*</td>
</tr>
<tr>
<td>Error</td>
<td>98</td>
<td>74.60</td>
<td>.76</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>100.83</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant (p < .0001)
Table 17

ANALYSIS OF VARIANCE
BY CLASS - TOOL 3
STANDARD #2 PENCIL WITH TRIANGULAR GRIP

<table>
<thead>
<tr>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>19.06</td>
<td>3.18</td>
<td>3.01*</td>
</tr>
<tr>
<td>Error</td>
<td>103.43</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>122.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant (p < .0096)

Table 18

ANALYSIS OF VARIANCE
BY CLASS - TOOL 4
ZANER-BLOSER SMALL PRIMARY PENCIL

<table>
<thead>
<tr>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>17.73</td>
<td>2.95</td>
<td>3.78*</td>
</tr>
<tr>
<td>Error</td>
<td>76.53</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>94.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant (p < .002)

Table 19

ANALYSIS OF VARIANCE
BY CLASS - TOOL 5
BIC FINE LINE FELT-TIP PEN

<table>
<thead>
<tr>
<th>Degrees Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>16.86</td>
<td>2.81</td>
<td>3.36*</td>
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<tr>
<td>Error</td>
<td>82.03</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>98.89</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant (p < .0047)
<table>
<thead>
<tr>
<th>Tool</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{x}$</td>
<td>SD</td>
<td>$\bar{x}$</td>
<td>SD</td>
<td>$\bar{x}$</td>
<td>SD</td>
<td>$\bar{x}$</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>1.30</td>
<td>1.03</td>
<td>2.27</td>
<td>.96</td>
<td>2.73</td>
<td>.97</td>
<td>1.20</td>
<td>.67</td>
</tr>
<tr>
<td>2</td>
<td>3.13</td>
<td>1.04</td>
<td>2.67</td>
<td>.84</td>
<td>1.67</td>
<td>1.11</td>
<td>1.90</td>
<td>.54</td>
</tr>
<tr>
<td>3</td>
<td>1.67</td>
<td>.86</td>
<td>1.76</td>
<td>.82</td>
<td>2.00</td>
<td>.87</td>
<td>2.27</td>
<td>1.08</td>
</tr>
<tr>
<td>4</td>
<td>1.77</td>
<td>1.05</td>
<td>2.43</td>
<td>.94</td>
<td>2.10</td>
<td>1.21</td>
<td>2.30</td>
<td>.62</td>
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<tr>
<td>5</td>
<td>1.93</td>
<td>.70</td>
<td>1.43</td>
<td>.98</td>
<td>2.73</td>
<td>1.21</td>
<td>1.80</td>
<td>.70</td>
</tr>
</tbody>
</table>
Discussion of Results from Handwriting Analyses

This study demonstrated that when the variables of tool, sex and handedness are examined, none of these variables have a significant effect on handwriting legibility of first grade writers. However, some other variable(s) within the teaching-learning process can make a highly significant difference between classes, whether or not the same writing tools are used. This study made no attempt to identify these other variables which so strongly affect legibility of the beginning writer.

Even though these variables were not identified by the study, it is possible to pose some tentative explanations for these differences. Chapter II, Review of Literature, explored the possible effects of readiness, methods of teaching and evaluation, posture and hand movements. Quantity of teaching and practice time, self-concept and motivation are other potential influencing factors.

Results From Teacher Survey

To further describe the procedures used by teachers for each tool and to explain further teacher differences within each group, all 35 teachers participating in the study responded to a questionnaire about their teaching practices.

Description of Teaching Practices

Teachers were asked if the assigned handwriting tool were used throughout the day or only for handwriting lessons. Those assigned the primary pencil used it throughout the day. Three teachers using the #2 pencil used it only for handwriting and four used it all day. Four used the #2 pencil with grip for handwriting and three used it all day. Five used the Zaner-Bloser pencil just for handwriting and two used it all day. All of the teachers assigned to the felt-tip pen
used it for handwriting only except for one teacher who let the children use it all day for the first nine weeks, after which they lost the privilege because the pens were disappearing. Clearly, children using primary pencils and, to some extent, the other pencils had more practice with this tool than those using felt-tip pens.

Teachers were asked to report the approximate amount of time spent by their classes in daily handwriting practice and instruction. The amount of time used to teach handwriting varied between classes but the variance was approximately equal among groups of tools. The approximate amount of time spent each day on handwriting instruction is reported in Table 21. In general, those teachers who reported spending a greater amount of time on handwriting instruction tended to have students who had more legible handwriting.

Table 21

<table>
<thead>
<tr>
<th>No. Minutes</th>
<th>Tool</th>
<th>Tool 2</th>
<th>Tool 3</th>
<th>Tool 4</th>
<th>Tool 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>15-20</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>2</td>
<td></td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>not stated</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>35</td>
</tr>
</tbody>
</table>
Teachers were asked to identify the source of their handwriting exercises. They reported that handwriting exercises came from a handwriting text (3 teachers), reading vocabulary (13 teachers), language experience stories (8 teachers), a teacher-developed program (17 teachers), a phonics lesson (3 teachers), a spelling book (2 teachers), and a combination of listed sources (14 teachers).

Teachers were asked whether handwriting instruction consisted of total class instruction, small group instruction, or individualized instruction. Only one teacher listed small group instruction as her primary method of instruction. All others listed total group instruction as the primary method of teaching with either small group or individualized instruction with specific needs.

The questionnaire sought to identify the writing text used by each teacher. Twenty-seven used no text at all. Of these, two mentioned that they used the Zaner-Bloser method and one, the Palmer method. Five teachers used five different texts: Creative Growth with Handwriting, (Zaner-Bloser), Learning to Read and Write, (Open Court), Disney Ditto Masters, I Learn to Write, (Bell), and Basic Goals in Spelling, (Kottmeyer and Claus).

Since it was anticipated that many different approaches were used, teachers were asked to describe briefly how they taught handwriting. Throughout the first grade classes, there appeared to be a consistent pattern in teaching handwriting. Large group instruction was generally followed by individual or small group instruction as needed. Letters were presented individually with a stress on similarities and differences. Six teachers reported introducing letters in the order they were taught during the phonics lesson, three reported introducing
letters in alphabetical order and eleven stated they were introduced in groups made up of straight lines, circles and curves. A variety of terms were used such as "Tail letters, tall letters." One teacher differentiated between types by calling them "first floor, basement and upstairs letters." Seven teachers made comments concerning the use of the overhead projector as an effective teaching tool. The use of erasers was mentioned by five teachers; three were in favor of using erasers and two were opposed to their use.

To summarize findings of the survey of teaching methods and attitudes, several patterns were observed throughout the teacher responses. Teachers spent between 10-30 minutes daily for direct instruction. Most teachers used large group instruction supplemented by individualized or small group instruction; only one teacher used small group instruction as the primary method of teaching handwriting. Most teachers did not use a handwriting text; instead, they used a combination of a teacher developed program, reading vocabulary, language experience stories, handwriting texts as a reference, in that order. Individual letters were taught by shape, in sequence of phonics lesson or in alphabetical order.

**Teachers' Attitudes Toward Writing Tools**

Teachers were asked to comment about the impact of the writing tools on their students and which tools they would use for handwriting now that the study was over. Thirty-three (94%) teachers responded to this part of the questionnaire. Teachers indicated a variety of attitudes concerning the use of the assigned tool. With a few exceptions, those who were pleased with the tool tended to report positive attitudes by students and those who were less pleased with the tool
would report negative student attitudes and comments. However, the investigator noticed that whenever she discussed aspects of the study with teachers, each one appeared to be genuinely concerned that her class do well with the assigned tool. Each teacher seemed committed to the success of the tool assigned to her classroom because it would be an indication of her success as a teacher.

All seven of the teachers who used the large primary pencil indicated they were satisfied with it as the appropriate writing tool. Six of those who were assigned the primary pencil plan to continue using it and one teacher plans to change to the #2 pencil for the second half of the year.

Most teachers who used the #2 pencil reported satisfaction with it and stated that children preferred to use it. One teacher said that parents were more pleased with their children's writing progress. Another had problems with the lead breaking and found it difficult to keep the pencils sharpened. This teacher preferred to use the large primary pencil. Two teachers plan to return to the primary pencil; one wants to use the primary pencil with an eraser because she felt the students had benefitted from having an eraser on the #2 pencil; two teachers plan to continue with the #2 pencil; one wants to use the #2 pencil with the triangular grip; and one did not state her preference.

Two problems were reported with the use of the #2 pencil with the triangular grip. Children chewed on the grip and the grips posed a problem when pencils had to be sharpened because they had to be moved up the pencil and then repositioned. One teacher stated that students complained that the grips hurt their fingers and another felt the grips
were difficult to use at the beginning of the year but were easier to use by the end of the semester because the children had become "adjusted" to them. One suggested that the pencil grip seemed to be more beneficial to some members of her class than to others. She felt the triangular grip automatically required that the pencil be held in the correct writing position, eliminating an improper grip. One of the teachers who was dissatisfied with this as a writing tool stated, "The children just loved them and hated to give them up at the end of the study." At the end of the study, this particular teacher, a close friend of the investigator, returned all of the pencils and grips used throughout the study. Upon opening the box, the investigator was startled to find a large number of very used pencils with many broken, torn, chewed and generally mutilated triangular grips. There was one exception. For some strange and unexplained reason, the yellow grips were virtually intact with almost no visible teeth marks.

To summarize teacher attitude concerning the use of the triangular grip, three teachers gave negative reports, two teachers generally liked using the #2 pencil with the triangular grip and two teachers indicated both positive and negative attitudes. Out of the group of teachers assigned the #2 pencil with triangular grips, one teacher plans to continue using them, one wants to use the Zaner-Bloser primary pencil; two of them prefer the primary pencil; and one plans to use the #2 pencil without the triangular grip. One wants to use the #2 pencil and furnish grips only for some children. One teacher wrote, "I have no choice but to use primary pencils at the conclusion of the study."

All of the teachers who used the Zaner-Bloser primary mechanical pencil indicated they were pleased with its use. One teacher wrote,
"I tried to imply there might be some magical powers in the pencils."

One class had problems with students who kept twisting the lead in and out, causing the lead to fall out and either break or become lost. From the teachers who were assigned the Zaner-Bloser primary pencil, four plan to continue using this tool, two will use the primary pencil. One teacher wrote, "I will let them choose. They know which is best and with which they can do best."

From the teachers assigned the felt-tip pen, five were generally negative about its use and two were favorable. The children liked the felt-tip pen considerably more than the teachers did. One of the teachers provided a list of advantages and disadvantages of this tool. Her comments accurately summarized the attitudes reflected by the other teachers in the group.

Advantages:

1. motivation: children liked the markers
2. no broken leads
3. saved time not having to sharpen pencils so often
4. finished papers were bright, easily read
5. children could manipulate markers with no problem
6. markers wrote smoothly and easily

Disadvantages:

1. when markers were new, children have difficulty not blotting the ink, especially when the marker is positioned in one place
2. when markers are new, they bleed through to other side of the paper
3. some children were messy with them, marking on self or desk, drawing on writing paper
4. some markers run out of ink within a week. Those that survived the first week usually lasted at least a month.
Although this teacher considered it a disadvantage that pens blotted when resting in one position, another considered it an advantage because it was a visual reminder that children were pausing as they formed basic letter strokes. She stated that this encouraged them to write smoothly and with a continuous movement in order to prevent the blots. One teacher attempted to use the markers throughout the day but discontinued this practice after the first nine weeks because so many markers were being stolen by the children, a clear indication that they were popular. Two quotes graphically depict the problems encountered when children improperly used the felt-tip pen.

One little boy who is "naturally messy" was still getting marker on himself and his desk, even at the end of the study. (His mother also complained about the markers.)

One child kept her fingernails painted blue. Ha!

To summarize teacher reactions to the various tools, teachers using the primary pencil and Zaner-Bloser pencil were the two groups which reported the most favorable reaction. Most of those who used the primary pencil plan to continue using it; those who used some tool other than the primary pencil were more willing to consider an alternative tool for writing and there was much variation among teachers as to their intention once the study had concluded. Teachers who were pleased with the tool they had been assigned were more apt to use it throughout the day, generally reported positive attitudes by children while those who were less pleased with the tool reported negative attitudes from the children. The exception to this was the group of teachers who used the felt-tip pen. Teachers generally did not prefer them but the children enjoyed them tremendously.
Cost of Tools

The cost of writing tools is an important factor in selecting an appropriate writing tool. Both a changing economy and source of supply would affect the cost of the tools. Most of the writing tools used in the present study were purchased through the Lake County Schools system which purchases supplies in bulk and on bid. At the time of the study, the #2 pencils used cost $5.14 per gross ($.036 each), large primary pencils without erasers cost $8.38 per gross ($.058 each), large primary pencils with erasers cost $11.19 per gross ($.078 each), and Bic fine line felt-tip pens cost $.92 per dozen ($.077 each). Zaner-Bloser furnished the primary pencils. However, if purchased through Zaner-Bloser, Columbus, Ohio, the price of the Zaner-Bloser primary pencil with eraser (510020-8) would have cost $.60 each for quantities of 12 or more. Refill leads (520023-7) cost $.50 for a package of 18 and refill erasers (520090-3) cost $.50 for a package of 12. The triangular pencil grips furnished by Hoyle Industries were also available through All-Florida School Supply, Jacksonville, Florida, at the cost of $3.65 per 20 ($.185 each).

The comparative costs of the various tools can be summarized as follows. The #2 pencil would be the least expensive to purchase. The Zaner-Bloser primary pencil would be the most expensive for the initial purchase but the least expensive to maintain over a prolonged period of time. The cost of the primary pencil without an eraser was less than one with the eraser. The primary pencil with eraser and the Bic felt-tip pen cost approximately the same but the felt-tip pen would probably not last as long. The triangular grip should last indefinitely if children can be taught not to chew them.
Summary

The purpose of this study was to investigate the effects of various writing tools on handwriting legibility of first grade children to determine if the use of a particular tool affects the handwriting legibility of beginning writers. Writing tools used were: large primary pencils, standard #2 pencils, standard #2 pencils with triangular pencil grips attached, Zaner-Bloser small primary pencils, and Bic fine line felt-tip pens. This study examined these questions: 1) Does the writing tool affect the legibility of the manuscript writing of beginning writers? 2) Which writing tools contribute to greater legibility in beginning writers? 3) Is sex a factor in the legibility of a particular tool? 4) Is handedness a factor in the legibility of a particular tool?

Two groups were utilized in this study. The sample (N=525) to determine effect of sex and tool was randomly selected from a population of 35 first grade classes in Lake County, Florida. From a population of 60, these classes were randomly selected from 42 teachers who volunteered to participate in the study. Another subsample (N=150) was made up of all left-handers (N=75) from the 35 classrooms plus an equal number of right-handers in each treatment group for analysis of handedness, sex and tool.
The five writing tools were randomly distributed with seven classes using each tool. From the beginning of school until the week before Christmas vacation, all students used the writing tool for all writing assignments. Teachers had the option of using the tool throughout the day. At the end of the study, all children copied a standardized sentence, "The quick red fox jumped over the lazy brown dog." Teachers completed a questionnaire concerning individual teaching methods and attitudes about the assigned tool.

Four raters were trained in using 1 Evaluation Scale - Manuscript by Zaner-Bloser until they reached 90% agreement. Each paper was scored by two raters on these items: letter formation, vertical strokes, spacing, alignment and proportion, line quality. Each item was scored as "satisfactory" or "needs to improve" to yield individual scores between 0-5. Raters were re-trained during the rating process when reliability began dropping below .90. Raters had 86 percent overall agreement and overall interrater reliability of .92 at the end of the study.

The design of the study was posttest only, using five treatment groups representing the five writing tools. With each treatment group, writing samples were further grouped according to sex and handedness. All groups received the same posttest. To determine significance among and between groups, the data were analyzed two ways. To determine significance of sex and tool, a 5 x 2 analysis of variance was used. A 5 x 2 x 2 analysis of variance was used with the subsample of all left-handers and randomly selected right-handers for an analysis of handedness, sex and tool.
Data analysis reported four major findings. No statistically significant results \((p < .05)\) were found for differences among tools. No statistically significant results \((p < .05)\) were found between sexes. No statistically significant results \((p < .05)\) were found between right- and left-handers. Statistically significant results \((p < .0001)\) were found among individual classes within each group of tools.

**Conclusions**

Findings of this study suggest that tools, sex and handedness have no statistically significant effect \((p < .05)\) on handwriting legibility of first grade children. The present study supports Wiles' (1943) findings which reported no significant differences among large, medium and small pencil. His year long study of 833 first grade students controlled for several factors: tools, groups of students using the tools, experience of teachers, subject matter and methods of teaching handwriting.

Conflicting findings were reported by three other studies. Tawney's (1967) study, comparing ball-point pen and primary pencil, reported performance was significantly better for the pen group. Because a specially constructed ball-point pen was used, findings cannot be generalized to indicate superiority of all ball-point pens. Krzesni's (1970) one day study found both felt-tip and ball-point pen were significantly superior to #2 pencil. His study measured the number of words written rather than quality of legibility. Smith's (1977) nine week study indicated the adult sized pencil was superior to both the primary pencil and the adult sized primary pencil with a triangular grip. Findings of the studies are mixed but no study has shown the primary pencil to be superior. Findings imply that no one writing tool seems to be superior at the first grade level. Most first grade teachers, however, limit their students to the use of the
primary pencils without erasers. Selection of handwriting tool ought not be limited to the traditional primary pencil but should take into account student preferences.

Findings of this study indicate there are other factors in the teaching-learning process which have a statistically significant (p < 0.0001) impact on legibility and make significant differences between classes. This study made no attempt to isolate those factors. A questionnaire administered to teachers revealed differences among them which may have contributed to classroom differences. Teachers differed in the degree to which they liked and had their students use the writing tools assigned to them. The teachers used varying curricular approaches to teaching handwriting and spent differing amounts of time on handwriting instruction and practice. In addition, the teachers varied in their own background preparation and experience in teaching. Further research is definitely needed to explain teacher differences in handwriting instruction.

Studies which examined the effect of writing paper on handwriting legibility reported conflicting findings. Leung (1979) found that at the first grade level, large spaced paper was superior to paper with normal sized (1.6 cm) spacing. Wiles (1943) reported width of space on writing paper did not affect legibility. Halpin and Halpin (1976) supported Wiles' findings. Writing paper as it affects legibility was not examined in this study. Thirty one classes used wide lined (1") paper and four used paper with narrower spacing (3/4"). Ranking class legibility mean scores from highest to lowest, the four classes using the narrow-spaced writing paper ranked as follows: 4, 7, 22, 23. These rankings indicated that two classes were in the top fifth and two classes were slightly below average in class legibility mean scores. Because so few classes used writing paper with
narrow spacing and because large variances were found among classes within each tool, independent of writing paper differences, this study provided no conclusive findings concerning the effect of writing paper on handwriting legibility.

The review of literature examined the role of readiness for the act of handwriting. The present study did not do a preassessment of writing skills and did not determine teacher methodology for providing readiness training in the total writing program. Many students in this study received low legibility ratings. This may indicate that these students were not ready to begin actual writing but would have profited from a variety of prewriting or readiness activities.

A number of studies dealing with teaching methods were cited. Those which dealt with perceptual training included investigations by Furner (1967), Marshall (1978), and Sommer (1967). The present study did not investigate whether teachers used any of these methods for teaching but this would be an appropriate topic for further research. Many teachers reported using large group instruction followed by individualized or small group teaching for children who needed additional help. Several studies (Horton, 1969; Marshall, 1978; Newland, 1932; and Tagatz, et al., 1969) supported this kind of individualization and diagnostic remediation.

Some methods of handwriting evaluation include self evaluation, the use of overlays and the use of handwriting scales. The present study selected the Zaner-Bloser 1 Evaluation Scale - Manuscript as an effective evaluation tool. Appendix E contains examples of handwriting samples and how they were scored by using this scale.

The role of posture and hand movement as they affect legibility was studied by several investigators (Callewaert, 1947; Enstrom, 1962;
Herrick, 1954; and Kahn, 1969). Although the impact of those factors was recognized by the investigator, the present study did not include them as a legibility factor. However, the degree to which individual teachers emphasized posture and hand movement in their handwriting instruction might have accounted for some of the large classroom differences.

Conflicting findings were reported among studies of handedness. In general, right-handed students are not considered superior to their left-handed peers (Enstrom and Enstrom, 1971; Groff, 1964; and Trankell, 1956). Guilford (1936) and Horton (1969) indicated right-handed students were superior on measures of handwriting speed and quality. Findings of the present study indicate that handedness is not a statistically significant factor in legibility.

Sex as a factor in handwriting legibility was examined by several studies. Smith and Reed (1959) and Leung (1979) reported that sex was not a significant factor. Other studies (Jackson, 1971; and Strickling, 1974) found that, in general, handwriting of girls was more legible than boys. Findings of the present study indicate that sex is not a statistically significant factor in handwriting legibility.

The survey of teaching methods and attitudes about the writing tool indicate that teachers spent between 10-30 minutes daily for direct instruction. One teacher used small group instruction, all others used large group instruction supplemented by individualized or small group instruction. Most teachers did not use a handwriting text; instead, they utilized a combination of a teacher-developed program, reading vocabulary, language experience stories, handwriting texts, as a reference, in that order. Individual letter formation was taught by shape, in sequence of phonics lesson or in alphabetical order. Teachers who used
the primary pencil were much less apt to prefer an alternate writing tool than were the teachers who had been assigned a different tool. Teachers who had been assigned the primary pencil and Zaner-Bloser pencil were generally in favor of continuing their use. Those who had been assigned the felt-tip pen generally did not enjoy them but the children enjoyed them so much that they began disappearing from the classrooms. Classes using the #2 pencil and the #2 pencil with triangular grip reported both positive and negative attitudes. Teachers who liked the assigned tool were more apt to use it throughout the day and generally reported positive attitudes from children and those who were dissatisfied tended to report negative reactions from children.

Last, handwriting instruction in this school district at the first grade level was haphazard at best. No district-wide program was in operation. There might have been fewer teacher differences in a district with an adopted program. However, because there was no adopted program, results were more generalizable. Writing tools overall do not affect legibility. Had there been a district curriculum, that finding could only have been generalized to districts using a similar curriculum.

Recommendations for Teachers

Since no one tool was superior, there is no rationale for the continued use of the primary pencil as the sole writing tool for first grade children. Instead, teachers need to consider the purpose of communication (i.e., whether corrections will need to be made), the size of paper (i.e., small tools for small paper, large markers for large paper), the function of communication (i.e., thick markers for drawing, think markers for writing), and student preferences.
Handwriting companies ought not specify specific tools for all children but rather disseminate the implications of this study: namely, that different tools might be used for different purposes and student preferences should be taken into account.

The teachers in this study suggested that individual students responded differently to the writing tools. It is likely that greater sensitivity to individual student differences as well as preferences might improve the handwriting legibility of classes as a whole. In-service education on the relative merits of handwriting tools might increase teacher sensitivity to individual students.

Administrators would be well advised to periodically examine children's progress in handwriting, and since there appear to be great differences among teachers, observe the classrooms of more successful teachers to determine why they are successful and seek strategies to share with less successful faculty.

The ease with which volunteers were recruited for this study indicates the willingness on the part of first grade teachers to try new ideas. Since this experimental study revealed no differences between writing tools, but great differences between classrooms, teachers might be encouraged to explore alternative methods and materials for handwriting instruction. Teachers might, for example, try several different writing tools in their classrooms and then evaluate each student's handwriting using the preferred tool.

Recommendations for Further Study

Handwriting legibility research has fairly clearly shown that tools have little impact on legibility. All of these studies, including the present one, have employed experimental research techniques. Although
there are several further questions which might be studied experimentally (i.e., the impact of pencil erasers and the impact of student choice of preferred writing tool), even these topics might best be explored by ethnographic techniques.

The two most critical findings of this study -- that teacher and/or student differences within each tool were greater than tool differences, and that both teachers and students varied in their reactions to the different writing tools -- merit further investigation. We know that vast teacher differences exist. In-depth studies of these individual classrooms might tell us why. For example, these studies could examine how teachers differ in instructional methods to extend the findings by Tagatz and others (1969). The single factor of time devoted to handwriting instruction and how that affects legibility merits consideration. The study of the development of gross and fine motor skills and instruction in motor movement in relationship to writing skills would determine if Marshall's (1979) findings with kindergarten children would also be applicable at the first grade level. A comparative study could be done of how student training in visual discrimination affects handwriting, as indicated by Sommer (1967). The varying amount of emphasis teachers placed on motivation and self esteem as related to the effectiveness of handwriting skills could be examined. Teachers may also vary in the quality and quantity of writing readiness experiences which are related to written composition as well as handwriting legibility. The physical maturity level could vary from classroom to classroom; this factor could be examined to determine its influence on both writing composition and legibility. It is this type of research on writing tools that is likely
to lead to some clues as to teacher differences in instructional efficacy and individual student achievement.

This study needs to be followed up by several which allow children free choice of writing tools. When given free choice, do children use one tool for math and another for composing? Most adults use a variety of writing tools in this manner. Do children rewrite and edit their compositions more with one tool than with another? We have much to learn about how children actually use writing tools. For example, is proper grip facilitated by the use of certain tools during the preschool years?

This study needs to be followed by several which assign writing tools to children within a classroom for a variety of purposes. Does a child with too tight a grip do better with a felt-tip pen? Does a child with an inappropriate grip do better with a triangular grip? With the Zaner-Bloser pencil? By longitudinally following the progress of individual children as tools are systematically diagnostically prescribed for them, the appropriateness of tools for individual needs could be determined.

The present study focused on handwriting legibility of beginning writers. Additional studies similar to the present one should consider whether handwriting legibility of older children is affected by the choice of tool.

Since children who write well, write well with any tool, a study which investigates the development of handwriting in children might yield information about how good legibility is acquired. Such a study would have to consider writing done in the home as well as writing done at school.
Several teachers in the present study recommended the use of the overhead projector as an effective teaching procedure in teaching correct letter formation. This method should be compared with other methods such as copying from the board or using a writing text to determine whether one method is superior in producing legible handwriting.

All teachers who participated in this study had previously used the primary pencil as the only handwriting tool in their classes. After using other writing tools, many teachers expressed an interest in using alternative writing tools. A follow-up study a year later would determine whether these teachers actually did make this change. If they are not using the primary pencil, are they using the one assigned during this study? Are they using an alternative tool? Do they feel this change in tools has had an impact on handwriting legibility within the class?

The present study has examined handwriting legibility of a large group of children in regular classrooms. Many children at the first grade level have been identified as having perceptual and/or motor problems which affect their handwriting. There is a need for a study similar to the present one which specifically examines handwriting legibility of children with special needs to determine appropriate tools to meet these varying individual needs.

Each of these proposals places handwriting more closely with research on composing (of which handwriting is a small technical skill). As researchers study children's composing processes, more attention might be given to the impact of the writing tool on legibility, duration of composing and content. Some writing tools may cause young children to tire more quickly than others. Some (especially felt-tip pens), although they may not enhance legibility, may cause such positive attitudes toward
composing that they may encourage better handwriting legibility. Information from such studies could then be experimentally applied to larger populations. We know that teachers and students vary in their reactions to various writing tools. Detailed observations of children as they write and compose might reveal reasons for varying preferences for writing tools. More specifically, the classrooms which produced extreme scores in this study might be examined to explain these classroom differences. These teachers might be interviewed and their classrooms observed by qualitative researchers skilled in developing questions and hypotheses for further study. One of the most fundamental contributions of this study to the research of handwriting is the identification of classrooms which produced extreme differences in the handwriting legibility of children.
APPENDIX A

SURVEY TO LOCATE INTERESTED PARTICIPANTS
TO: First Grade Teachers, Lake County Schools
FROM: Mrs. Beulah M. Ayris
Teacher, Specific Learning Disabilities
Leesburg 5 & 6 East

SUBJECT: Study to determine the impact of various writing instruments on the legibility of beginning writers.

As a graduate student at the University of Florida, I am interested in studying the effect of different writing instruments on the legibility of handwriting at the first grade. This study would be the subject of my doctoral dissertation. The writing tools I want to compare are:

1. Large primary pencils
2. Standard #2 pencils which have triangular grips attached
3. Standard sized pencils with primary lead
4. Thin-point felt-tipped markers

Randomly assigned writing tools would be furnished to each participating teacher.

Mr. Sam Commander, Superintendent of Schools, has given permission to send out this inquiry, stating that your participation would be on a volunteer basis.

If you are interested in participating in the study, please fill out the attached form. An envelope is not required if you fold the form, staple or tape it closed and return by Jack Rabbit. Please return no later than the end of post-planning. Thank you for your cooperation and prompt response!
TO ALL FIRST GRADE TEACHERS OF LAKE COUNTY

This is a survey to determine the amount of interest teachers have in participating in a handwriting legibility study. Program funding will partially depend on the interest level of classroom teachers. If you express an interest in the study, you will be contacted in the fall. The proposed study would be conducted in this way.

1. Each participating teacher would be randomly assigned a writing instrument for her students. Each class would be assigned only one kind of instrument. Instruments include: primary pencil, #2 pencil with grip, standard size pencil with primary lead, fine line felt-tip pens.

2. Students would use the assigned tool for all writing lessons during the fall semester. They would not be required to use them at other times unless desired.

3. Two handwriting samples would be collected from each student at a specified time during the semester. Paper would be furnished for the copying and a uniform lesson provided for the sample.

4. The study would require no changes in the regular handwriting instruction and no one would visit the classroom in connection with the study. Manuscript will be used.

If you are interested in participating in such a study please fill out and return this form to Mrs. Beulah M. Ayris, Leesburg 5 & 6 East. No envelope is required if you fold and staple or tape closed. You may return the form by Jack Rabbit. Please return by the end of post-planning! Thank you for your cooperation!

Yes, I would be interested in participating in a study to determine the impact of various writing tools on the handwriting legibility of the first grade child.

Name

School

Comments and questions may be written on the back.
APPENDIX B

ASSIGNMENT OF TOOL AND VERIFICATION OF PARTICIPATION
August 13, 1980

Dear First Grade Teachers:

Thank you for your spirit of adventure! Earlier you volunteered to participate in the study, "The Effect of Various Handwriting Tools on Handwriting Legibility of First Grade Children." Little research is available on writing tools so you are furnishing vital information to the field of learning. The following statements should clarify the study and your responsibilities in completing it.

1. Five different writing tools have been randomly assigned: primary pencil, #2 pencil, #2 pencil with attached grip, Zaner-Bloser primary pencil, felt-tip pen.

2. Thirty-five classes are participating, seven with each tool. The study will last one semester.

3. The only change this study will make in your teaching is that your students are to use the writing tool assigned to your group for all handwriting lessons. You may use any tool you like during the rest of the day. If you decide to use the assigned tool at all times, that is your decision.

4. At the end of the study you will receive a sample sentence for your students to copy.

5. All handwriting tools are furnished except the primary pencil, the tool you would normally use.

6. If you find you need an additional supply of writing tools, please notify me prior to your supply being depleted.

7. You will receive a complete summary of findings when the study is completed and all data analyzed.

If you have any problems or questions, please call me! My home ph. is 787-2581. My school is Leesburg 5 & 6 East, Ph. 787-3124. I will be happy to hear from you and will help in any possible way. I am extremely grateful for your cooperation in this study!

Sincerely,

[Signature]

(Mrs.) Beulah M. Ayris

P.S. Please return the statement of intent which is attached. The tool which has been randomly assigned to your class is
VERIFICATION OF PARTICIPATION IN THE WRITING TOOLS STUDY

PLEASE RETURN THE FOLLOWING (Check one)

I have received the information and required writing tools for the writing tools study. I plan to participate in the study and will use the tools in daily writing lessons as requested.

I have decided not to participate in the study. Please find another teacher to take my place. Writing tools are being returned by Jack Rabbit.

Name

School

Date

You may staple and return by Jack Rabbit.
Return to Mrs. Beulah M. Ayris, Leesburg 5 & 6 East

COMMENTS:
APPENDIX C

INSTRUCTIONS FOR OBTAINING SAMPLE AND TEACHER SURVEY
December 5, 1980

TO: First Grade Teachers, Lake County Schools

FROM: Mrs. Beulah M. Ayris
Teacher, Specific Learning Disabilities
Leesburg 5 & 6 East

SUBJECT: Handwriting samples for legibility study

Your conscientious participation in the handwriting study has been greatly appreciated! Only through your cooperation and assistance have I been able to obtain necessary information concerning the effect of handwriting tools. The results of the study will be shared with you in February when the samples have been analyzed.

Enclosed are sample sentences for your students to copy on handwriting paper usually used for handwriting lessons. To standardize presentation, please use the attached instruction sheet for administering the sample sentence. Do not return the copying sheet but send the children's handwriting samples to me by Jack Rabbit. Handwriting sample should be obtained on the morning of December 10th, if possible. You may want to allow a student to start over if he becomes extremely frustrated with his first trial. However, do not encourage students to start over unless you observe real emotional anxiety. It is not necessary to obtain samples at a later time from absentees unless you choose to do so.

At the top of each writing paper, please indicate sex and writing hand. This information is VITAL to my study!

Also enclosed is a brief questionnaire. You are under no obligation to complete it because one stipulation of the study was that you would not be bothered with extra forms. However, I am extremely interested in your handwriting program. Answers to these questions would help me gain a better understanding of what you are doing. Even if you choose not to answer the top section, I am particularly interested in your comments, would like to compile them in the discussion section of my dissertation to show similarities and differences among the various handwriting classes. Individuals would not be identified.

Again, thanks!

[Signature]

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INSTRUCTIONS FOR OBTAINING HANDWRITING SAMPLES
IF POSSIBLE, PLEASE PRESENT SAMPLE ON MORNING OF DEC. 10th

(Please read the following instructions to your class.)

"Boys and girls, here is a sentence I would like for you to copy. It is a special sentence because it has all of the letters of the alphabet in it. Let me read it to you. 'The quick red fox jumped over the lazy brown dog.' I would like for you to point your fingers to the words as I read it to you again. (Do this several times, if necessary, until you are certain that the class can read what is to be copied.) When you copy this sentence, take time to do your very best writing. Please write it on your handwriting paper. Don't hurry to finish. Write slowly enough to show me your very best writing." (You may also want to discuss the meaning of the sentence to be certain that all children understand the meaning of what they are writing.)

BE CERTAIN TO INDICATE SEX AND HANDEDNESS ON THE TOP OF EACH WRITING PAPER! (M, F, R, L)
Please return to Mrs. Beulah M. Ayris, Leesburg 5 & 6 East

Teacher: ___________________________ Date: __________________

Handwriting Tool: _______________________

1. Assigned handwriting tool was used:

   Only for handwriting lessons ...... ______

   Throughout the day ................. ______

2. Approximate amount of time spent by my class in daily handwriting practice and instruction (general average) ______ min.

3. Handwriting exercises usually come from:

   Handwriting text ...................... ______

   Reading Vocabulary ................... ______

   Language experience stories ...... ______

   Teacher-developed program ......... ______

   Combination of listed sources .... ______

   Other source, specify below ...... ______

4. Handwriting instruction usually consists of:

   Total class instruction .......... ______

   Small group instruction .......... ______

   Individualized instruction ...... ______

5. Writing text used by my class:

   Creative Growth with Handwriting, Zaner-Bloser  . ______

   Palmer Method Easy Teach Series, A. N. Palmer .. ______

   Spell/Write Series, Noble and Noble .............. ______

   Other (please list) ____________________________

   Do not use handwriting text ...................... ______

   (CONTINUED)
6. Describe briefly how you teach handwriting:

7. How did your students do using the tool you were assigned? In what ways did the tool have an impact upon their growth in handwriting?

8. Now that the study is over, which tool(s) will you use for handwriting instruction?

9. Do you have any additional comments or criticisms? Please itemize.
APPENDIX D

HANDWRITING SCALE AND STANDARDIZED SAMPLE

Copyright 1979, Zaner-Bloser, Inc.
Reprinted with permission
# First Grade Evaluation Scale - Manuscript

## How to Evaluate Writing with this Scale

### I. Writing
- **A.** The teacher writes on a ruled chalkboard a model of the sentence.
- **B.** Students practice writing the sentence on lined paper.
- **C.** Using their best handwriting, students then write the sentence again.

### II. Evaluation

Compare the students' writing to the examples on the scale, and if no more than one element needs improvement, the writing is rated excellent (Example 1). If no more than two elements need improvement, the writing is rated good (Example 2). If no more than three elements need improvement, the writing is rated average (Example 3). If no more than four elements need improvement, the writing is rated fair (Example 4), and if five elements need improvement, the writing is rated poor (Example 5).

### Example 1 — Excellent for Grade One

```
I wrote my name
upon the sand.
```

### Example 2 — Good for Grade One

```
I wrote my name
upon the sand.
```
Example 3 — Average for Grade One

I wrote my name upon the sand.

Example 4 — Fair for Grade One

I wrote my name
upon the sand.

Example 5 — Poor for Grade One

I wrote my name upon the sand.
The quick red fox jumped over the lazy brown dog.
The quick red fox jumped over the lazy brown dog.
APPENDIX E

HANDWRITING SAMPLES
The quick red fox jumped over the lazy brown dog.
<table>
<thead>
<tr>
<th>Satisfactory</th>
<th>Needs Improvement</th>
</tr>
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<tbody>
<tr>
<td>✓ Letter Formation</td>
<td></td>
</tr>
<tr>
<td>✓ Vertical Strokes</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Spacing</td>
<td></td>
</tr>
<tr>
<td>✓ Alignment, Proportion</td>
<td></td>
</tr>
<tr>
<td>✓ Line Quality</td>
<td></td>
</tr>
</tbody>
</table>

The quick red fox jumped over the lazy brown dog.
The quick brown fox jumped over the lazy dog.
<table>
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<th>Needs Improvement</th>
</tr>
</thead>
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<td>✔</td>
</tr>
<tr>
<td>Vertical Strokes</td>
<td>✔</td>
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<tr>
<td>Spacing</td>
<td>✔</td>
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<tr>
<td>✔ Alignment, Proportion</td>
<td></td>
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<tr>
<td>✔ Line Quality</td>
<td></td>
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</tbody>
</table>

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<td>✓</td>
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<td>Spacing</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Alignment, Proportion</td>
<td></td>
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<tr>
<td>Line Quality</td>
<td>✓</td>
</tr>
</tbody>
</table>

The quick red fox jumped over the lazy brown dog
The quick red fox jumps over the lazy brown dog.
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Beulah M. Haynie Ayris was born in Carnesville, Georgia, on June 12, 1931. She graduated from Clearwater High School, Clearwater, Florida, in 1949. She was awarded the Lewis Scholarship and received her Bachelor of Science degree in elementary education and English from Florida State University, Tallahassee, Florida, in 1953. During her undergraduate years she was a member of Alpha Omicron Pi, served as editor of the literary magazine, Smoke Signals, and was elected to Garnet Key. She received her master's degree in early childhood education from the University of Florida in 1975. In 1979, she was awarded her specialist's degree in curriculum and instruction from the University of Florida.

She was elected to Phi Kappa Phi, Kappa Delta Pi and Pi Lambda Theta honorary societies. She is a member of Council for Exceptional Children and Lake County Education Association.

Her teaching experiences include fifteen years of classroom teaching in Pinellas, Marion and Lake Counties, elementary art supervisor and director of a private kindergarten. She is presently employed as teacher of specific learning disabilities at Leesburg 5 & 6 East, Lake County, Florida.

Beulah ("Boots") Ayris is married to Arthur A. Ayris, an electrical contractor, and has three children: Arthur, Cynthia and David.
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Linda L. Lamme
Chairperson
Associate Professor, General Teacher Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

William D. Hedges
Professor, Instructional Leadership and Support

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Cecil D. Mercer
Professor, Special Education
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Dorene D. Ross  
Assistant Professor, General Teacher Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Evelyn L. Wenzel  
Professor, Instructional Leadership and Support

This dissertation was submitted to the Graduate Faculty of the Division of Curriculum and Instruction in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Education.

June, 1981  
Dean for Graduate Studies and Research