

Abstract

IMPACT OF PRESCHOOL HANDWRITING WITHOUT TEARS
INSTRUCTION ONE YEAR FOLLOWING INTERVENTION

by

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Handwriting is a communication skill that must be taught to young students as it serves as the primary manner in which elementary school students are able to demonstrate their knowledge of academic concepts. Occupational therapists who work in the school system commonly engage students who struggle with handwriting skills in specific occupations to reach the goals of improving handwriting abilities and achieving overall academic success.

Handwriting Without Tears (HWT)® is a program used by some therapists to teach students the basic component skills of handwriting and proper letter/number formation, sizing, and spacing in order to improve functional written communication.

This paper illustrates the outcomes of a quantitative study that compared results of the Shore Handwriting Screening between students who participated in the HWT Get Set for School program at a Head Start center and those students in control and alternative intervention groups one year following the initial study.

IMPACT OF PRESCHOOL HANDWRITING WITHOUT TEARS
INSTRUCTION ONE YEAR FOLLOWING INTERVENTION

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CHAPTER 1: INTRODUCTION

Impact of Preschool Handwriting Without Tears Instruction One Year Following Intervention

Handwriting is an important life skill and serves as the primary manner in which elementary school students demonstrate their knowledge of academic concepts and express themselves in written form (Case-Smith, 2002; Graham, Harris, & Fink, 2000; Milone, 2007). Although the use of computer processors is becoming increasingly more popular, young writers must still complete a majority of their composing and note taking by hand (Graham et al., 2000). Research has found that approximately 30-60% of a student's school day is comprised of fine-motor tasks (Hoy, Egan, & Feder, 2011). Numerous studies reveal that handwriting skills have a significant influence on students' text production abilities and are closely linked to overall academic achievement (Cahill, 2009; Feder & Majnemer, 2007; Parush, Lifshitz, Yochman, & Weintraub, 2010). "Struggling with handwriting can lead to a self-fulfilling prophecy in which students avoid writing, come to think of themselves as not being able to write, and fall further and further behind their peers" in all academic areas (Graham, 2010, p. 49).

Children typically begin understanding that writing is meaningful during the preschool and kindergarten years (Naidoo, Engelbrecht, Lewis, & Kekana, 2009). As a result, it is imperative that students have adequate writing skills in place upon entering formal education in order to "express their thoughts, feelings and ideas for both themselves and the intended audience" (Naidoo et al., 2009, p. 18).

Occupational therapists commonly work in the school system and engage students who struggle with handwriting skills in specific classroom learning occupations in order to reach the goal of improving handwriting abilities. After receiving a referral, occupational therapists must first assess underlying deficits in order to determine the cause of handwriting difficulties (Feder,

Majnemer, & Synnes, 2000). Next, handwriting challenges can be addressed during intervention sessions by targeting the following motor, cognitive and sensory skills which affect handwriting: motor planning, visual perception, visual-motor integration, bilateral hand skills, in-hand manipulation skills, kinesthesia, sustained attention, sensory processing, and posture (Asher, 2006; Denton, Cope, & Moser, 2006; Erhardt & Meade, 2005; Feder & Majnemer, 2007; Woodward & Swinth, 2002). However, students frequently are not referred to school-based occupational therapy at a young age (preschool or grade 0); therefore, therapeutic interventions are less than optimally effective and handwriting difficulties often persist throughout formal education (Naidoo et al., 2009).

In response to the problem of insufficient handwriting instruction in the early years, some teachers and occupational therapists are using the Handwriting Without Tears® (HWT) program to train students in the basic component skills of handwriting and proper letter and number formation, sizing, and spacing. The following literature review (Chapter 2) provides an overview of the underlying component skills of handwriting that must be addressed in order to achieve success with handwriting as well as evidence for the effectiveness of the HWT program. While evidence of the program's immediate effectiveness is available, there is a lack of follow-up studies to determine if the program has carry over effects (Carlson, 2009; Kiss, 2007; Lust & Donica, 2011; Owens, 2004).

Problem Statement

Technological advances have resulted in a decreased focus and value being placed on handwriting instruction within the classroom (Kiss, 2007). However, the increased use of computers does not negate the fact that handwriting remains the most immediate form of communication and that children need adequate handwriting skills for the following reasons:

completing assignments in class, taking notes related to class material, writing class assignments, and demonstrating knowledge on tests in written form (Graham et al., 2000; Olsen, 2005). As a result, it is important for handwriting to once again be a part of preschool and elementary school curricula (Case-Smith, 2002). “The instruction of handwriting is the foundation for the entire process of producing written text. If handwriting is not sufficiently and consistently taught, children will not be able to retrieve letter forms from memory and will thus have problems composing text” (Press, Hinojosa, & Roston, 2009, p.171).

It is common for young children to easily learn the auditory and visual aspects of words but to have difficulty converting information into the motor patterns required for handwriting (Gregg & Mather, 2002). Due to this motor planning deficit, poor handwriting has been shown to lead to underachievement in a variety of academic pursuits. In this case, decreased performance is due to the effort required to execute the mechanics of handwriting rather than a lack of knowledge (Hoy et al., 2011; Lee-Corbin & Evans, 1996). Research has found that students who must focus on handwriting mechanics are distracted from other writing processes, such as creating content and planning the flow of text, and therefore struggle to develop as writers (Graham et al., 2000). Handwriting performance is also hindered when children are delayed in developing the ability to form letters automatically. These students tend to write at a slower pace and must put forth more effort than the norm to complete handwritten assignments (Hoy et al., 2011; Medwell & Wray, 2007). As a result, students may struggle to keep up with the volume of work required even in the early years of elementary school (Feder & Majnemer, 2007).

Handwriting of low quality may also lead to a misinterpretation of students’ written responses or cause teachers to feel that the student is noncompliant or not putting forth adequate

effort to write neatly or in-depth (Case-Smith, 2002). For example, when teachers or other adults read two or more versions of the same text, higher marks are commonly given to neatly written papers over those that have poorer legibility (Graham et al., 2000). The problem of inadequate handwriting instruction and a decreased focus on the importance of handwriting in the early years of school has led to many students struggling to produce legible written text.

Purpose of the Study

The purpose of this study was to determine if students who received Handwriting Without Tears- Get Set for School® (HWT-GSS) program instruction while in preschool demonstrated higher rating of handwriting abilities than a control and alternate intervention group one year post participation in the preschool program. Researchers compared scores between pre- and successive post-tests on the Shore Handwriting Screening for Early Handwriting Development in order to determine if students' handwriting readiness skills improved over the two-year period (one year of intervention and one year following). Focus was placed on each individual student's progress and a comparison was made between the differences in mean scores for the experimental versus the control and alternative intervention classrooms as a whole.

This research is specifically seeking to answer the following question: Does the preschool Handwriting Without Tears® program have a greater impact on the writing abilities of young students one year post intervention, as indicated by a greater increase in mean score on the Shore Handwriting Screening, than traditional teaching methods (control) or an alternative intervention?

Handwriting demands increase significantly from pre-school to kindergarten which requires students to repetitively practice handwriting skills in the classroom; therefore,

researchers expected that all study participants would demonstrate improvement in handwriting abilities from year one to year two of the study due to maturation and continued development. However, researchers questioned if students who were provided intervention using HWT-GSS in pre-school would have a stronger foundation for writing in kindergarten than peers in the control or alternative intervention classrooms and would therefore have a greater increase in mean score on the SHS than students in the other groups.

Limitations and Scope of Study

Limitations of this study primarily stem from the lack of a standardized handwriting assessment tool for this age group and the recruiting strategies used to obtain participants. Standardized handwriting assessment tools are not standardized on groups of children who are younger than grade one or age 6 years. Because of this lack of standardized tools, a non-standardized tool was selected for use in this project because it was age appropriate and included necessary handwriting-related components. The use of a non-standardized assessment tool is recognized as a limitation to this study as it decreases the reliability and validity of the data. Reliability in scoring the assessments was further decreased because the assessments were not scored blindly in one sitting. The study results were also limited because a voluntary sampling method was used and a relatively small number of participants completed the study (n=16), making each group very small thus decreasing the power of statistical analysis. An additional limitation was the lack of environmental consistency from year one to year two of the study. Contextual differences existed between the Head Start center (used in year 1) and East Carolina University Department of Occupational Therapy testing rooms (used in year 2) in terms of noise and other possible distractions.

Significance of the Study

This study was conducted in order to begin filling a gap in the literature about the carry-over effectiveness of Handwriting Without Tears ® instruction for preschool students following a structured handwriting intervention program. This study builds on previous research that demonstrates the immediate positive effects of HWT instruction in a full classroom setting and seeks to also provide evidence that the program provides a strong foundation in handwriting when provided in a less structured center-time setting. Researchers questioned if the base of handwriting skills developed during the preschool year allows students to continue to demonstrate quality handwriting abilities during a follow-up year.

The importance of early handwriting instruction has been established in research (Cahill, 2009; Case-Smith, 2002; Graham et al., 2000; Hoy et al., 2011; Naidoo et al., 2009; Milone, 2007). Additional evidence of the effectiveness of structured handwriting programs is necessary in order to meet the need to address handwriting difficulties at a young age.

CHAPTER 2: LITERATURE REVIEW

This literature review focused on the importance of early handwriting skill development, the underlying skills of handwriting, and the processes of writing. With this knowledge, one can understand how the Handwriting Without Tears® (HWT) program has the potential to effectively teach the handwriting skills that a student must have in order to meet the standards set by the North Carolina Department of Public Instruction. Literature was searched by using various search engines including CINAHL by EBSCO, ERIC, EBM reviews, and the N.C. Department of Education website. Keywords used included: handwriting deficits, handwriting instruction, Handwriting Without Tears, component skills of handwriting, school-based occupational therapy, and handwriting standards for preschool and kindergarten students.

Importance of Early Handwriting Skill Development

The capacity to produce high quality, legible handwriting is an important skill for students to develop during the preschool and kindergarten years. The capability to write legibly is correlated with an increased likelihood that students will be able to attain proficiency in schoolwork and have a higher self-esteem (Feder & Majnemer, 2007; Kiss, 2007). Legibility is determined by considering letter formation, spacing, size, slant, and alignment (Feder & Majnemer, 2007). Assessments of legibility use scales and checklists in which handwriting samples are matched to a set of graded samples to assign scores based on grading criteria (Gregg & Mather, 2002).

One study found that as many as 10-20% of students suffer from writing difficulties, which makes it necessary for them to focus their attention on handwriting mechanics rather than the production of ideas and writing plans (Parush et al., 2010). In this case, students quickly become frustrated and fatigued, which can lead to secondary behavioral problems and negative

self-image (Case-Smith, 2002; Feder & Majnemer, 2007; Parush et al., 2010). On the other hand, students who are able to achieve quality handwriting skills are able to “focus more on ideas and composition, and not so much on the mechanics of writing in producing assignments” (Kiss, 2007, p.12). Early handwriting instruction has the potential to improve students’ overall writing abilities both in the short- and long-term by enhancing the quality and quantity of writing (Graham, 2010).

Underlying Skills for Handwriting

Handwriting is a complex occupational task that demands the acquisition of the previously mentioned underlying component skills, including perceptual-motor body functions (Asher, 2006; Denton, Cope, & Moser, 2006; Erhardt & Meade, 2005; Feder & Majnemer, 2007; Parush et al., 2010; Woodward & Swinth, 2002). Maturation and integration of the component skills, as well as control of spatial, temporal, and force elements, is necessary to be proficient in handwriting tasks (Feder, Majnemer, & Synnes, 2000).

Handwriting ability is also influenced by internal and external factors, such as biomechanical or environmental elements (Feder & Majnemer, 2007). Internal or client factors are the specific abilities or characteristics of a person which affect performance in areas of occupation, such as handwriting (American Occupational Therapy Association [AOTA], 2008). Specific internal factors that affect handwriting include the ability to process and appropriately respond to sensory and cognitive information and to plan how to execute the fine motor components of handwriting. Students must also be able to sustain attention on writing tasks in order to complete them with skill. External factors that may influence handwriting include aspects of the environment, a person’s physical or social surroundings, or the context in which handwriting occurs (AOTA, 2008). Context consists of interrelated conditions within and

surrounding the individual which may affect occupational performance. Young students are commonly asked to complete handwriting activities in a classroom setting; therefore, writing abilities are influenced by students' position in the classroom as well as other contextual factors such as noise level and lighting of the room. The station where a student is asked to complete a writing task also influences the student's handwriting abilities. It is important for the student to be able to sit at a supportive table where the height of the table and chair is a good fit for the student with both feet flat on the floor and the table top two inches above the flexed elbows (Schneck & Amundson, 2010).

A study conducted in 2010, which consisted of 70 third-grade students from public schools in central Israel (35 students with recognized handwriting difficulties and 35 in a control group), sought to assess component skills, perceptual-motor body functions, and overall handwriting abilities (Parush et al., 2010). Students completed a series of assessments which were administered in a random order to avoid sequential effect and limit the possible impact of fatigue and attention span. Assessment tools included: The Brief Assessment Tool for Handwriting, The Hebrew Handwriting Evaluation, perceptual-motor assessments, The Developmental Test of Visual Motor Integration, and The Bruininks-Oseretsky Test of Motor Proficiency (Beery, Buktenica, & Beery, 1989; Bruininks, 1978; Erez, Yochman, & Parush, 1996; Lifshitz & Parush, 1993). After reviewing the results from the different assessments, researchers found that students who have handwriting difficulties performed at a lower level on all of the assessments, which measured different skills, than students in the control group. Differences in letter formation, spatial organization, overall legibility, and writing speed are significant between students who have handwriting difficulties and those who do not.

One important skill underlying handwriting which has been studied extensively is orthographic-motor integration (Medwell & Wray, 2007). This skill can be defined as “the ability to call to mind and write letter shapes, groups of letters, and words efficiently and effectively without allocation of cognitive attention” (Medwell & Wray, 2007, p.12).

Orthographic coding explains how students store and retrieve letter forms from memory when writing (Cahill, 2009; Press et al., 2009). Evidence suggests that it is critical for students to master this skill in order to produce smooth and efficient handwriting and concentrate on other writing processes, such as planning, organizing, and producing text (Medwell & Wray, 2007).

In addition to being able to recall letter forms from memory, students must be able to motor plan how to produce letters and words on paper (Press et al., 2009). The ability to efficiently motor plan leads to accurate stroke formation and automatic symbol use.

Fine motor skills also have a strong correlation with handwriting achievement. Studies have shown that weak fine motor control is a major contributory factor of underachievement in the area of handwriting (Lee-Corbin & Evans, 1996). Specific results of poor fine motor control include incorrect size/placement of letters and relationship of parts (Feder & Majnemer, 2007). Inadequate pencil grasp may also be observed in children who have difficulty isolating finger movements, which may make handwriting more challenging and less functional (Schneck & Amundson, 2010; Feder & Majnemer, 2007). Graham (2010) stressed the importance of children learning to consistently use a comfortable pencil grasp, such as the tripod grasp, as soon as they begin learning to write.

In-hand manipulation skills, the ability to adjust objects in the hand after grasp, are a major component of fine motor skills. A student must have the ability to “shift” writing utensils by moving the pencil in linear motions in order to position the tool appropriately for writing.

Students also need to be able to “translate” the pencil between the finger tips and palms. In addition, it is important for students to master “complex rotation” to facilitate rotating the pencil 180 degrees to place it in a position to write or erase (Feder & Majnemer, 2007).

In order to obtain the fine motor skills necessary to produce high quality handwriting, students must be encouraged to participate in various activities to increase hand strength and dexterity (Cahill, 2009). It is important for teachers to assist young students in developing adequate skills through providing opportunities for repetitive engagement in activities that focus on fine motor skill development (Rule & Stewart, 2002). Handwriting and other fine motor skills are most effectively obtained when students frequently engage in writing activities (Graham, 2010). One study indicated that kindergarten through third grade students should be provided structured learning opportunities, with a goal of improving handwriting and fine motor skills, approximately 50-100 minutes per week. This number of minutes was determined after conducting a survey of first through third grade teachers’ instructional strategies for handwriting. A vast majority of teachers reported dedicating an average of 70 minutes per week to handwriting instruction. All early childhood educators and occupational therapists must partner to ensure that the development of fine motor skills begins in preschool settings to enhance readiness for learning (Marr, Cermak, Cohn, & Henderson, 2003).

Processes of Writing

Handwriting consists of low- and high-level processes (Press et al., 2009). Low-level processes include: creating letter representations in memory, retrieving the information from memory, motor planning, and motor production. Strategies for planning, creating, and editing language and written text are high- level processes. For children who have writing difficulties, attention must be placed on the low level processes rather than on the larger goals of a writing

assignment, which may lead to a slower working pace. As a result, occupational therapy interventions need to address the lower-level aspects of writing in order to ultimately achieve success at the higher level (Press et al., 2009).

North Carolina Standards

The North Carolina Department of Public Instruction has set “Early Learning Standards for North Carolina Preschoolers and Strategies for Guiding Their Success” (North Carolina Department of Public Instruction, 2004a). There are a number of skills related to handwriting that preschool students are expected to demonstrate by the end of the preschool year. It is necessary to ensure that children ages 4-5 years advance through a progression of skill development in order to increase success in academic settings. Students are required to learn how to use a variety of writing tools and materials, such as pencils, chalk, crayons, computers, etc. before entering kindergarten. During preschool, students begin to represent thoughts and ideas through pictures (drawing), scribbles, and letter approximations. Educators encourage young students to make writing a part of play activities, and students are required to explore writing letters. The next step for young students is to use known letters to write their name and other simple words. Finally, preschool students should be able to verbally communicate words to be written by an adult and to connect the sounds in a word with its letterforms.

The development of handwriting related skills must continue to develop at the kindergarten level. Educators expect students to be able to apply strategies and previously learned skills to create written texts (North Carolina Department of Public Instruction, 2004b). Specific handwriting skills that should develop by the conclusion of the kindergarten year include the ability to write from left to right and top to bottom and to write most letters and some words when dictated.

Handwriting Without Tears®

A variety of handwriting curriculums have been implemented in schools across the United States to teach handwriting skills. While most programs and curriculums share the common goal of increasing handwriting abilities, each program uses a unique method in teaching handwriting skills. One such program was developed by Jan Olsen, an occupational therapist, in response to her son's struggle with handwriting and the teacher's inability to provide adequate and appropriate handwriting instruction. Olsen's program, Handwriting Without Tears® (HWT), was created in 1976 (Olsen, 2005). She began developing the program by completing a task analysis and applying developmental principles to the task of handwriting. The program uses a developmental approach to handwriting instruction marked by simple vertical, horizontal, and diagonal lines and a framework that groups letters according to difficulty (Cahill, 2009; Case-Smith, 2002; Kiss, 2007). Throughout the program, students are exposed to a variety of tools, such as chalk slates, wood pieces, and a crayon-based workbook to enhance development of handwriting readiness skills through a multisensory approach (Carlson, 2009). The program also provides a consistent language for parents and teachers to use when teaching all of the letters of the alphabet to children.

The Handwriting Without Tears® program addresses the aforementioned underlying motor and cognitive skill deficits which result in handwriting challenges. Handwriting instruction for preschool age students targets memory, orientation, start, and sequence (Olsen & Knapton, 2008). Memory is the ability to identify letters and numbers quickly from a random list and the ability to visualize a letter or number without visual cues. Graham (2010) affirms the importance of having visual memory of letters and numbers in stating that students must have the ability to name the letters of the alphabet, match the letter name to its drawing, and write letters

quickly when named in order to produce written text. The Handwriting Without Tears® curriculum also teaches students to correctly orient letters and numbers without reversals (Olsen & Knapton, 2008). In addition, the program instructs students to start letters and numbers at the top of writing spaces. Finally, the program trains preschool students to make letter parts in the correct order and direction on a consistent basis. As students advance past the preschool level, formal handwriting instruction adds the components of placement, size, control and spacing to further improve handwriting legibility (Olsen & Knapton, 2008).

The Handwriting Without Tears® program also addresses the components of bilateral hand skills, posture, in-hand manipulation skills, kinesthesia, sustained attention, and sensory processing. The use of a “helper hand” requires bilateral hand skills because one hand is used to position and hold the paper while the dominant hand manipulates the writing utensil (Olsen & Knapton, 2008). The helper hand also helps students maintain an appropriate body posture during writing tasks. Songs and small crayons are used to practice in-hand manipulation skills. While singing a song, students learn to pick up the writing utensil and use in-hand manipulation skills to place it in their fingers in a manner that is appropriate for handwriting tasks. Students are also provided with the opportunity to learn through movement or kinesthesia. Preschool activities include standing at an easel when writing or drawing because working against gravity helps build strength in the shoulders and arms and facilitates a stable, slightly extended wrist position. Students also participate in an activity that includes shaking hands with peers to learn right/left discrimination. Throughout the handwriting-readiness program, young students increase their ability to demonstrate sustained attention as they work through a series of writing tasks during each lesson. Finally, the multisensory lessons address students’ diverse learning styles to make instruction more effective. At the same time, participating in all of the lessons

that appeal to different senses (visual, tactile, auditory, and kinesthetic) facilitates students' ability to learn to process information from the different senses (Olsen & Knapton, 2008).

The Handwriting Without Tears® curriculum also encourages young children to learn the proper way to hold writing utensils (Olsen & Knapton, 2008). The program recommends that four and five year old children use small, dual color crayons as writing tools during structured handwriting readiness activities. The authors of the HWT program stress that crayons, which are small in size, are the best tool for preschool age students because they create a natural resistance when used on paper, build hand strength, and promote a proper grasp pattern. The crayons also promote in-hand manipulation skills as students enjoy rotating the dual color crayons to use different colors and shift their fingers along the crayon to properly position them for coloring. Weinraub (1999) conducted a study to evaluate the use of small or broken crayons, an adaptive technique, with four and five year old children who had developmental disabilities. Her research found that the technique of using small crayons as a writing instrument fosters the formation of a mature tripod pencil grasp that can be used during handwriting activities.

Research has been conducted that justifies HWT's design. Multi-sensory teaching methods allow the program to be effective for most children because they appeal to many learning styles. The program's unique teaching order is also advantageous because it trains students in a manner that facilitates proper letter size, formation, and spacing developmentally (Olsen, 2010). Tan-Lin (1981) examined the prewriting and handwriting skills of three to five year old children and found the following sequential stages of development: (1) controlled scribbles; (2) discrete lines, dots, or symbols; (3) straight-line or circular uppercase letters; (4) uppercase letters; and (5) lowercase letters, numerals, and words. This research is the basis for the pre-K, Kindergarten, 1st and 2nd grade HWT printing curriculum design. Studies conducted

by Feder and Majnemer (2007) offer a similar description of the developmental stages and add that an indication of handwriting readiness is the ability to copy geometric shapes which require crossing the body midline.

Evidence of Program Effectiveness

Studies have found the Handwriting Without Tears® program to be effective for both typically developing children and those who have special needs (Kiss, 2007; Lust & Donica, 2011; Owens, 2004). For example, Kiss (2007) reports noticeable changes in the handwriting legibility of upper-and lower-case letters have been found after a brief 2-week instruction period. Kiss stated that the benefits of Handwriting Without Tears® include but are not limited to: consistent instruction, consistent legibility of handwriting as speed of output increases, and decreased referrals to occupational therapy for handwriting problems (Kiss, 2007).

An additional study was conducted by Lust and Donica (2011) to verify the effectiveness of HWT by determining if students at a Head Start center who participated in the Handwriting Without Tears®-Get Set for School (HWT-GSS) program two times per week through full-class implementation showed improvements in prewriting skills, kindergarten readiness, first-name writing, and handwriting-nonspecific fine motor skills. By comparing pre- and posttest scores, the researchers found that the experimental group (students who participated in HWT-GSS) made significant improvements in prewriting, kindergarten readiness, and fine motor skills in comparison to the control group.

Another study implemented to test the effectiveness of the HWT program was conducted by Kiss (2007). Her research goal was to determine if the Handwriting Without Tears® program could improve handwriting performance in an independent school district. This district included five elementary schools that served approximately 2,600 students between the ages of four and

nine years. Each school in the district was allowed to select a handwriting curriculum to use with students but formal handwriting instruction time was generally minimal. One of Kiss's study participants was a pre-kindergarten teacher who implemented the HWT Pre-K program in the classroom for four weeks. Students took a 15-minute "break" each school day to participate in handwriting instruction. Students were tested using the Objective Procedures Scoring Writing and Keyboarding Tool before and after intervention (Honaker, 2003). A significant difference, which suggests the effectiveness of HWT, was found between all students' pre-and posttest scores ($p=.028$) (Kiss, 2007).

Owens (2004) conducted a study to compare the effectiveness of HWT versus traditional teaching methods. This study used two experimental classes who received instruction with the Handwriting Without Tears methods and two comparison classes who received traditional teaching methods. The average age of males in the experimental group was 8 years 3 months and the average age of females was 8 years 4 months. The control classrooms included males who were an average age of 8 years 2 months and females who were 7 years 9 months. The Minnesota Handwriting Assessment (MHA) was used to measure handwriting performance using print (Reisman, 1999). At the end of the 10 week study, students in the experimental classrooms showed statistically significant improvement compared to the control classrooms in the areas of size ($p=.008$) and spacing ($p=.014$). The children in the classrooms receiving Handwriting Without Tears® instruction also had higher mean MHA posttest scores.

During the 2010-2011 school year, researchers at East Carolina University began a research study at the Head Start center in Greenville, North Carolina to examine the effects of handwriting readiness programs on the development of handwriting related skills. The Handwriting Without Tears® Get Set for School curriculum was implemented in one

experimental classroom (Donica, Goins, & Wagner, 2011). Handwriting assessment scores were compared between the experimental classroom and a control classroom who received no specialized handwriting readiness instruction. The study included a total of 32 (14 control and 18 HWT) preschool students. The Shore Handwriting Screening for Early Handwriting Development was used to measure postural control, hand control, pre-writing skills, letter/number formation, and bilateral hand skills. Researchers conducted a total of 37 one hour small group sessions with the Head Start students. Graduate student researchers visited the Head Start center twice a week and started each session with a whole group motor coordination activity. Following this activity, students rotated between independent and HWT instruction centers. Students remained at each center for approximately five to ten minutes of each session.

A second experimental classroom at the Head Start center participated in the Pathways for Learning Fine Motor and Early Writing pre-K curriculum (alternative intervention). This group consisted of 16 preschool students who participated in 32 biweekly sessions with graduate occupational therapy student researchers. Students in this classroom rotated between four centers: two instructional and two independent learning centers, two times per week. The implementation schedule was similar to the HWT experimental group except four centers were available rather than two.

At the conclusion of the 2010-2011 study at the Head Start Center, results suggested that handwriting readiness programs have a positive effect on handwriting outcomes and are a beneficial addition to the Head Start curriculum. This follow-up study determined if positive changes in handwriting skill development persisted in the year following the initial handwriting instruction.

Summary

Problems related to handwriting are one of the most common reasons for referral to occupational therapy services for young students. In order for teachers and occupational therapists to more effectively address handwriting skill deficits in the classroom, more research is needed to increase the amount of evidence supporting the implementation of HWT and other handwriting programs, which enable students to reach target handwriting outcomes based on the North Carolina Department of Public Instruction standards for pre-K and Kindergarten students. The long-term effects of early handwriting instruction, specifically Handwriting Without Tears®, also needs to be investigated to determine if the design of the HWT-GSS program, implemented through a small group learning center format, serves as a strong foundation from which Kindergarten students can build from to achieve lasting handwriting and overall academic success.

CHAPTER 3: METHODOLOGY

Design

This study used a quantitative design, specifically an experimental longitudinal time series design, to measure changes in student scores on the Shore Handwriting Screening over the course of two years (intervention year plus a follow-up year). In this follow-up study, students who attended the local Head Start center in Greenville, North Carolina during the 2010-2011 school year and participated in the initial study qualified for participation. The study included children who were in an experimental group which participated in biweekly lessons over 37 weeks using the HWT-GSS curriculum during a year at Head Start, a control group, and an alternative intervention group. The time series design used a pretest and successive posttests to examine the progress students made in their handwriting abilities during preschool and to determine any longer-term impact of the HWT curriculum during the year following the program implementation. Previous researchers evaluated the effectiveness of the independent variable, HWT intervention, during the preschool year. Progress has been measured by examining the program's longer-term effects over a two year time frame of the dependent variable, which is handwriting skill as measured by scores on the Shore Handwriting Screening. The study design and procedures were submitted to and approved by the Institutional Review Board (IRB) at East Carolina University (ECU).

Subjects

There were a total of 47 students eligible to participate in this follow-up study including 14 potential participants from the control group, 18 from the HWT group, and 15 from the alternative intervention group who participated in the Fine Motor and Early Writing program. Data was analyzed for a total of 20 participating subjects at Test 2 in spring 2011 and Test 3 in

fall 2011. By the final follow-up assessment (Test 4) in the spring of 2012, the sample size decreased to a total of 16 subjects due to participant drop out. At all testing times, there was an age discrepancy between the alternative intervention group, which had a higher mean age, and the control and experimental groups. There was also an uneven distribution of male and female students among the three groups (see Table 3.1 for age and gender distribution of participants by group at Test 4). Further detail of the recruitment process for both follow-up assessment sessions will be provided in the “procedure” section.

The number of participants depended on voluntary participation and no additional recruitment was carried out. The voluntary sampling method was used to select participants because each student’s parent chose to allow his or her child to participate in the follow-up study. The main inclusion criterion for this study was that students participated in either the experimental group who received HWT instruction in addition to traditional Head Start teaching methods or were a part of the control or alternative intervention classroom during the 2010-2011 study at the Head Start center. Students were excluded from the study if the parental consent form failed to be signed and returned and/or if students did not complete both pre- and post-testing assessments from the 2010-2011 study.

Instrumentation

The Shore Handwriting Screening for Early Handwriting Development was selected as the scoring instrument for this study. The non-standardized diagnostic tool was chosen because it can be used to determine the causes of handwriting dysfunction in young children. The screening tool addressed multiple factors including postural control, somatosensory perception, functioning of the neuromuscular system, cognition, visual motor and perceptual skills, and sensory processing (Shore, 2003). The postural and hand control portions of the screening tool

included a section of “yes” or “no” responses to a series of questions about students’ positioning at their work space in the classroom, a choice of left or right hand dominance, and a space to indicate the hand grasp pattern used during the screening session. Pre-writing skills, letter/number formation, and bilateral hand skills were assessed as students drew or copied various lines, shapes, letters and numbers. Finally, the screening tool included a section of “yes” or “no” responses concerned with other aspects to be considered when assessing handwriting, such as vision, hearing, physical impairments that limit the ability to write, a student’s motivation level, and the presence of learning disabilities (see Appendix A for a copy of the Shore Handwriting Screening components used in scoring).

The screening tool allowed researchers to observe students’ performance with the component skills of handwriting (Shore, 2003). Fine motor/hand control and proprioception were observed throughout the screening tasks by noting pencil or scissor grasp patterns as well as posture and body positioning while seated at the table during writing tasks. Motor planning skills and visual-motor control were needed throughout the screening to draw lines, letters, and numbers, color a balloon, and to precisely cut a square shape. Visual perceptual skills were necessary for students to correctly copy and draw shapes from models. Students demonstrated in-hand manipulation skills and an awareness of the fingers when attempting to rotate the pencil to erase during the screening. Finally, sustained attention was observed by determining if students were able to complete the screening and remain focused as the assessment progressed and the tasks became more challenging.

There are limited standardized handwriting assessment tools available for preschool or kindergarten age students and published research concerning the reliability and validity of the Shore Handwriting Screening tool is not available. Regardless of the fact that the screening tool

is not standardized, the Shore Handwriting Screening (SHS) is available for use as a part of a comprehensive evaluation when working with 4-6 year old students who present handwriting problems (Shore, 2003).

The data generated from this screening were at a low nominal level of measurement. Researchers developed scoring criteria which was used for this study in order to quantify information gathered (see Appendix B). The SHS was scored three different ways resulting in three percentage scores per student per test administration. The screening tool had two components. One portion of the screening tool was designed to be administered to children ages 3-5 years while a second portion was created for children 6 years of age and older. However, no clear component was indicated for child between 5 and 6 years of age, which all children would have been during some point of the study. Therefore, all components (those for 3-5 year olds and 6 and older) were administered to each child (Test 2-4) and three different ways of scoring were developed and considered. The younger portion is a percentage for the components in the 3-5 year old child (47 points possible). This was the only portion of the screen administered during Test 1. The older portion is the score for the components for children 6 years and older (47 points possible). The comprehensive score is the sum of points for the items exclusively on the younger portion of the screen, the items exclusively on the older portion of the screen, and the components that are shared between both age ranges (69 points possible).

During Test 1 (fall 2010), students were only assessed on the younger portion of the SHS resulting in a single percentage score. Students completed the comprehensive assessment during Tests 2, 3, 4 and received a total of three percentage scores (younger, older, and comprehensive). There are currently no norms to which scores can be compared. Rather, this study compared the

differences in scores for each individual student between pre- and post-tests and the difference in mean scores between the control, alternative intervention, and experimental (HWT) groups.

Procedure

At the end of the preschool year, parents were asked to sign a second consent form at the Head Start center stating their child had permission to remain in the handwriting study throughout the year following the initial study and that researchers were allowed to contact them directly to schedule follow-up assessment appointments. Consent forms were initially administered by the Head Start classroom teachers. At the conclusion of the 2010-2011 preschool year, one teacher had not received any signed permission forms; therefore, an alternative recruitment strategy was created and approved by the IRB. Researchers returned to the Head Start center during the summer of 2011 to contact parents by phone and mail a consent form to the home of each qualified student explaining the purpose and details of the study. The consent form also stated that parents or other caregivers were responsible for bringing their child into the East Carolina University Occupational Therapy department at scheduled times for two assessment sessions and for remaining at the testing site for the duration of each assessment. Interested parents were asked to return the signed consent form to the principal investigator at East Carolina University via postage paid mail. However, only one parent returned a consent form following this second attempt to recruit participants; therefore, researchers returned to the Head Start center in September 2011 to call parents again. Post cards with limited information about the study and information about how to contact ECU researchers to schedule an appointment were mailed out.

After the recruitment process was completed and participants were identified, the research subjects completed a total of four handwriting assessments over the course of two years.

A pretest was administered in the fall of 2010 (Test 1) at the local Head Start center. Students were post- tested, also at the Head Start center, in the spring of 2011 (Test 2) to determine the amount of progress made during the intervention year. The students were reassessed during the follow-up year in the fall of 2011 (Test 3) and the spring of 2012 (Test 4) at the East Carolina University occupational therapy department to determine the long-term impact of the occupational therapy based handwriting interventions that were implemented during the prior year. See Table 3.2 for a timeline of student assessments.

Study participants were rewarded with a \$25 Walmart gift card at each visit during the second year of the study and an additional \$25 gift card at the end of the study if the student attended both sessions (fall 2011 and spring 2012) and completed all assessments.

Students presented to the ECU Occupational Therapy department for the follow-up assessments in fall 2011 and spring 2012, where the Shore Handwriting Screening was administered by a trained graduate student researcher on an individual basis. The testing environment was kept as consistent as possible throughout the series of posttests and the same examiner administered and scored the screening tool during both follow-up year posttest sessions. Assessments were coded upon administration and scored hours after students were seen in the department. Scores were also reviewed weeks later to ensure accuracy. After all assessments were completed and scored, data was added to the computer spreadsheet from the 2010-2011 preschool year.

At the conclusion of the study in spring 2012, data was added to the previously created spreadsheet. Researchers analyzed the data to determine if students displayed a difference in handwriting abilities from the previous year. Researchers used the data to compare the differences in handwriting abilities, as measured by the assessment tool, between the control,

alternative intervention, and HWT experimental groups to determine if students who formerly participated in the HWT program made greater progress in developing skills in areas that affect handwriting ability during the follow-up year than peers in the control and alternative intervention groups. Review of the data and statistical analysis from the pretest and successive posttests allowed conclusions to be drawn about the longer-term impact of the preschool Handwriting Without Tears® program on the handwriting abilities of students.

Table 3.1

Age and gender distribution by group at Test 4

| | Male | Female | Total | Average Age |
|--------------------------|------|--------|-------|--------------|
| Control | 4 | 0 | 4 | 66.25 months |
| HWT | 2 | 4 | 6 | 69.3 months |
| Alternative Intervention | 1 | 5 | 6 | 74.5 months |

Table 3.2

Timeline of Assessments

| Testing Session | Date |
|-----------------|----------------------------|
| Test 1 | September 2010 |
| Intervention | September 2010- March 2011 |
| Test 2 | March 2011 |
| Test 3 | September 2011 |
| Test 4 | March 2012 |

CHAPTER 4: RESULTS

Researchers' primary goal with this study was to determine the impact of the Handwriting Without Tears® Get Set for School program on handwriting abilities one year following intervention in comparison to control and alternative handwriting intervention curricula. Researchers specifically sought to determine if the HWT-GSS program had greater carry-over effects on the handwriting abilities of young students one year following intervention.

Data, scores on the Shore Handwriting Screening, were previously analyzed during the preschool year (2010-2011), and this current study primarily focused on the data gathered and analyzed during the follow-up year (2011-2012). Shore Handwriting Screening (SHS) scores were calculated and analyzed after each screening session in order to monitor changes in performance within and between the Handwriting Without Tears® experimental group, the control group, and the alternative intervention group. Numerous box plots were created, and researchers reviewed the plots to determine if outliers were present and to visualize the variability of the data.

Results of this follow-up study showed the HWT curriculum did not have greater carry-over effects on student handwriting abilities in comparison to traditional teaching methods (control group). When looking at mean change in percentage scores in spring 2012, the control group had a greater mean change than the HWT group on the younger and older sections of the SHS as well as the comprehensive assessment (see Tables 4.1, 4.2, and 4.3). However, the HWT group did show greater mean changes in scores when compared to the alternative intervention group.

Younger Portion of SHS

Data analysis from fall 2011 (Test 3) showed the median score for the control group on the younger portion of the SHS was 72.5% while the HWT group had a median score of 78.25% and the alternative intervention group had a median of 89%. In spring 2012 (Test 4), the control and HWT group medians increased to 86% and the alternative intervention group median remained at 89%. The range of scores within the Handwriting Without Tears® and the alternative intervention groups narrowed during the Test 3 and Test 4 assessment sessions, while the control group who received traditional teaching methods while at Head Start did not show this trend (see Figure 4.1).

When looking at individual test scores, some interesting facts were noted. Percentage scores for each student on the three to five- year-old section of the SHS showed that students in all three groups generally exhibited an improvement in scores over time (see Figure 4.1). However, some students did not have a continuous upward trend in percentage score over the course of the study; rather, their scores fluctuated up and down between testing sessions (see Table 4.4). For example, child number 129 scored 93.6% on Test 1 followed by 70.2% on Test 2, 91% on Test 3 and 89% on Test 4 (see Table 4.4). One student in each of the groups scored much lower than peers on Test 2 (20-36% below the group means). Although these students remained the lowest scoring across the follow-up assessment times, their percentage scores increased 26-45% by Test 4.

Older Portion of the SHS

The box plots comparing the scores for the portion of the test designated for children 6 years of age and older generally showed improvements in students' scores between Tests 2, 3, and 4 with a few students making drastic progress (see Figure 4.2 and Table 4.5). In fall 2011

(Test 3) the median score for the control group was 56%, HWT 59.5%, and alternative intervention 87%. All group median scores increased by spring 2012 (Test 4) to 86% for the control group, 84% for the HWT group, and 96% for the alternative intervention group. After looking at the differences between scores on Test 4 versus Test 2, it was determined that the lowest scoring students in the control and HWT groups scored 6.9-35.8% higher on Test 4 (spring 2012) than Test 2 (spring 2011). The student in the alternative intervention group who was an outlier in the spring of 2011 (Test 2) improved 54.9% by Test 4 (spring 12). A large increase in scores on this portion of the screening was expected because the children were not yet six years old when the section was completed during Test 2 but many were 6 years old by Test 4.

Comprehensive SHS

When looking at the box plots for comprehensive percentage scores on the SHS, a similar trend of the dispersion of scores narrowing within the HWT and alternative intervention groups over time was observed (see Figure 4.3). Individual scores also generally improved over time (see Table 4.6). The median scores in fall 2011 (Test 3) were as follows: control group median 60%, HWT group median 64.5%, and alternative intervention group median 87.5%. By spring 2012 (Test 4), group medians had increased to 87%, 86.5%, and 94% respectively.

Individual points of interest were noted when looking at the comprehensive SHS scores as well. One student in the alternative intervention group was an outlier in the spring of 2011 (Test 2) and the fall of 2011 (Test 3) due to scoring at least 29% lower than peers on Test 2 and 12% lower on Test 3. However, this child demonstrated a large increase in score on the comprehensive screening on Test 4 with a 57.6% increase from Test 2 and was no longer considered an outlier. A student in the control group also demonstrated a large improvement in score from Test 2 to Tests 3 and 4 with a 51% increase in score (see Table 4.6).

Descriptive Statistics

Younger portion of the SHS. Descriptive statistics were calculated to analyze the mean change in percentage scores within each group during year one (Test 1 to Test 2) of the study, during the time from Test 1 to Test 3, and the time between Tests 1 and 4. The mean change during year one (initial year of study) for the younger portion of the SHS in the HWT group was 7.75 percentage points higher than the control group (see Table 4.1). Data from this study of the follow-up year found that the mean change in scores for the younger section of the SHS increased by fall 2011 and spring 2012 in all three groups. The HWT group continued to have a greater mean change than the control group (6.7 percentage points) from Test 1-3 but did not have the greatest mean change at Test 4 (mean change 0.3% less than the control group). Mean changes at Tests 2 and 3 were based on a sample size (N) of 20 (4 control, 9 HWT, 7 alternative intervention) while mean change at Test 4 was based on a sample size (N) of 16 (4 control, 6 HWT, 6 alternative intervention).

Comprehensive and Older Portions of the SHS. The differences in means for the scores on the comprehensive SHS, as well as the older portion of the screening, in fall 2011 and spring 2012 were calculated by comparing the scores from Test 2 to Test 3 or 4 respectively. When comparing the mean differences in fall 2011 versus spring 2012, the mean score increased by at least 5.5% in all three groups on the comprehensive assessment and at least 9.2% on the older portions (see Tables 4.2 and 4.3). The increase in mean comprehensive score was expected because the students generally scored higher in the spring of 2012 on the older section of the SHS than in fall 2011. Figure 4.4 depicts the mean changes in comprehensive SHS scores from Test 2-Test 4 for each group.

Figures

Figure 4.1. Distribution of Percentage Scores on the Younger Portion of the SHS by group at each screening session. Median scores for the control and HWT groups increased by Test 4 while the median for the alternative intervention group remained the same at Test 3 and Test 4. The range of scores within the Handwriting Without Tears® and the alternative intervention groups narrowed during the Test 3 and Test 4 assessment sessions, while the control group who received traditional teaching methods while at Head Start did not show this trend.

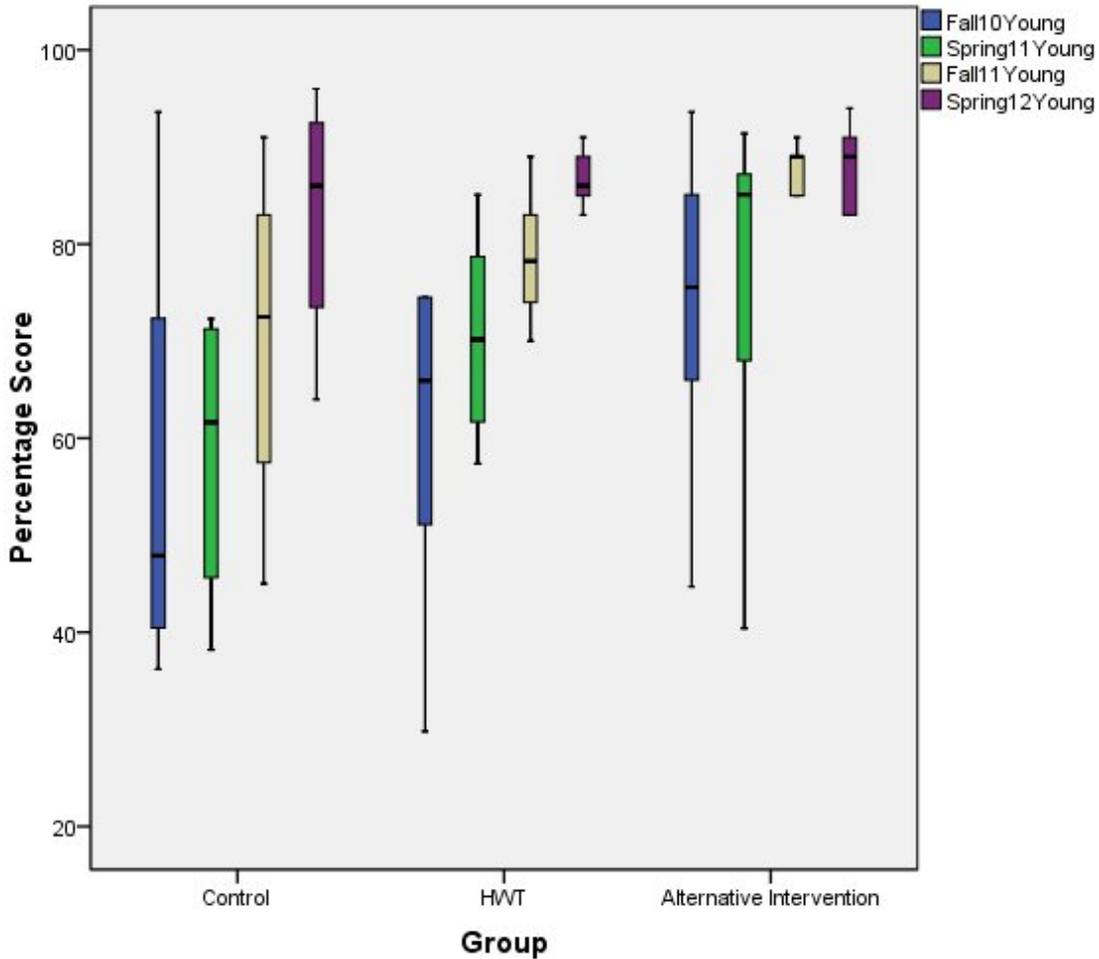


Figure 4.2 Distribution of Percentage Scores on the Older Portion of the SHS by group at each screening session. All group median scores increased by spring 2012 (Test 4).

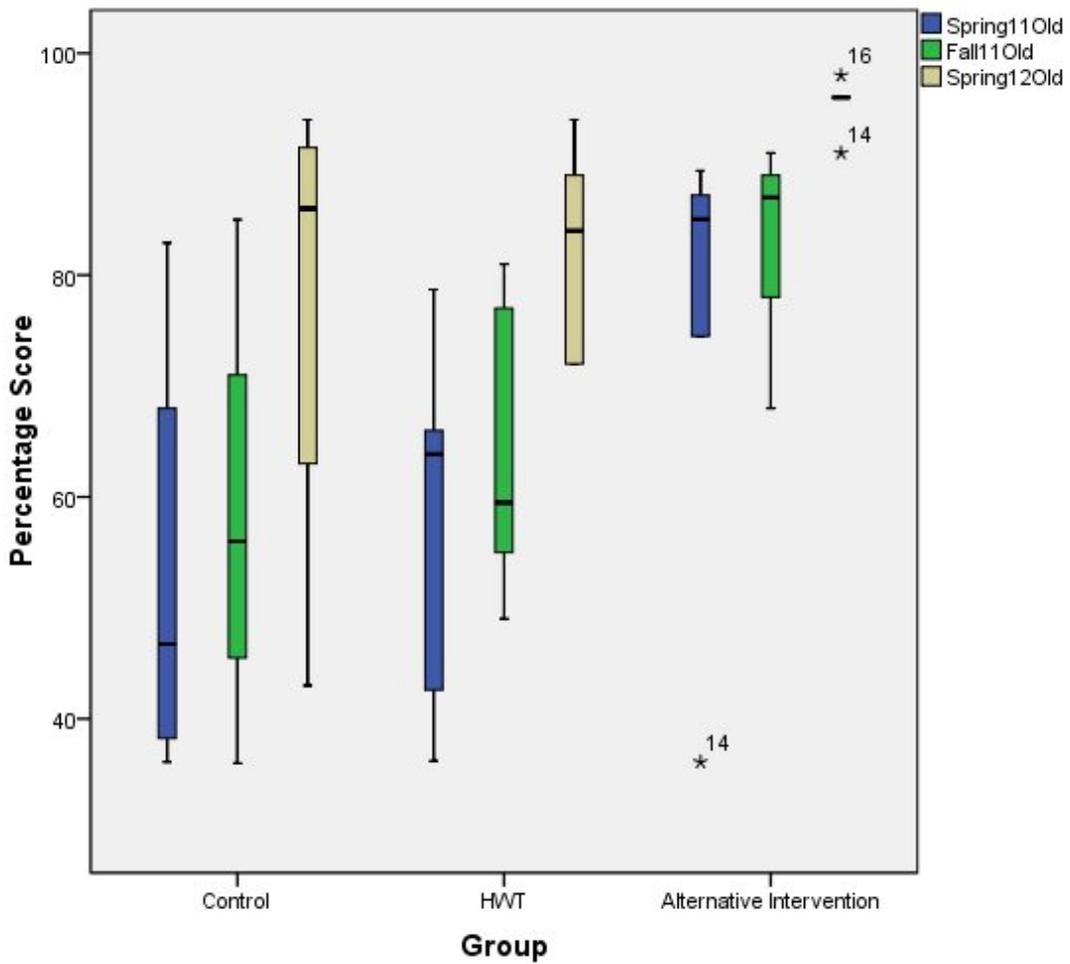


Figure 4.3 Distribution of Percentage Scores for the Comprehensive SHS by group at each screening session. An increase in median score for all groups and a narrowing of the dispersion of scores for the HWT and alternative intervention groups was observed over time.

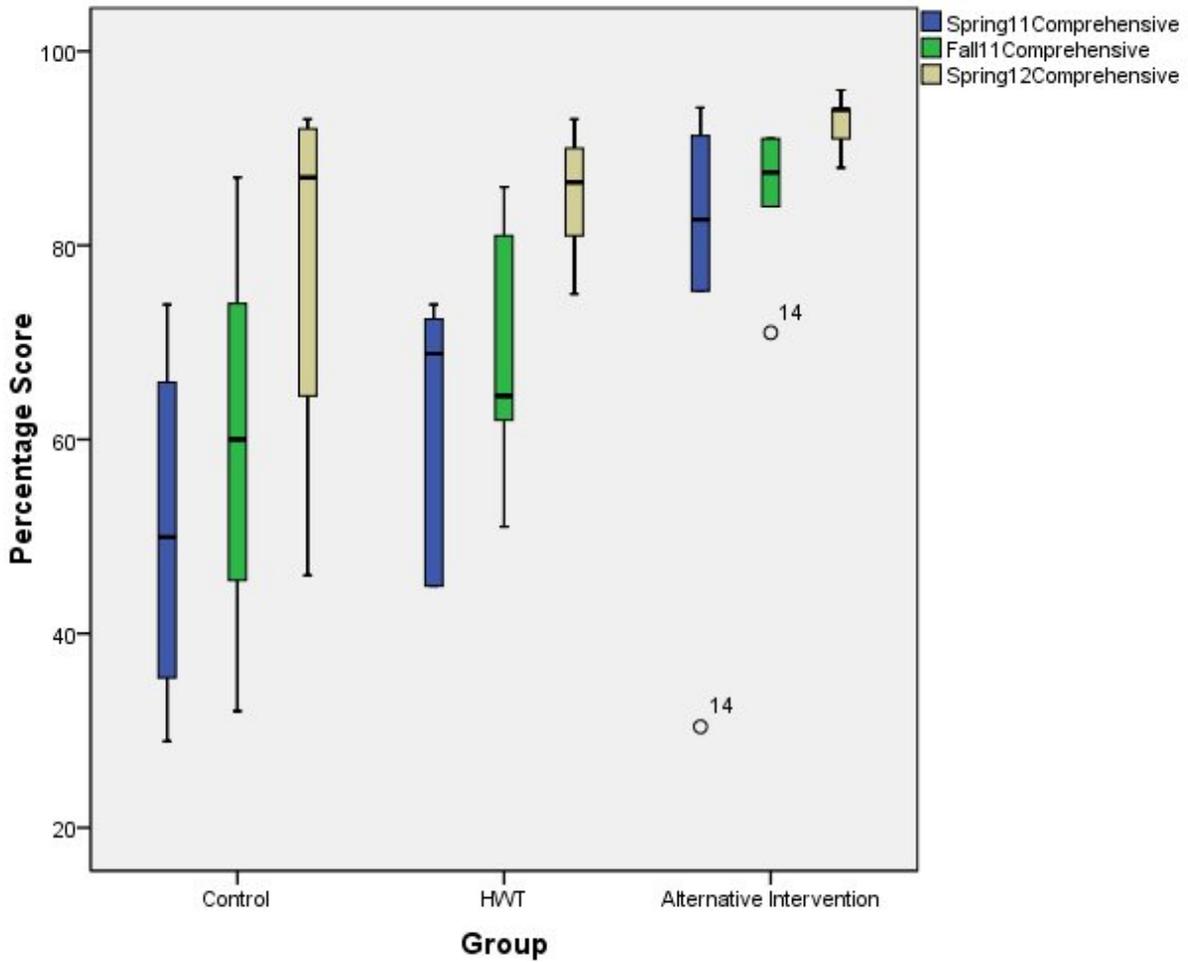
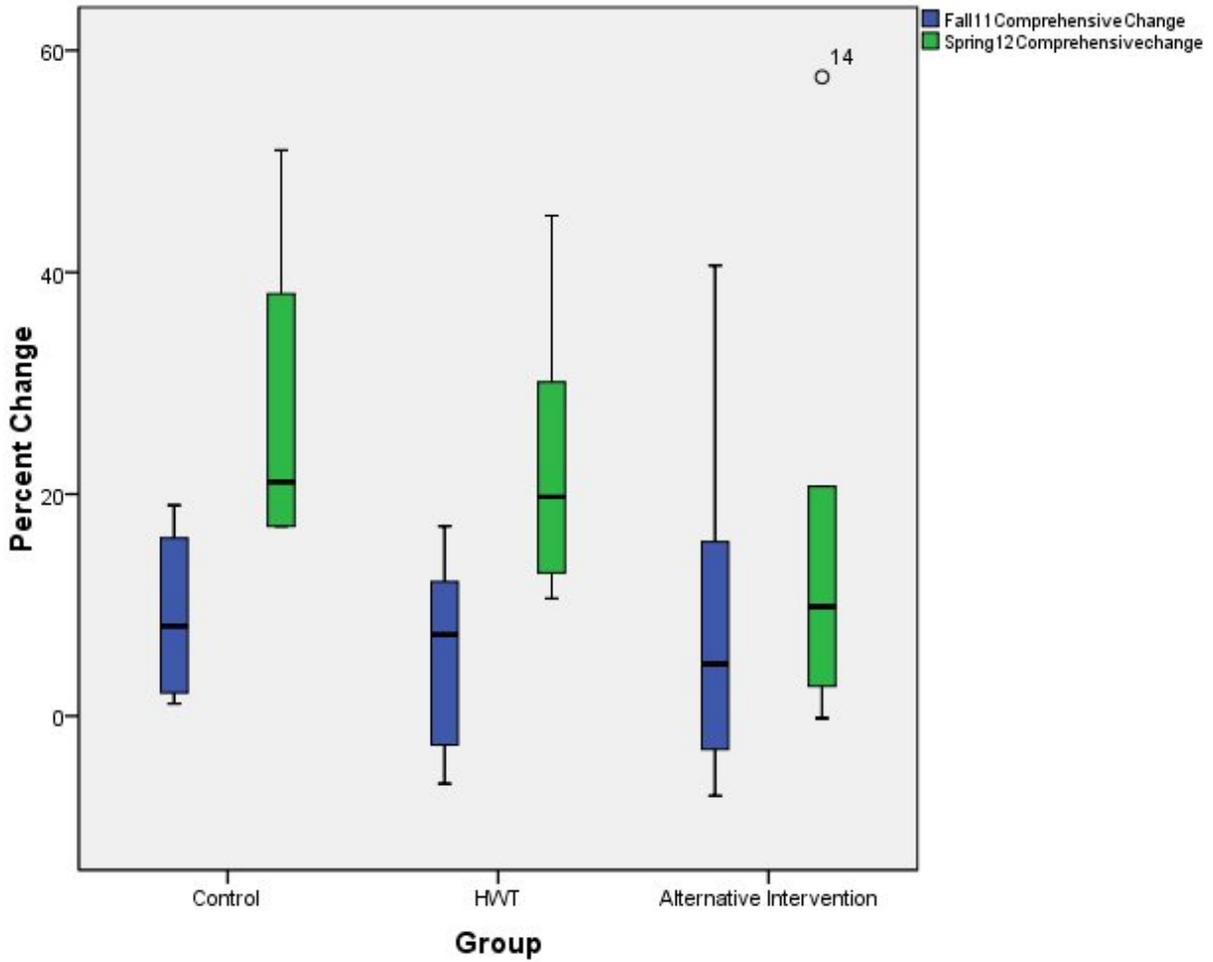


Figure 4.4 Changes in Mean Comprehensive SHS Scores from Test 2 to Test 4 for the Control, HWT, and Alternative Intervention Groups.



Tables

Table 4.1

Mean change in percentage scores for the younger portion of the SHS

| Group | Sample Size (N=20) | Mean Change Test 1-Test 2 | Mean Change Test 1-Test 3 | Sample Size (N=16) | Mean Change Test 1-Test 4 |
|--------------------------|-----------------------|------------------------------|------------------------------|-----------------------|------------------------------|
| Control | 4 | 2.05 | 13.8 | 4 | 26.6 |
| HWT | 9 | 9.8 | 20.5 | 6 | 26.3 |
| Alternative Intervention | 7 | 5.1 | 16.4 | 6 | 14.7 |

Table 4.2

Mean change in percentage scores for the older portion of the SHS

| Group | Sample Size (N=20) | Mean Change Test 2-Test 3 | Sample Size (N=16) | Mean Change Test 2-Test 4 |
|--------------------------|-----------------------|------------------------------|-----------------------|------------------------------|
| Control | 4 | 5.1 | 4 | 24.1 |
| HWT | 9 | 4.5 | 6 | 23.9 |
| Alternative Intervention | 7 | 10.1 | 6 | 19.3 |

Table 4.3

Mean change in percentage scores for the comprehensive SHS

| Group | Sample Size (N=20) | Mean Change Test 2-Test 3 | Sample Size (N=16) | Mean Change Test 2-Test 4 |
|--------------------------|-----------------------|------------------------------|-----------------------|------------------------------|
| Control | 4 | 9.08 | 4 | 27.6 |
| HWT | 9 | 7.5 | 6 | 23 |
| Alternative Intervention | 7 | 11.3 | 6 | 16.8 |

Table 4.4

Student percentage scores on the younger portion of the Shore Handwriting Screening

| Student ID | Group | Test 1 | Test 2 | Test 3 | Test 4 | Percent Change (Highest-Lowest Score) | Percent Change (Test 1- Test 4) |
|-------------------|--------------|---------------|---------------|---------------|---------------|--|--|
| 105 | 1 | 44.7 | 72.3 | 75 | 83 | 38.3 | 38.3 |
| 127 | 1 | 51.1 | 53.1 | 70 | 96 | 44.9 | 44.9 |
| 129 | 1 | 93.6 | 70.2 | 91 | 89 | 23.4 | -4.6 |
| 145 | 1 | 36.2 | 38.2 | 45 | 64 | 27.8 | 27.8 |
| 108 | 2 | 68.1 | 85.1 | 80 | 91 | 22.9 | 22.9 |
| 115 | 2 | 74.5 | 68 | 83 | 85 | 17 | 10.5 |
| 119 | 2 | 29.8 | 57.4 | 74 | 87 | 57.2 | 57.2 |
| 125 | 2 | 78.7 | 91.4 | 89 | * | 12.7 | * |
| 130 | 2 | 48.9 | 65.9 | 85 | * | 36.1 | * |
| 133 | 2 | 63.8 | 72.3 | 76.5 | 89 | 25.2 | 25.2 |
| 140 | 2 | 51.1 | 61.7 | 70 | 83 | 31.9 | 31.9 |
| 150 | 2 | 74.5 | 78.7 | 89 | 85 | 14.5 | 10.5 |
| 156 | 2 | 36.2 | 34 | 64 | * | 30 | * |
| 117 | 3 | 85.1 | 85.1 | 89 | 94 | 8.9 | 8.9 |
| 120 | 3 | 74.5 | 85.1 | 85 | 83 | 10.5 | 8.5 |
| 122 | 3 | 93.6 | 91.4 | 89 | 91 | 4.6 | -2.6 |
| 136 | 3 | 59.6 | 78.7 | 87 | * | 27.4 | * |
| 137 | 3 | 44.7 | 40.4 | 85 | 83 | 44.6 | 38.3 |
| 139 | 3 | 76.6 | 87.2 | 89 | 87 | 12.4 | 10.4 |
| 155 | 3 | 66 | 68 | 91 | 91 | 25 | 25 |

Note. Group 1= control group, Group 2= HWT group, and Group 3= alternative intervention group.

*Unable to calculate due to participant dropout.

Table 4.5

Student percentage scores on the older portion of the Shore Handwriting Screening

| Student ID | Group | Test 2 | Test 3 | Test 4 | Percent Change (Highest-Lowest Score) |
|-------------------|--------------|---------------|---------------|---------------|--|
| 105 | 1 | 53.1 | 55 | 83 | 29.9 |
| 127 | 1 | 40.4 | 57 | 89 | 48.6 |
| 129 | 1 | 82.9 | 85 | 94 | 11.1 |
| 145 | 1 | 36.1 | 36 | 43 | 7 |
| 108 | 2 | 66 | 62 | 89 | 27 |
| 115 | 2 | 78.7 | 77 | 81 | 4 |
| 119 | 2 | 42.6 | 55 | 87 | 44.4 |
| 125 | 2 | 82.9 | 79 | * | 3.9 |
| 130 | 2 | 46.8 | 55 | * | 8.2 |
| 133 | 2 | 61.7 | 57 | 72 | 10.3 |
| 140 | 2 | 36.2 | 49 | 72 | 35.8 |
| 150 | 2 | 66 | 81 | 94 | 28 |
| 156 | 2 | 29.7 | 36 | * | 6.3 |
| 117 | 3 | 87.2 | 78 | 96 | 18 |
| 120 | 3 | 74.5 | 89 | 96 | 21.5 |
| 122 | 3 | 87.2 | 87 | 96 | 9 |
| 136 | 3 | 53.2 | 81 | * | 27.8 |
| 137 | 3 | 36.1 | 68 | 91 | 54.9 |
| 139 | 3 | 89.4 | 87 | 96 | 9 |
| 155 | 3 | 82.9 | 91 | 98 | 15.1 |

Note. Group 1= control group, Group 2= HWT group, and Group 3= alternative intervention group.

*Unable to calculate due to participant dropout.

Table 4.6

Student percentage scores on the comprehensive Shore Handwriting Screening

| Student ID | Group | Test 2 | Test 3 | Test 4 | Percent Change (Highest-Lowest Score) |
|-------------------|--------------|---------------|---------------|---------------|--|
| 105 | 1 | 57.9 | 59 | 83 | 25.1 |
| 127 | 1 | 42 | 61 | 93 | 51 |
| 129 | 1 | 73.9 | 87 | 91 | 17.1 |
| 145 | 1 | 28.9 | 32 | 46 | 17.1 |
| 108 | 2 | 69.6 | 67 | 93 | 23.4 |
| 115 | 2 | 72.4 | 81 | 83 | 10.6 |
| 119 | 2 | 44.9 | 62 | 90 | 45.1 |
| 125 | 2 | 85.5 | 83 | * | 2.5 |
| 130 | 2 | 52.1 | 65 | * | 12.9 |
| 133 | 2 | 68.1 | 62 | 81 | 19 |
| 140 | 2 | 44.9 | 51 | 75 | 30.1 |
| 150 | 2 | 73.9 | 86 | 90 | 16.1 |
| 156 | 2 | 24.6 | 46.3 | * | 21.7 |
| 117 | 3 | 87 | 84 | 94 | 10 |
| 120 | 3 | 78.3 | 88 | 91 | 12.7 |
| 122 | 3 | 91.3 | 91 | 94 | 3 |
| 136 | 3 | 59.4 | 83 | * | 23.6 |
| 137 | 3 | 30.4 | 71 | 88 | 57.6 |
| 139 | 3 | 94.2 | 87 | 94 | 7.2 |
| 155 | 3 | 75.3 | 91 | 96 | 20.7 |

Note. Group 1= control group, Group 2= HWT group, and Group 3= alternative intervention group.

*Unable to calculate due to participant dropout.

CHAPTER 5: DISCUSSION

When looking at individual student progress, results of this study suggest that students who received Handwriting Without Tears®-Get Set for School (HWT-GSS) instruction while in preschool demonstrated immediate and longer-term (one year following intervention) positive outcomes on handwriting readiness skills. However, scores on the SHS revealed the effectiveness of the HWT program was not superior to traditional teaching methods when comparing the experimental group's change in mean score on the SHS to the change in mean score for the control group over time. As a group, students who participated in the HWT-GSS program while in preschool at the local Head Start center did not show a greater mean change in score on the comprehensive Shore Handwriting Screening than peers in the control and alternative intervention groups at Test 3 of the study nor did the HWT group demonstrate a greater mean change at the conclusion of the follow-up study (Test 4) than the control group (see Table 4.3).

The boxplots generated for the younger and older sections of the SHS revealed some interesting trends (see Figures 4.1 and 4.2). When looking at the younger and older portions of the SHS, all groups showed an increase in median percentage score. The narrowing of student scores across time in the groups who participated in a handwriting curriculum, signifying that students who earned a lower percentage score at earlier testing sessions demonstrated improvement in performance (score increase) at Test 4, supports the use of a handwriting curriculum to at least improve the skills of the lower performing students.

The HWT group had the greatest change in mean percentage score between Test 1- Test 2 and Test 1-Test 3 on the younger section of the screening tool, but the control group had a slightly greater mean change in percentage score from Test 1- Test 4 (see Table 4.1). This fact

could suggest that the HWT program had greater effects on handwriting abilities immediately following intervention (Test 2) and after a brief period of no formal handwriting instruction (Test 3) than traditional teaching methods but not a significantly greater impact one year following intervention (Test 4). This finding could also be attributed to the small sample of participants in each group, which may not have been representative of the population in each classroom as a whole.

Students in the control and HWT groups demonstrated a larger increase in median score on the older portion of the SHS from Test 2-Test 4 than the alternative intervention group (see Figure 4.2). While median score did increase for the alternative intervention group on the older portion of the screening, the increase was not as large. This fact could be due to the ceiling effect. Students in this group were older and scored higher on the older section of the screening during Test 2 than students in the other groups; therefore, there was less room for improvement in this group.

Percentage scores for the control group on the comprehensive SHS showed that all students exhibited improvement over time and the group median score increased (See Figure 4.3 and Table 4.6). Many students in the Handwriting Without Tears® group showed improvement in percentage scores on the comprehensive SHS over time as well (see Table 4.6). Figure 4.3 displays that the median score for the HWT group decreased from spring 2011(Test 2) to fall 2011(Test 3) but increased by spring 2012 (Test 4). This fact could be due to a lack of handwriting practice over the summer months and then resuming regular handwriting practice during the kindergarten year. The dispersion of scores narrowed over time in this group as well, which suggests that the students who had scored lower than peers during the earlier assessment sessions had made gains in their handwriting abilities such that scores across a given group had

become more similar. Finally, percentage scores on the comprehensive SHS for the alternative intervention group followed similar trends as the HWT group (see Figure 4.3). Many students showed improvement in percentage score, the group median and mean increased, and the dispersion of scores narrowed over time. This fact supports that the use of a structured handwriting program helped those struggling most with handwriting skills to improve handwriting abilities and to be more on the same skill level as classroom peers.

Results of scores on the Shore Handwriting Screening from fall 2011 and spring 2012 (Tests 3 and Test 4) showed that the underlying skills for handwriting continued to improve in all three groups one year following intervention. While the preschool curriculums may have influenced an improvement in handwriting skills, other factors, such as continued handwriting practice in kindergarten and maturation, may have also impacted students' improvement in performance on the SHS.

Study results suggest that all students who participated in some form of handwriting instruction during the preschool year made progress in developing the skills identified by the North Carolina Department of Public Instruction as important at both the preschool and kindergarten levels. Students in all groups demonstrated the ability to continue developing handwriting skills in kindergarten from the foundation formed during the preschool/intervention year. Although research does not suggest one program to be superior over another, both intervention groups appeared to more effectively improve the handwriting skills of the lowest performing students than traditional teaching methods.

As previously mentioned, much research has been conducted to support the fact that handwriting readiness programs are a beneficial component of preschool curriculums, such as the programs offered at the Head Start center. While results of this study do not indicate that the

HWT-GSS program, conducted twice a week in a small group format, offers superior outcomes when compared to control and alternative interventions, results do support that there are positive changes in handwriting skill development which persist in the year following initial handwriting instruction when looking at individual student progress. More research needs to be conducted in order to determine if the HWT-GSS program enables students to better reach target handwriting outcomes one year following intervention than peers who participated in other handwriting instruction curriculums. Additional exploration is needed to determine if the HWT-GSS preschool program has the potential to provide a stronger foundation from which students can build from to meet the North Carolina Department of Public Instruction standards for kindergarten-age students when compared to traditional teaching methods and alternative interventions.

Ethical Issues

This study included few ethical issues. One possible concern is that Dr. Donica, principal investigator, is a part-time employee of Handwriting Without Tears. This affiliation has slight potential to introduce bias to the study, and a conscious effort was made to ensure the study remained objective. Dr. Donica only participated in the study as an advisor/overseer and did not administer or score any student assessments. A second possible ethical issue is related to offering gift cards as a reward for participation, which could be viewed as coercion; however, researchers clearly explained in the study informed consent form how the gift cards would be rendered and parents were free to choose to participate in the study with an understanding of how the compensation would be rewarded.

Safeguards were in place to avoid potential ethical issues in this study in that each student's parent or guardian acknowledged that they were aware of the study procedure and

requirements by signing the informed consent form prior to beginning the study. All data (results of screening tool) were kept confidential by coding the identifying information and keeping files in a locked cabinet and computer system.

Implications for Occupational Therapists and Teachers

As previously mentioned, difficulties with handwriting skills are one of the most frequently reported reasons for the referral of young students to school-based occupational therapy. As a result, occupational therapists working in school systems are often overwhelmed with large numbers of referrals for handwriting. This research, as well as other studies, indicates that teachers and occupational therapists should take note of the benefits of having students participate in a variety of handwriting activities in order to increase hand strength, dexterity, and other handwriting readiness skills (Cahill, 2009). The design of the HWT-GSS curriculum, as well as the other programs included in this study, provide students with opportunities for repetitive engagement in an array of activities which contribute to handwriting skill development. Study results suggest that the design of all handwriting instruction methods used at the Head Start center provided students with sufficient opportunities for repetitive engagement in a variety of activities which contributed to handwriting skill development, but having a structured handwriting curriculum in place may assist those students most at risk for handwriting delays in kindergarten develop foundational skills to foster future success.

Conclusion

As previously mentioned, the research question posed with this study was as follows: Does the preschool Handwriting Without Tears® program have a greater impact on the writing abilities of young students one year post intervention, as indicated by a greater increase in mean percentage score on the Shore Handwriting Screening, than traditional teaching methods

(control) or an alternative intervention? Study results suggest that participation in the Handwriting Without Tears- Get Set for School® program does not lead to greater positive effects on the handwriting-readiness skills of young students, as measured by the Shore Handwriting Screening, during the year following intervention.

The results of this study raise the question of why this study did not show the same significant changes as other research. This fact could be attributed to the study design (small group, center-based instruction vs. full-classroom training) and/or the smaller sample size. The four students representing the control classroom, the six participants from the HWT classroom or the six students who were a part of the alternative intervention group at Test 4 may not be representative of the performance of all students in the different groups as a whole.

Of particular interest, researchers questioned why the Lust and Donica (2011) study, conducted using a similar study design and sample population, showed the HWT-GSS program to have statistically significant superior results on handwriting readiness skills in comparison to a control group, which received standard Head Start handwriting instruction, and this current study did not. This fact may be attributed to the following details of the Lust and Donica (2011) study design: (1) A combination of three different instruments were used, including a criterion-referenced assessment and a standardized test, to assess student's abilities at both a pre-test and a post-test which increases test-retest reliability; (2) Intervention was provided three times per week and researchers provided suggested teacher follow-up activities to be used on days researchers did not provide handwriting instruction; (3) A larger sample of students participated in the study (n=32) and the students in each group were similar in terms of average age and performance abilities at the time of pre-test.

Recommendations for Future Research

Future research needs to be conducted in order to generate further evidence of the long-term effectiveness of the preschool Handwriting Without Tears ® program. Such research should include a larger sample size in order to increase the power of statistical analysis. Different assessment tools that are more sensitive to the handwriting related changes made because of the participation in the program may be warranted. The power of evidence generated from future studies will also be greater if a standardized assessment tool is used as it would increase the reliability and validity of the data. Reliability of future research could also be improved by increasing the level of environmental consistency over the course of an extended study.

A more rigorous recruitment strategy could be used to select participants in a random manner. It would be beneficial to select an equal number of students to be in each group and to compose each group of students who are of more similar age, gender distribution, and performance on the initial screening.

Handwriting is an area of school-based occupational therapy practice that is in need of additional empirical data to support the use of specific assessment and instructional methods to teach students the necessary handwriting skills to create functional written text. Regardless of the methods used to teach handwriting, research reveals that students benefit from structured handwriting instruction (Kiss, 2007; Lust & Donica, 2011; Owens, 2004). Occupational therapists must provide valuable information about the importance of early handwriting instruction and occupational therapy- based handwriting curriculums to school systems in order to assist in developing effective instructional strategies to ultimately improve students' ability to communicate in written form.

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APPENDIX A

Shore Handwriting Screening Components Used in Scoring

- **Postural Control** (4 points max)
 - Overall posture at desk
- **Hand Control** (15 points max)
 - Dominance
 - Grasp
 - Vertical strokes from demonstration
 - Rotate pencil to erase
- **Prewriting Skills** (4 points max)
 - Copy from demonstration
- **Letter/Number Formation** (14 points max)
 - Draw a person
 - Copy the word LOFT
- **Bilateral Hand Skills** (10 points max)
 - Coloring
 - Use of non-dominant hand with coloring
 - Cutting a square

APPENDIX B

SHORE Score Sheet

_____ 1f. Postural Control

Appropriate sitting posture (ankle-knee-hip 90-90-90) = 4 pts
if 1 box checked = 3 pts
If 2 boxes checked = 2 pts
If 3 boxes checked = 1 pts
If 4 or more boxes checked = 0 pts

Comments:

_____ 2. a. Dominance (Lt Rt) circle if dominance present

Demonstrates hand dominance = 3 pts
Inconsistent dominance = 1pts

Comments:

_____ 2c. Hand Control

Mature pencil grasp pattern (2 choices) = 4 pts
Transitional pencil grasp pattern (2 choices) = 2 pts
Immature pencil grasp pattern (2 choices) = 1 pt

Comments:

_____ 2d. Vertical Lines on page A

All independent single vertical lines = 4 pts
1-2 Vertical lines present but not distinct individual lines = 2pts
No vertical lines = 0 pts

Comments:

_____ 2d (6+). Printing Name

Name is printed and all letters are distinguishable = 4 pts
50% of letters attempted are distinguishable = 3 pts
First letter of first name is distinguishable but no others = 2 pts
Individual letters were attempted but not recognizable = 1pt
Only scribbles or no marks attempted = 0 pts

Comments:

_____ 2e. Rotate Pencil to Erase

Can rotate pencil with 1 hand without dropping (yes for both questions) = 4 pts
Can rotate pencil but required 2 hands to rotate easily = 2 pts
Other hand helped in unusual or awkward way = 1 pt
Unable to do = 0 pts

Comments:

_____ 3a. Copies Row of Shapes after demonstration on page A (lines of + must intersect)

Accurately draws 4 out of 4 shapes = 4 pts

Accurately draws 3 out of 4 shapes = 3 pts
Accurately draws 2 out of 4 shapes = 2 pts
Accurately draws 1 out of 4 shapes = 1 pt

Comments:

3a (6+)

Copies Rows of 8 Shapes page B (lines of + must intersect)

Accurately draws 7-8 out of 8 shapes with necessary sides and curves or angles = 4 pts

Accurately draws 5-6 out of 8 shapes with necessary sides and curves or angles = 3 pts

Accurately draws 3-4 out of 8 shapes = 2 pts

Accurately draws 1-2 out of 8 shapes = 1 pt

Comments:

4a. Draw a Person on page B

Record number of body parts, maximum # of parts is 10

(head, eyes, nose, mouth, ears or hair, body, arms, hands, legs, feet)

Comments:

4c. Copy the Word LOFT on page B

Accurately draws 4 out of 4 letters = 4 pts

Accurately draws 3 out of 4 letters = 3 pts

Accurately draws 2 out of 4 letters = 2 pts

Accurately draws 1 out of 4 Letters = 1 pt

Comments:

4a (6+) *Printing Numbers*

Able to print 9-11 numbers out of 11 legibly = 5 pts

Able to print 7-8 numbers out of 11 legibly = 4 pts

Able to print 5-6 numbers out of 11 legibly = 3 pts

Able to print 3-4 numbers out of 11 legibly = 2 pts

Able to print 1-2 numbers out of 11 legibly = 1 pt

ADD and EXTRA 2 points to score if >50% of numbers were printed from memory

ADD and EXTRA 1 point to score if 10-50% of numbers were printed from memory.

Comments:

4b(6+) *Copying the Date*

Copy the date accurately and legibly with >75% of the letters between the lines = 4 pts

Copy 50%-75% of the date accurately and legibly and/or 50% of the letters written between the lines = 3 pts

Copy 25%-50% of the date accurately and legibly and/or 25% of the letters between the lines = 2 pts

Individuals letters attempted but <25% of the letters/numbers are distinguishable = 1 pt

Comments:

_____ 4c(6+) Near point copying

- Able to copy 9 words of the sentence legibly with regard for the lines = 5 pts*
- Able to copy 6-8 words of the sentence legibly with regard for the lines = 4 pts*
- Able to copy 4-5 words of the sentence legibly = 3 pts*
- Able to copy 2-3 words of the sentence legibly = 2 pts*
- Able to copy one word of the sentence legibly = 1 pt*
- Makes marks and/or attempts letters = 0 pts*

Comments:

_____ 5a Coloring the Balloon on page C

- Colors $\frac{3}{4}$ of the balloon and does so within $\frac{1}{4}$ " of the line = 4 pts
- Colors $\frac{1}{2}$ to $\frac{3}{4}$ of the balloon and/or coloring extends $\frac{1}{4}$ " to $\frac{1}{2}$ " outside the line = 3 pts
- Colors less than $\frac{1}{2}$ of balloon and/or coloring extends $\frac{1}{2}$ " to 1" outside the line = 2 pts
- Greater than 1" outside of the line = 1pt
- Incomplete and/or primitive scribbling = 0 pts

Comments:

_____ 5b. Non – Dominant Hand on Paper during Coloring

- Hand held with helping hand = 2 pts
- Did NOT hold paper with helping hand = 1pt

Comments:

_____ 5c. Cut out Square on page C

- Cuts out square with 4 corners and less than $\frac{1}{2}$ " deviation from the line = 4 pts
- Cuts out square with ≥ 1 square corner and/or $\frac{1}{2}$ " to 1" deviation from the line = 3 pts
- Cuts out shape but it does not resemble a square = 2 pts
- Attempts to cut out square but can only make snips or single line cut = 1pt
- Unable to do = 0 pts

Comments:

_____ Total Points for 3-5 test (possible 47) = _____ % (black and orange)

_____ Total Points for entire score sheet (possible 69) = _____ % (black, orange, blue)

_____ Total Points for 6+ test (possible 47)= _____ % (black and blue)

APPENDIX C

University and Medical Center Institutional Review Board Form



EAST CAROLINA UNIVERSITY

University & Medical Center Institutional Review Board Office
1L-09 Brody Medical Sciences Building • 600 Moye Boulevard • Greenville, NC 27834
Office 252-744-2914 • Fax 252-744-2284 • www.ecu.edu/irb

TO: Denise Donica, DHS, OTR/L, Dept. of Occupational Therapy, ECU—Health Sciences Building--3305

FROM: UMCIRB *KZ*

DATE: May 10, 2011

RE: Expedited Continuing Review of a Research Study

TITLE: "Long- Term Effects of Handwriting Readiness Programs on 4 to 6 Year Old Children in Eastern North Carolina"

UMCIRB #10-0447

The above referenced research study was initially reviewed and approved by expedited review on 8.27.10. This research study has undergone a subsequent continuing review using expedited review on 5.6.11. This research study is eligible for expedited review because it is a research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

The Chairperson (or designee) deemed this **unfunded** sponsored study **no more than minimal risk** requiring a continuing review in **12 months**. Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The investigator must adhere to all reporting requirements for this study.

The above referenced research study has been given approval for the period of **5.6.11** to **5.5.12**. The approval includes the following items:

- Continuing Review Form (date 5.2.11)
- Protocol Summary (dated 4.28.11)
- Presentations
- Packet of Pictures
- Test of Handwriting Skills
- Parent Survey (dated 4.28.11)
- Informed Consent (dated 4.28.11)

The Chairperson (or designee) does not have a conflict of interest on this study.

The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies under the Food and Drug Administration regulation. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.

UMCIRB #: 10-0447

RECEIVED

UNIVERSITY AND MEDICAL CENTER INSTITUTIONAL REVIEW BOARD
REVISION FORM

UMCIRB #: 10-0447

Date this form was completed: May 3, 2011

UMCIRB

Title of research: Long-term Effects of Handwriting Readiness Programs on 4 to 6-year-old Children in Eastern North Carolina

Principal Investigator: Denise Domico, DHS, OTR I, BCP

Sponsor: NA

Fund number for IRB fee collection (applies to all for-profit, private industry or pharmaceutical company sponsored project revisions requiring review by the convened UMCIRB committee). If you are a non-ECU entity payment is required at the time of submission:

| Fund | Organization | Account | Program | Activity (optional) |
|------|--------------|---------|---------|---------------------|
| | | 73059 | | |

Version of the most currently approved protocol: August 24, 2010

Version of the most currently approved consent document: August 24, 2010

CHECK ALL INSTITUTIONS OR SITES WHERE THIS RESEARCH STUDY WILL BE CONDUCTED:

- | | |
|---|--|
| <input type="checkbox"/> East Carolina University | <input type="checkbox"/> Beaufort County Hospital |
| <input type="checkbox"/> Pitt County Memorial Hospital, Inc | <input type="checkbox"/> Carteret General Hospital |
| <input type="checkbox"/> Heritage Hospital | <input type="checkbox"/> Boice-Willis Clinic |
| <input type="checkbox"/> Other | |

The following items are being submitted for review and approval:

- Protocol: version or date 4/28/11
- Consent: version or date 4/28/11
- Additional material: version or date 4/28/11

Complete the following:

1. Level of IRB review required by sponsor: full expedited
2. Revision effects on risk analysis: increased no change decreased
3. Provide an explanation if there has been a greater than 60 day delay in the submission of this revision to the UMCIRB. NA
4. Does this revision add any procedures, tests or medications? yes no If yes, describe the additional information: Two additional assessment sessions will occur for each child whose parent gives consent. These additional assessment sessions will continue to assess handwriting and motor skills as a follow-up to the original study in the initial 10-0447 proposal. Additionally, a parent survey will be administered to the parent both times while the child is being tested. The new consent form, parent survey, and additional testing materials are attached for review
5. Have participants been locally enrolled in this research study? yes no
6. Will the revision require previously enrolled participants to sign a new consent document? yes no

Briefly describe and provide a rationale for this revision The current participants in the original study are being asked to complete two additional testing sessions during the 2011-2012 school year in order to determine more long-term effects of the intervention provided during the 2010-2011 school year. The testing location will be at East Carolina University at the Health Sciences Building in lab rooms not designated for research purposes. The parent will be completing a consent form before the conclusion of the 2010-2011 school year which consents not only to their participation in the study but also consent to contact the parent in the 2011-2012 school year to schedule the the follow-up sessions. The new consent form is attached. In addition, a parent survey will be completed about the parent's perceptions of the child's handwriting abilities which will be administered at both testing sessions. This survey is attached. An additional assessment may be used during the two testing sessions for the child which is attached called the Test of Handwriting Skills-Revised. Payment by giftcard will also be issued to the parents which is outlined in the attached protocol

Denise Domico _____ *Denise Domico* _____ *7/3/11* _____
Principal Investigator Signature Print Date

Box for Office Use Only

The above revision has been reviewed by:

Full committee review on _____ Expedited review on 5.6.11

The following action has been taken:

Approval for period of 5.6.11 to 5.5.12

Approval by expedited review according to category 7

See separate correspondence for further required action

Simon McLennan, PhD (G2) Simon McLennan 5.10.11
Signature Print Date

UMCIRB #: 10-0447

UNIVERSITY AND MEDICAL CENTER INSTITUTIONAL REVIEW BOARD
INVESTIGATOR REVISION FORM

UMCIRB #: 10-0447

Date this form was completed: May 5, 2011

Title of research Long-term Effects of Handwriting Readiness Programs on 4 to 6-year-old Children in Eastern North Carolina

Principal Investigator Denise Donica, DHS, OIR L, BCP

Sponsor: None

Revision submission requested for:

- Principal Investigator
- Subinvestigator

List the duties of any new research team members and describe the qualifications of each member to perform their duties, including the completion date of the human protections modules located on the UMCIRB web site.

- Anna Call – November 20, 2010
- Whitney Lear – December 8, 2010
- Simone Cowan – January 20, 2011
- Anne Thomas – April 12, 2011

The subinvestigators will be responsible for assisting with obtaining consent, administering assessments and surveys as identified in the protocol summary, data analysis and interpretation, and writing of the research. All subinvestigators will be trained on the administration and scoring of the assessment tools. All subinvestigators have completed an introduction to research course within the occupational therapy curriculum. Whitney and Anna have additionally taken a statistics course to assist with data analysis. All subinvestigators have completed 2 semesters in the graduate occupational therapy program.

| | | |
|----------------------------------|-------------------------|----------------|
| <i>Anna Call</i> | <i>Anna Call</i> | <i>5/12/11</i> |
| Investigator Signature | Print | Date |
| <i>Whitney Lear</i> | <i>Whitney Lear</i> | <i>5/12/11</i> |
| Investigator Signature | Print | Date |
| <i>Simone Cowan</i> | <i>Simone Cowan</i> | <i>5/12/11</i> |
| Investigator Signature | Print | Date |
| <i>Anne Thomas</i> | <i>Anne Thomas</i> | <i>5/11</i> |
| Investigator Signature | Print | Date |
| <i>Denise Donica</i> | <i>Denise K. Donica</i> | <i>5/4/11</i> |
| Principal Investigator Signature | Print | Date |

DEPARTMENT CHAIR APPROVALS STATEMENT IF CHANGE IN PRINCIPAL INVESTIGATOR (IF YOU DO NOT HAVE A DEPARTMENT CHAIR, SUBMIT 1 COPY OF YOUR CURRENT CV FOR REVIEW)

I have reviewed this project. I believe that the research is sound, the goals are scientifically achievable, and does not involve any significant human rights issues. There are appropriate departmental resources (financial and otherwise) available to conduct the research. The investigator is qualified to conduct all aspects of this research project based on education, training or experience, and has the necessary authorizations or privileges to conduct all outlined procedures. I endorse the investigator and outlined research project as indicated by my signature below.

UMCIRB #: 10-0447

I have reviewed the UMCIRB Conflict of Interest Disclosure Form and evaluated the principal investigator of this project for risk related to conflict of interest according to the UMCIRB Standard Operating Procedure Manual. I endorse the investigator and the attached plan (if required) for managing conflict of interest related to this research study as indicated by my signature below.

NOTE: A department chair may not sign this statement if listed as an investigator, and should seek the signature of the division chair/dean.

Levenand C. Duggan 5/3/11
Signature Date

Box for Office Use Only

The above revision has been reviewed by:

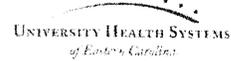
Full committee review on _____ Expedited review on 5/6/11

The following action has been taken:

- Approval for period of 5/6/11 to 2/5/12
- Approval by expedited review according to category US 46 III
- See separate correspondence for further required action

Levenand C. Duggan 5/10/11
Signature Print Date

APPENDIX D Informed Consent Form



Informed Consent to Participate in Research

Title of Research Study: Long-term Effects of Handwriting Readiness Programs on 4 to 6-year-old Children in Eastern North Carolina

Principal Investigator: Denise Donica, DHS, OTR/L, BCP
Institution/Department or Division: East Carolina University/Occupational Therapy
Address: 3305-G Health Science Building Greenville, NC 27834
Telephone #: 252-744-6197

Why is this research being done?

East Carolina University Department of Occupational Therapy continuing to collect information on the handwriting research project that your child participated in during the 2010-2011 school year at the Pitt County Head Start. This project will help us continue to look at the impacts of participation in a handwriting readiness program long-term.

Why am I being invited to take part in this research?

You are being invited to take part in this research because your child was in the initial study during the 2010-2011 year at Head Start.

What other choices do I have if I do not take part in this research?

You can choose not to participate.

Where is the research going to take place and how long will it last?

The research procedures will be conducted at East Carolina University Allied Health Sciences Building located off of 5th street near Pitt County Memorial Hospital in Greenville, NC. You will come to room 3305 (directions will be provided upon request). You will only need to bring your child to 2 sessions (one in August/September 2011 and one in March/April 2012) that will last about one hour each. You will be required to stay in the building while your child is testing.

What will I be asked to do?

We are now asking if you would be willing to give consent for your child's participation and to provide your contact information so that we can contact you to schedule these 2 testing sessions. The testing sessions will involve your child completing assessments involving writing, coloring, cutting, and manipulating objects. You will need to arrange transportation to the testing location for both sessions. While your child is completing the testing, we will ask you to complete a brief survey related to your child's fine motor skills.

What possible harms or discomforts might I experience if I take part in the research?

There are no more risks with participation than you would experience in everyday life.

What are the possible benefits I may experience from taking part in this research?

The goal of this program is to see if those who participated in the programs offered at the Head Start continue to demonstrate gains as they move on to Kindergarten.

Will I be paid for taking part in this research?

YES! You will receive a \$25 gift card at each session for attending that testing session (maximum of 2 cards). In addition, you will receive another \$25 gift card at the completion of the two sessions.

UMCIRB Number: 10-0447

Consent Version # or Date: 4-28-11
UMCIRB Version 2010.05.01

UMCIRB
APPROVED
FROM S. E. J.
TO S. S. J.

Participant's Initials

Title of Study: Long-term Effects of Handwriting Readiness Programs on 4 to 6-year-old Children in Eastern North Carolina

Who will know that I took part in this research and learn personal information about me?

Your information will be kept private and will only be shared with those necessary such as The University & Medical Center Institutional Review Board (UMCIRB) and its staff, who have responsibility for overseeing your welfare during this research, and other ECU staff who oversee this research. All information will be locked and names will be removed. When the information is no longer needed, it will be shredded.

What if I decide I do not want to continue in this research?

You may stop your participation at any time. You will not be penalized or criticized for stopping.

Who should I contact if I have questions?

You may contact the Principal Investigator, Denise Donica, at 252-744-6197 or email at donicad@ecu.edu. If you have questions about your rights as someone taking part in research, you may call the Office for Human Research Integrity (OHRI) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the OHRI, at 252-744-197.

I have decided I want to take part in this research. What should I do now?

Fill out the information below:

As the parent or guardian of _____,

(Write your child's name)

I grant my permission for Dr. Donica to contact me by the means I indicate below to schedule 2 testing times with my child during the 2011-2012 school-year. I understand I need to take my child to the Health Sciences Building where these sessions will occur and I will be given a **\$25 gift card** for **EACH** session my child attends and an **additional \$25 card for my child** at the end of the study if the child completes both sessions. I understand this information will not be shared with my child's school and will be kept confidential being used only for the purposes of the above research study.

- Home phone: _____
 - Mailing address: _____

 - Cell phone: _____
 - Check here if texting is ok
 - Email: _____
 - Other contact person's name and information: _____

- Preferred contact method and time: _____

| Participant's Name (PRINT) | Signature | Date |
|----------------------------|-----------|------|
|----------------------------|-----------|------|

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

| Person Obtaining Consent (PRINT) | Signature | Date |
|----------------------------------|-----------|------|
|----------------------------------|-----------|------|

| Principal Investigator (PRINT) | Signature | Date |
|--------------------------------|-----------|------|
|--------------------------------|-----------|------|

UMCIRB Number: 10-0447

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