

Abstract

EFFECTS OF THE PRE-K HANDWRITING WITHOUT TEARS[®] PROGRAM ON HANDWRITING READINESS SKILLS OF PRESCHOOLERS WITH PRE-WRITING DEFICITS IN A RURAL EASTERN NORTH CAROLINA HEAD START PROGRAM

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The purpose of this study was to determine if preschoolers with pre-writing deficits who received additional small group exposure to the Pre-K Handwriting Without Tears[®] (HWT) – Get Set for School[™] (GSS) program would improve more in their fine motor and pre-writing skills than similar students who only received whole class Pre-K HWT[®] – GSS handwriting instruction. Pre and post-test data were collected using the *Shore Handwriting Screening* (Shore), the HWT[®] Check Readiness screen, the *Bruininks-Oseretsky Test of Motor Proficiency*, 2nd Edition (BOT-2 Fine Motor Composite), and the *Learning Accomplishment Profile*, 3rd Edition (LAP-3 Pre-Writing Domain). The ten lowest scoring students on the SHORE were rank ordered and paired. This cohort was chosen because of their potential for greatest benefit from additional exposure to HWT[®] – GSS. From each pair, students were randomly assigned to either control or experimental groups. The entire class received HWT[®] instruction twice weekly while the experimental group received additional exposure to the handwriting program twice weekly over a five month period. At the conclusion of the study, there were no statistically significant differences in fine motor and pre-writing skills between control and experimental groups, when

assessed using the BOT-2, LAP-3, and the HWT[®] – GSS Check Readiness. However, the Shore did suggest pre-writing skill improvement of the control group (p-value = 0.053) as compared to the experimental group. In conclusion, twice weekly HWT[®] – GSS, implemented on a whole class basis using occupational therapy support, was beneficial in enhancing handwriting readiness in preschoolers at Head Start. Additional small group exposure to the HWT[®] – GSS program was not needed for handwriting readiness, but may produce additional benefits in a targeted subset of fine motor skills.

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by

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CHAPTER 1: INTRODUCTION

Handwriting, as an integral academic task and a primary mode of communication, is introduced to children early in educational systems and remains an essential skill throughout the entire schooling process. Development of fine motor skills is necessary to accomplish the many fine motor tasks that consume the majority of classroom time, and is an ongoing requirement throughout primary and secondary education (Marr, Cermak, Cohn, & Henderson, 2003; McHale & Cermak, 1992). Fine motor tasks have been understood in the literature as those tasks “for which performance required a major use of one’s hands, such as writing with a pencil” (McHale & Cermak, 1992, p. 899). In the preschool setting, children must be able to demonstrate a variety of fine motor classroom tasks, such as manipulating puzzles, scissors, crayons, blocks, pegs, and beads. Fine motor tasks become more complex in the elementary school setting as students are expected to handle a pencil, use an eraser, tear and fold paper, put paper into envelopes, notebooks and folders. Students are also expected to complete assignments using math related utensils such as a ruler, protractor, and compass, as well as other materials during complex art projects (Exner, 2006).

McHale and Cermak (1992) investigated fine motor activities in elementary school classrooms in second, fourth, and sixth grades. They specifically identified the following fine motor tasks that occurred in the classrooms: copying from text or the board, doing repetitive writing, writing headings on paper, writing from dictation, taking notes, completing commercial work sheets, workbooks or tests, correcting work rapidly, answering questions from text, doing creative writing, and drawing. Other fine motor manipulative tasks that occurred in the classrooms included folding paper to make margins and dividing lines, cutting, pasting, using a computer, and manipulating objects such as seeds (McHale & Cermak, 1992). It is apparent that there is a strong daily emphasis on fine motor tasks, at all school levels, in the academic setting.

Early fine motor and handwriting deficits may impact a student's future performance across all academic areas. Therefore, preschool children who do not adequately develop the fine motor skills necessary for accomplishing the required fine motor classroom tasks may quickly fall behind as they enter kindergarten or later grades.

Problem Statement

Economically disadvantaged preschool children, who are at-risk academically, may not have the opportunity to develop fine motor skills necessary to achieve fine motor milestones or handwriting readiness. However, at-risk preschoolers and their families may have the opportunity to receive early education and comprehensive support services in order to address such skill development. Head Start programs across the nation aim at providing services necessary to help three and four year old children prepare for school. A structured handwriting intervention program such as the Handwriting Without Tears[®] (HWT) – “Get Set for School” (GSS) curriculum may be beneficial to the Head Start population. The HWT[®] – GSS curriculum could potentially lead to more developed fine motor skills and improved handwriting readiness. However, other than our group, there are no other published reports involving the use of this multi-sensory handwriting program at the Pre-K level with an at-risk population. It is necessary to investigate the effectiveness of the occupational therapy supported HWT[®] – GSS curriculum in order to demonstrate its effectiveness and promote best practice in developmental or educational centers and beyond.

Purpose of Study

The general purpose of this study was to expand the evidence base on the effectiveness of the Pre-K HWT[®] – GSS Program in a Head Start population. More specifically, the purpose of this study was to test the following hypothesis:

Preschoolers with below average pre-writing skills who received supplemental small group exposure to the Pre-K HWT[®] – GSS program will improve more in their fine motor and pre-writing skills than similar students who only received whole class Pre-K HWT[®] – GSS handwriting instruction.

CHAPTER 2: LITERATURE REVIEW

Handwriting in Education

Elementary-school aged children spend approximately 30% to 60% of classroom time on fine motor activities, handwriting being the predominant task (McHale & Cermak, 1992). Although teachers differ in their methods of instruction, manuscript writing is generally taught in first and second grades with cursive writing introduced in third grade (Asher, 2006; Benbow, 2006). Handwriting is then used by students as the primary way of demonstrating their knowledge in all of the academic areas. Placing such an emphasis on handwriting in the educational curricula may cause a child experiencing such skill deficits to fall behind quickly by concentrating too heavily on correct letter formation or legibility rather than the actual course content (Case-Smith, 2002). Children who often experience handwriting difficulties may require additional instruction by the teacher. However, after handwriting problems are identified, remedial instruction may be limited due the lack of the teacher's time or because the additional instruction provided is not enough to entirely address the issue. Services that exceed the scope of a traditional educational handwriting curriculum are needed if such children are to be proficient at handwriting (Woodward & Swinth, 2002). Frequently, issues with handwriting in elementary-school necessitate occupational therapy evaluation and intervention. In a study by Tait (1998), 98% of occupational therapists working in the Ohio school system reported receiving referrals for students with handwriting problems (Case-Smith, 2002). Handwriting remediation plays a prominent role in school-based occupational therapy and involves consultation with the teacher, adaptations to the educational environment, and direct intervention services to the student (Feder, Majnemer, & Synnes, 2000).

Occupational therapists must consider performance components associated with handwriting skills for intervention planning. Handwriting is a complex activity that involves interaction between both lower-level perceptual-motor processes and higher-level cognitive processes (Graham & Weintraub, 1996). Sensorimotor components that have been understood to be related to handwriting include: visual perception, kinesthesia, in-hand manipulation, and visual-motor integration (Denton, Cope, & Moser, 2006). Although the underlying mechanisms responsible for handwriting difficulties are not entirely understood, research has been conducted to investigate the effect of various perceptual-motor and cognitive processes on handwriting performance (Volman et al., 2000).

Theoretically, it is believed visual perception is a necessary component for letter recognition, and is therefore, a fundamental component of handwriting. A study by Graham, Struck, Santro, and Berninger (2006) investigated the dimensions of good and poor handwriting legibility in first and second graders. Results of the study indicated children with poor handwriting produced more letters with additional strokes, smaller letters, and showed greater variability in spacing and alignment. The visual spatial elements of handwriting in this study were identified as spacing between words, spacing within letters of words, and alignment of letters on the baseline. When analyzing the variability in the visual spatial elements of handwriting, investigators found statistically significant differences between good and poor handwriters. Poor handwriters were more variable than good writers in their spacing between words, spacing between letters within words, and in how well they aligned letters to the baseline (Graham, Struck, Santro, & Berninger, 2006). Therefore, visual-spatial arrangement was a distinguishing factor when comparing dimensions of legibility.

However, Tseng and Cermak (1993) investigated and summarized the findings of four correlational studies indicating weak or no relationship between visual perception and handwriting. One problem complicating interpretation of these results was that visual perception was measured using a motor response, which could have potentially produced a confounding effect on the relationship. Unfortunately there is not adequate research investigating the relationship between visual perception and handwriting measured as a motor-free response (Tseng & Cermak, 1993).

Similarly, it is widely accepted that the child's ability to know the position of their hands, extremities and body, without visual input, is believed to be highly influential on the development of a skilled fine motor task such as handwriting (Benbow, 2006). In fact, according to Benbow (2006) kinesthetic training is essential to teaching handwriting, regardless of whether or not a child has a visual motor or visual spatial deficit. However, there is lack of sufficient evidence to support the connection between kinesthesia and handwriting performance. Studies have also investigated the relationship between in-hand manipulation and handwriting. Cornhill and Case Smith (1996) found that two different types of in-hand manipulation, translation and rotation, were significantly different between typically developing first graders with good and poor handwriting. Conversely, Humphry, Jewell, and Rosenberger (1995) did not find a significant relationship between in-hand manipulation and performance of many different functional activities, including coloring, in typically developing children between the ages of two and seven.

Further, findings suggest that second and third graders with handwriting difficulties appear less proficient in fine motor coordination, visual-motor integration, visual perception, and cognitive planning ability when compared to children without handwriting problems (Volman et

al., 2000). According to regression analyses, fine motor coordination was the only significant predictor of handwriting quality in the control group. In contrast, visual-motor integration was the major predictor for performance problems in handwriting quality. In fact, of all the sensorimotor components, visual-motor integration is the only one that is moderately to strongly related to handwriting performance (Cornhill & Case-Smith, 1996; Daly, Kelley, & Krauss, 2003; Hagborg & Aiello-Coultier, 1994; Maeland, 1992; Tseng & Murray, 1994; Weil & Cunningham-Amundson, 1994; Weintraub & Graham, 2000).

It has been shown that handwriting is a predominant school task, and occupational therapists working in the schools have a large referral base of children with poor handwriting. Research shows that fine motor coordination is a predictor in handwriting quality. It has also been identified that a deficit in visual-motor integration is a reliable predictor associated with poor handwriting. However, it remains unclear whether the same predictors are valid for pre-writing readiness skills, or whether these predictors apply as well to preschool aged children.

Handwriting Intervention

Many theories and principles have been proposed to guide occupational therapists when planning and implementing handwriting intervention. Some approaches to handwriting remediation are more biomechanical or kinesthetic in nature. Benbow (2006) theorized that handwriting is generally a kinesthetic skill and improvement is shown when the hand is first biomechanically and perceptually prepared to grasp writing instruments. Benbow's (2006) cursive handwriting curriculum, "Loops and Other Groups", teaches children the fundamental movements of letter formation by introducing letters in groupings based on shape. The child's perceptions of their movements are reinforced through visual and kinesthetic cues (Benbow, 2006). This motor-learning approach is one strategy for handwriting remediation in which the

particular approach includes practice and feedback to enhance motor memory and kinesthetic feedback in children (Benbow, 2006). Further, the use of weights at the wrist or trunk has been identified as a handwriting intervention. This approach has been reportedly used in practice by as many as 68% of therapists surveyed. Most therapists indicated that weights were used for poor motor coordination, tremor, hypotonia, poor postural stability, and/or sensory under-responsiveness (Feder, Majnemer & Synnes, 2000). Even though the use of weights is reported as a common intervention, its effectiveness remains unsupported in the literature with no published clinical evaluation studies.

Feder, Majnemer, and Synnes (2000) reported survey data suggesting that occupational therapists tend to use an eclectic approach toward interventions for children with handwriting problems. Approaches commonly used by therapists include perceptual-motor (74%), motor learning (68%), cognitive training (64%), biomechanical (64%), sensory integrative (50%), and neurodevelopmental (42%). However, the results of this study indicated that the sensorimotor approach is by far the most frequently selected (90%) by therapists for pediatric handwriting and related fine motor assessment and treatment (Feder et al., 2000). In a similar study, Cornhill and Case-Smith (1996) found that students with poor handwriting, as indicated by their teachers, had lower scores on assessments of sensorimotor performance which include eye-hand coordination, visuomotor integration, and in-hand manipulation. Further, these performance component findings also proved to be reliable predictors of scores in handwriting performance (Woodward & Swinth, 2002).

Additional research suggests that when there are insufficiencies in sensorimotor performance components, a multisensory approach is frequently used in addressing handwriting deficits (Reis, 1990; Rutherford, 1991; Vickery & Cochran, 1987). In a survey study looking at

the various multisensory modalities used by occupational therapists, results show that most therapists use five or more modalities and activities per client (Woodward & Swinth, 2002). According to Woodward and Smith (2002), the most common modality reported by respondents was use of chalk and chalkboard (87.3%). Other modalities frequently used included magic markers or felt pens (71.2%), verbal description while the student writes (71.2%), finger writing in viscous substances (64.8%), and copying and tracing on regular lined paper (63.2%). These modalities include the proprioceptive, visual, auditory, and tactile sensory systems. However, the survey study also indicates that as many as 114 types of multisensory modalities were used in addition to the five primary ones listed, and the 25 most commonly used were documented in the literature. This information puts into perspective the breadth of multisensory modalities being used, and suggests that the research supporting the effectiveness of a multisensory approach is currently very limited (Woodward & Swinth, 2002).

A study by Denton, Cope, and Moser (2006) compared the effects of sensorimotor and therapeutic practice based intervention on improving handwriting performance in six to eleven year old children. All of the participants in this study were identified as typically developing with handwriting dysfunction and were randomly assigned to one of the two intervention groups or a control group. The intervention groups met for thirty minutes of intervention four times a week over a five week span. The sensorimotor group intervention protocol incorporated a total of 2.5 hours of each of the four major sensorimotor components: visual perception, visual-motor integration, proprioception/kinesthesia, and in-hand manipulation. The therapists providing intervention utilized a number of games, activities, worksheets, and equipment. The therapeutic practice group protocol included the use of workbooks with work sheets to practice dictated and copied handwriting as well as writing from memory using a variety of writing instruments.

Therapists provided feedback to the participants based on their performance. Handwriting was measured pre and post-intervention using the Test of Handwriting Skills. The results surprisingly indicated that the children receiving therapeutic practice moderately improved in their handwriting performance and children receiving sensorimotor intervention declined in their handwriting performance. Although upon examining all of the sensorimotor components at pre and post-test, the investigators found an improvement in visual perception (motor-reduced) and in-hand manipulation (Denton et al., 2006).

Another study also investigated the use of sensorimotor handwriting intervention. Weintraub, Yinon, Hirsch, and Parush (2009) investigated the short and long term effectiveness of sensorimotor and task-oriented handwriting intervention in elementary school-aged children with handwriting difficulties. Both intervention groups incorporated “higher-level” functions such as cognitive or executive functions. The results indicated that both intervention groups scored higher than the control group in overall legibility. However, the difference was only statistically significant in the task-oriented group. Immediately following intervention as well as four months after intervention, significant gains were noted in both intervention groups without either approach to intervention found to have an advantage over the other (Weintraub et al., 2009). These results differ from those of Denton et al., (2006) who found that students in a therapeutic practice group, which is similar to the task-oriented group, performed better than their peers in a sensorimotor intervention group that did not incorporate “higher-level” functions. From these studies, it appears that intervention approaches that incorporate “higher-level” functions may be beneficial when enhancing handwriting performance in children with handwriting difficulties (Weintraub et al., 2009).

Sensorimotor performance components have been researched and deemed reliable predictors of handwriting performance in children. Furthermore, it is understood that a sensorimotor approach is most frequently used by occupational therapists when assessing and treating handwriting deficits in the pediatric population. A large number of multisensory modalities have been identified by occupational therapists when working on handwriting skills with children. However, the effectiveness of these multisensory modalities and an overall sensorimotor approach to handwriting intervention has not been thoroughly researched (Feder et al., 2000; Reis, 1990; Rutherford, 1991; Vickery & Cochran, 1987; Woodward & Swinth, 2002).

Handwriting Without Tears®

Jan Olsen (2008), an occupational therapist, developed the Handwriting Without Tears® (HWT) program that uses a multisensory approach, combined with developmentally appropriate practice, to teach children handwriting skills. The developmental principles of Arnold Gessell, Ph.D., M.D., encompass the underlying theory behind the readiness approach of the HWT® program for preschoolers and kindergarteners (Olsen, 2008). Developmentally, it is understood that children begin with the ability to copy the vertical line and progress to the horizontal line, circle, cross, square, triangle (Gessell & Amatrude, 1947). While advancing through the curriculum, the letters are grouped by the difficulty of the stroke (Case-Smith, 2002). The HWT® program follows this sequence and teaches children letters that begin with the vertical line stroke (Olsen, 2008).

The Pre-K Handwriting Without Tears® program is titled Get Set for School™ and consists of various multisensory and developmentally appropriate educational activities. This program aims to develop skills for preschoolers that include language proficiency, social skills, fine and gross motor control, color and shape awareness, letter and number recognition and

counting (Olsen, 2008). This curriculum fits into a daily preschool routine and consists of wooden pieces for building, music, dough, chalk, crayons, workbooks, and chalkboards. The HWT[®] – GSS readiness activities are designed to promote effective learning and prepare children for formal handwriting instruction that will occur in kindergarten. The Pre-K HWT[®] – GSS program is appropriate for preschool aged children with various skill levels as it can be adapted and modified.

In summary, the HWT[®] – GSS program is a multisensory preschool handwriting readiness curriculum that was developed by an occupational therapist. This curriculum is based on development and utilizes a sensorimotor approach in order to prepare preschoolers for the handwriting skills that are expected in kindergarten. Research on the efficacy of this curriculum is limited and should be considered to ensure best practice for therapists and teachers alike (Case-Smith, 2002; Olsen, 2008).

At-Risk Preschoolers

Over the years there has been a growing concern for those preschoolers with a low socioeconomic status who may be at an increased risk for difficulty in elementary school. Federal and state legislation policy have emphasized the expectation that a primary purpose of education for preschool and elementary aged children is the acquisition of knowledge and skills that will promote later success in their education. Examples of such legislation include the Improving Head Start for School Readiness Act of 2007 (H.R., 1429) and the No Child Left Behind Act of 2002 (NCLB, 2002; Diamond, Gerde, & Powell, 2008). Head Start is a federally funded school readiness education program that is specifically designed to assist children from low income families. Head Start is implemented through the U.S. Department of Health and Human Services as a federal initiative to provide school readiness opportunities to low-income

children. Head Start programs focus on enhancing the child's cognitive, social and emotional development (Chandler & Lucas, 2010). Head Start is administered by local non-profit organizations as well as local education agencies. In 2009, Head Start served more than 900,000 children throughout the nation (U.S. Department of Health and Human Services, n.d.). Early literacy skills have become an area of increased focus, especially with at-risk populations such as Head Start (Diamond et al., 2008).

Diamond, Gerde, and Powell (2008) examined the relationship between low-income Head Start children's early writing competence, knowledge of letter names, print concepts, and initial sounds of letters. This study looked at four Head Start centers which included 35 classrooms. They found that children whose writing was more refined at the end of the Head Start year knew the names of more letters, understood more about print concepts, and were more sensitive to initial sounds of words. There was further support of an influence of writing on growth in letter knowledge and vice versa of letter knowledge on growth in writing competence (Diamond, Gerde, & Powell, 2008). Essentially, this study suggests that preschool activities that include letters and encourage children to write, even their name, may support an early understanding of the alphabet with a low-income, at-risk population.

Marr, Cermak, Cohn, and Henderson (2003) compared fine motor activities in Head Start classrooms to those in kindergarten classrooms in order to gain a better understanding about what preschool children will face in kindergarten. Results of the study indicated that children in Head Start spent an average of 37% of the in-class day in fine motor activities while children in kindergarten spent an average of 46% of the time engaged in fine motor activities. Kindergarten children spent 42% of total fine motor activity time involved in paper and pencil activities. In comparison, children in Head Start spend 10% of fine motor activity time in paper and pencil

activities. This study concluded that there was a significant increase in the percent of time spent in paper and pencil activities from Head Start to kindergarten. Further, this information informs Head Start of the fine motor demands that their children will face in kindergarten (Marr, et al., 2003).

Although the amount of time spent on fine motor activities appears close when comparing children in Head Start to those in kindergarten, the amount of time spent specifically on pencil and paper activities is not equal (Marr, et al., 2003). With a clear discrepancy between the amount of time spent on paper and pencil activities with children in Head Start compared to children in kindergarten, it is important to bridge this gap and increase the exposure to the already at-risk Head Start population. Further, it can be concluded from research that occupational therapy intervention is effective in improving handwriting of school aged children who are economically disadvantaged (Peterson & Nelson, 2003).

Summary

It is apparent that there is limited research determining the most effective handwriting approach and the most effective instruction program to significantly increase handwriting readiness at the preschool level. Although it is understood that early exposure to writing may promote an understanding of the letters of the alphabet, additional research on the topic of preschool handwriting intervention needs to be conducted. Implementing an occupational therapist-developed handwriting curriculum in a Head Start program is a means of testing the multisensory approach and its effects on handwriting readiness. This research will contribute to the efficacy of the HWT[®] – GSS program and will increase evidence used to determine best practice for occupational therapists when working with preschoolers on handwriting readiness skills in a Head Start setting. This study explicitly investigated whether or not students who

received additional small group exposure to the HWT[®] – GSS program improved more in their fine motor and pre-writing skills than similar students who only received whole class Pre-K HWT[®] – GSS handwriting instruction.

CHAPTER 3: METHODOLOGY

Design

This study was conducted as part of ongoing research projects within the East Carolina University Occupational Therapy department measuring the effectiveness of the HWT[®] – GSS curriculum on handwriting readiness in the Pre-K Head Start population. A pre-test/post-test research design among control and experimental groups was used with this study. This design was selected because it fit within the framework of the Head Start program and allowed each student to serve as his or her own control. Screening of all students within the classroom took place in order to identify the children with pre-writing deficits (PWD). For the purposes of this study, a student was identified as having a PWD if they scored below the 50th percentile for the class overall based on the *Shore Handwriting Screen* (Shore). The students with the ten lowest scores on the Shore, and thus identified as those with PWD, were rank ordered and paired. This cohort was chosen because previous preliminary work (Lust, 2009) indicated that these students had the potential for greatest benefit from additional exposure to HWT[®] – GSS. From each pair, students were randomly assigned to either control or experimental groups. Pre-test data of those children with PWD were collected using the HWT[®] – GSS Check Readiness, the *Bruininks-Oseretsky Test of Motor Proficiency*, 2nd Edition (BOT-2) – the Fine Manual Control composite portion, and the *Learning Accomplishment Profile*, 3rd Edition (LAP-3) the Pre-Writing domain. Following pre-testing, HWT[®] – GSS instruction took place for the entire Head Start class twice a week. The experimental group received two additional days of separate small group instruction each week. All HWT[®] – GSS instruction lasted no more than fifteen minutes on any given day. Supplemental experimental group instruction did not occur on the same day as whole class instruction, and the program lasted over the course of eleven weeks.

The independent variable in this study was supplemental HWT[®] – GSS instruction. The dependent variables in this study were handwriting readiness, fine motor skills and pre-writing skills measured using the Shore, HWT[®] – GSS Check Readiness, BOT-2, and LAP-3 instruments. The goal of this research study was to determine if an experimental group of preschool children with PWD, who received supplemental HWT[®] – GSS instruction twice a week, would improve their handwriting readiness skills significantly when compared to a similar control group that only received HWT[®] – GSS instruction in the whole class setting.

Sample

The sample consisted of ten students identified by the investigators from a Head Start class of twenty students. The lower fifty percent was identified for study on the premise that they would have the best potential for demonstrating a measureable benefit from the supplemental instruction. The criteria for selection of students included: age of four to five years old; enrollment in the Pitt County Head Start program and obtained parental consent.

Participants were selected by convenience from one Head Start classroom of twenty students, with a teacher who was experienced with the HWT[®] – GSS program. The experimental group and the control group were evenly and randomly assigned from the ten students identified with PWD before HWT[®] – GSS instruction began. An explanation of the study and assurance of confidentiality and anonymity was made prior to the data collection through a parental consent form (Appendix B).

Participants in the experimental group ranged in age from 55 – 61 months (58 ± 2.83 , mean \pm SD) with four males and one female represented. Head Start uses Department of Health and Human Services definitions to classify racial characteristics of the students. All of the participants in the experimental group were African American. Participants in the control group

ranged in age from 52 – 61 months (57.6 ± 3.65 , mean \pm SD). There were three males and two females in the control group. One of the males in the control group was Hispanic American, and the remaining participants in the control group were African American.

Instrumentation

In order to determine the children with PWD, the *Shore Handwriting Screening* (Shore) was used. The Shore is a non-standardized tool that provides a check-list style format to determine causes of handwriting deficits in children (Shore, 2003). The screening process involved observation of the environment, the child's posture, behaviors, hand dominance, grasp pattern, bilateral hand skills and in-hand manipulation. The Shore also measures the student's ability to draw a person, copy a selection of upper-case letters, color in a drawing, and cut out a basic shape. Since the Shore is a non-standardized screening tool, a Score Sheet developed by the investigators was used for the Shore to determine a fractional score, which then provided a basis for determining the children with PWD (Appendix C).

The Handwriting Without Tears[®] – GSS Check Readiness screen was used during pre and post-testing with the Head Start sample. The HWT[®] – GSS Check Readiness is a non-standardized assessment that is part of the Pre-K curriculum. This screen is used to evaluate handwriting components including: crayon grip, tracing and copying shapes, drawing a person, number and letter recognition, and name writing. Since the Check Readiness is a non-standardized screening tool, a Score Sheet developed by the investigators was used for this assessment to determine a percentage of items correct (Appendix D).

The fine motor assessment that was used for pre-testing and post-testing was the *Bruininks-Oseretsky Test of Motor Proficiency*, Second Edition (BOT-2) (Bruininks & Bruininks, 2005). The BOT-2 is a standardized test that uses goal directed activities to measure

a variety of motor skills. The Fine Manual Control composite was used with this study. The BOT-2 is a standardized test that provides comprehensive assessment of motor skill proficiency with test results that offer information on a subject's normative strengths and weaknesses (Bruininks & Bruininks, 2005). The BOT-2 uses scale scores to describe each student's level of proficiency on each subtest. This type of scale score identifies how far an examinee's point score is from the mean point score of examinees of the same age. Further, the BOT-2 uses standard scores to describe the subject's level of proficiency within the composite areas and to tell how far the subject's score is from the mean score of examinees of the same age (Bruininks & Bruininks, 2005). With scores of both subtests and composites, the standard deviation of the population sampled is taken into account.

The BOT-2 Fine Manual Control composite consists of two subtests: Fine Motor Precision and Fine Motor Integration. The Fine Motor Precision subtest consists of seven test activities that require precise control of finger and hand movement (Bruininks & Bruininks, 2005). Activities in the Fine Motor Precision subtest include five drawing items, one paper-folding item, and one cutting item. The drawing tasks include filling in shapes, drawing lines through paths, and connecting dots. The items in this subtest are untimed because emphasis is placed on precision. The second subtest, Fine Motor Integration, requires the subject to copy drawings of various shapes that range in complexity from a simple circle to overlapping pencils. The subject is asked to reproduce the drawings as accurately as possible. As with the Fine Motor Precision subtest, the drawing tasks require precise control of finger and hand movement and are therefore untimed. Since the examinee must copy the drawing without additional visual aids or guidelines, this subtest also measures visual-motor integration (Bruininks & Bruininks, 2005).

The BOT-2 is a reliable, valid measure of motor-skill ability appropriate for use in many research designs (Bruininks & Bruininks, 2005). Three measures of reliability have been conducted on the BOT-2: internal consistency, test-retest, and inter-rater. The validity of the BOT-2 has been presented through theoretical and empirical sources of evidence which include: test content, internal structure, clinical group differences, and relationships with other tests of motor skills (Bruininks & Bruininks, 2005). Both reliability and validity testing have been documented for items within each overall composite and subtests. Therefore, a researcher only using certain composites within the BOT-2 will reliably obtain valid results based on that specific composite test, and each of the composites can be used independently if desired (Bruininks & Bruininks, 2005).

The assessment used during pre/post-testing to measure pre-writing skills was the *Learning Accomplishment Profile*, Third Edition (LAP-3) (Hardin & Peisner-Feinberg, 2004). The LAP-3 is a criterion-referenced assessment that assesses individual skill development of preschool children in seven domains of development. Only the pre-writing domain was used for this study and was calculated into a single raw score.

Reliability analysis completed for each domain of the LAP-3 includes: correlations with age, internal consistency, standard error of measurement, test-retest reliability, and inter-rater reliability. Evidence of validity has been established through construct, criterion, and content validity analyses (Hardin & Peisner-Feinberg, 2004).

Procedure

All aspects of this study were conducted under procedures previously reviewed and approved by the University Health Systems Institutional Review Board (Appendix A). Informed parental consent was obtained from all participants prior to the start of the study through a signed

parent permission form with the signatures of the Head Start Director and the Principal Investigator. All investigators administering the HWT[®] – GSS curriculum had specific prior training in this program. The four and five year old students in the Head Start classroom were screened using the Shore and the ten children with the lowest pre-test scores were paired and then randomly placed in either the experimental or the control group. The LAP-3, the BOT-2, and the HWT[®] – GSS Check Readiness were used to gather pre-test data. Both groups completed the same pre-test measures prior to beginning the Pre-K HWT[®] – GSS program.

The investigators were responsible for facilitating the Pre-K HWT[®] – GSS program for the whole Head Start class twice a week for fifteen minutes. The experimental group received two additional days of supplemental instruction per week, each lasting fifteen minutes. The total number of supplemental sessions averaged 13 ± 1.22 per student, and ranged from 12 – 15 for the group. The sessions reinforced HWT[®] – GSS concepts and letters that had or soon would be covered with the whole class. The control group did not participate in supplemental experimental group instruction. All HWT[®] – GSS instruction occurred within the Head Start classroom.

At the end of five months of HWT[®] – GSS instruction, the experimental and control groups were given the *Learning Accomplishment Profile* – Pre-Writing domain (LAP-3), the *Bruininks-Oseretsky Test of Motor Proficiency* (BOT-2) – Fine Manual Control composite, and the Handwriting Without Tears[®] Check Readiness during post-test data collection. The *Shore Handwriting Screen* (Shore) was also administered to experimental and control groups for post-test data. All investigators were involved in both pre-test and post-test administration and scoring.

Intervention

HWT[®] – GSS intervention was provided by two East Carolina University occupational therapy graduate students who had received training in the HWT[®] – GSS Pre-K curriculum prior to beginning the research study. The weekly HWT[®] – GSS intervention activities were pre-planned and scheduled by the investigators in order to follow the HWT[®] curriculum as closely as possible. On the days that the investigators were not scheduled to go to Head Start, the classroom teacher and the teacher assistant were asked to carry out brief whole class instruction following the HWT[®] – GSS curriculum schedule.

The HWT[®] – GSS program began with whole group instruction. During beginning instruction, the children would sing and dance to music about shapes, letters, numbers and directional terms. Multisensory activities introduced early on in the curriculum included tapping of the HWT[®] wooden pieces (big curve, little curve, big line, little line) to a song, use of wooden pieces to build Mat Man (representing a person), and shaking hands to a song in order to differentiate right from left orientation. As the curriculum progressed, the participants learned letters and how they are written using the curriculum's top to bottom approach. Experimental group instruction began when the HWT[®] – GSS curriculum introduced tracing letters in workbooks. Multisensory activities involved building letters with wooden pieces, singing and dancing about letters, forming letters with dough, drawing, coloring with small crayons, tracing letters with the HWT[®] magna-doodle (Stamp & See Screen), and tracing letters in workbooks with crayons. Each week always began with whole class instruction followed by a day of supplemental experimental group instruction and so on. During the supplemental experimental group instruction, the concepts or letters from the previous day were emphasized with additional practice and exposure. Different modalities from the HWT[®] – GSS curriculum were often

utilized with the experimental group in order to provide different multisensory experiences versus the same exact instruction they received with the whole class the day before. A calendar schedule describing whole class and experimental group activities is provided in Appendix E.

Ethical Issues

The Institutional Review Board for the Protection of Human Subjects classified this study as “minimal risk.” No ethical considerations were identified. The selection of the study group was based on arbitrary definition of the lowest half of the class, and characterization as a group with prewriting deficits was determined on that basis and no other.

Data Analysis

Pre-test and post-test data collected in this study using the BOT-2 and the LAP-3 were compared using paired t-tests. A non-parametric t-test was used since there was not a large sample size or the presence of a large interaction. These two assessments were kept separate for statistical analysis because the scores from the two instruments were independent of each other. A HWT[®] – GSS Check Readiness Score Sheet (Appendix D) developed by the investigators was used to obtain data from the non-standardized screen. These data also were analyzed using t-tests to identify differences between the groups, as well as differences within the groups between pre-test and post-test results. The *Shore Handwriting Screen* was analyzed using a percentage of items correct from an established Score Sheet. T-tests were subsequently used for analysis of Shore scores to determine a difference between the groups or among the groups when comparing pre and post-test results. Statistical analysis was performed using Graph-Pad Prism[®], 3rd Edition (GraphPad Software, Inc., San Diego) and significance in any comparison was accepted when $p < 0.05$.

CHAPTER 4: RESULTS

Preliminary Analysis of Children with Pre-writing Deficits

Pre-screening of the Head Start class was conducted using the Shore Handwriting Screen (Shore) to identify students in the class with PWD. Preliminary findings revealed that the percentage of items correct on the Shore screen ranged from 37.9% to 84% ($X = 61.75$). Twelve children scored below the class average of 61.75%. Based on the number of low scores on the Shore, indicating possible PWD, ten participants were selected, paired by scores, and then randomly assigned into control and experimental groups. The mean Shore screen score for the experimental group was $52.0 \pm 8.0\%$, and was $52.1 \pm 6.2\%$ for the control group, verifying balanced distribution of participants between the two groups.

Shore Handwriting Screen Results

Analyses were calculated to determine if there were differences between the control and experimental groups across all instruments used, including the Shore, the BOT-2, LAP-3, and the HWT[®] Check Readiness. Statistical comparisons were made using paired t-tests and significance was accepted when $p < 0.05$. Major comparisons for each assessment were pre vs. post within each group and then pre vs. pre or post vs. post between groups.

The results indicated the presence of a significant difference in Shore post-test scores between the two groups (80.3 ± 8.85 vs. 69.7 ± 5.67 control vs. experimental, mean \pm standard deviation, $p = 0.05$). In comparing the two groups, both improved significantly between pre and post testing, (experimental group 52.0 ± 8.02 vs. 69.7 ± 5.6 , mean \pm standard deviation, $p = 0.03$; control group 54.1 ± 8.74 vs. 80.3 ± 8.85 pre-test vs. post-test, mean \pm standard deviation $p = 0.009$), however, the control group showed greater improvement. Thus, it was the control group changes that were responsible for the significant differences in post-test scores between the groups (See Table 1).

BOT-2 Fine Motor Coordination Results

Results of the BOT-2, analyzing fine motor coordination, did not indicate significant improvement in post-test average standard scores on the Fine Manual Control composite between control and experimental groups (36.7 ± 11.17 vs. 35.4 ± 2.61 , control vs. experimental, mean \pm standard deviation, $p = 0.276$). Further, analysis of BOT-2 pre and post-test standard scores did not indicate improvement within control or experimental groups (See Table 2).

LAP-3 Pre-writing Results

Both the control group and the experimental group showed significant improvements in LAP-3 Pre-Writing domain scores between pretesting and post-testing, but there were no significant differences between the two groups in post-test scores (33.4 ± 4.62 vs. 31.4 ± 1.52 control vs. experimental, mean \pm standard deviation, $p = 0.3842$). (See Table 3).

HWT[®] Check Readiness Results

Similarly, both groups also improved significantly from pre-test to post-test in the HWT[®] Check Readiness assessment, but there were no significant differences in the amount of improvement between the two groups (68.8 ± 14.08 vs. 73.4 ± 12.05 control vs. experimental, mean \pm standard deviation, $p = 0.59567$). (See Table 4).

Trends Within the Experimental Group

Several trends toward significant improvement, exclusive to the experimental group, were suggested by specific components of the HWT[®] Check Readiness. The “Naming Pictures” component of the Check Readiness required children to accurately name an apple, carrot, banana, tree, pants and grapes based solely on a black and white picture of these items. A score was given based on the total number of pictures named correctly. When comparing the post-test scores for the “Naming Pictures” item between the groups, data shows a p-value approaching the level of acceptable significance (4.8 ± 1.3 vs. 6.0 ± 0.0 control vs. experimental, mean \pm standard

deviation, $p = 0.0736$). Within the “Using fill in coloring” and the “Drawing a Person” components of the Check Readiness, similar trends were noted (See Tables 5, 6 and 7), suggesting that with larger group sizes, treatment effects might well have been identified.

Table 1. Shore Handwriting Screen Data

<i>Shore</i>	Pre	Post	p-value
Control	54.1 ± 8.74	80.3 ± 8.85	0.00915
Experimental	52.0 ± 8.02	69.7 ± 5.67	0.03354
p-value	0.70258	0.05263	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 2. BOT-2 Fine Manual Control Data

<i>BOT-2</i>	Pre	Post	p-value
Control	33.7 ± 12.54	36.7 ± 11.17	0.6911
Experimental	35.6 ± 3.71	35.4 ± 2.61	0.9439
p-value	0.5134	0.2759	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 3. LAP-3 Pre-writing Data

LAP-3	Pre	Post	p-value
Control	21.4 ± 1.82	33.4 ± 4.62	0.00162
Experimental	21.0 ± 1.00	31.4 ± 1.52	0.00001
p-value	0.67762	0.38419	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 4. HWT Check Readiness Data

<i>Check Readiness</i>	Pre	Post	p-value
Control	55.1 ± 14.25	68.8 ± 14.08	0.03807
Experimental	49.5 ± 11.79	73.4 ± 12.05	0.03697
p-value	0.5190	0.5957	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 5. HWT Check Readiness “Naming Pictures” Data

<i>Naming Pictures</i>	Pre	Post	p-value
Control	4.2 ± 1.30	4.8 ± 1.30	0.2080
Experimental	5.0 ± 0.71	6.0 ± 0.00	0.0342
p-value	0.2623	0.0736	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 6. HWT Check Readiness “Fill In Coloring” Data

<i>Fill In Coloring</i>	Pre	Post	p-value
Control	1.4 ± 0.89	1.8 ± 0.45	0.1778
Experimental	0.40 ± 0.55	1.2 ± 0.45	0.0161
p-value	0.0656	0.0667	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

Table 7. HWT Check Readiness “Drawing a Person” Data

<i>Drawing a Person</i>	Pre	Post	p-value
Control	4.8 ± 1.30	4.8 ± 1.30	0.2080
Experimental	4.2 ± 1.92	7.8 ± 1.10	0.0342
p-value	0.2623	0.0736	

Values shown are mean ± standard deviation for each group, and the p values listed correspond to the respective comparisons of data points by row or by column.

CHAPTER 5: DISCUSSION

Interpretation of Results

Students in the experimental group, who received additional small group instruction in the HWT[®] – GSS curriculum, did not show significantly greater improvement in handwriting readiness skills compared to children in the control group who received regular whole class HWT[®] – GSS instruction. However, the results should not be interpreted to indicate that the HWT[®] – GSS program was not beneficial for children with pre-writing deficits. On the contrary, pre-test and post-test assessment with the Shore, HWT[®] Check Readiness and LAP-3 Pre-Writing domain all indicated statistically significant improvement in handwriting readiness skills in all ten children from the sample identified with pre-writing deficits. On balance, findings suggested that whole class exposure to the occupational therapy-based, multisensory, preschool HWT[®] – GSS curriculum is adequate and effective in providing handwriting readiness skills to the lower performing at-risk preschoolers with pre-writing deficits.

The original 2008-2009 study investigated the effectiveness of the HWT[®] – GSS program on handwriting readiness skills of preschoolers in a rural eastern North Carolina Head Start program. The results showed that a Head Start class exposed to the HWT[®] – GSS curriculum showed significant improvement in handwriting readiness, when compared to a control class that did not receive HWT[®] – GSS instruction (Lust & Donica, in press). Although the present study does not support an additional benefit from supplemental small group exposure to HWT[®] – GSS as a means of significantly improving handwriting readiness, the data are consistent with findings of the previous study indicating a general benefit of HWT[®] – GSS in Head Start preschool students (Lust & Donica, in press). Present study data show that the Head Start class who received whole class HWT[®] – GSS instruction, significantly improved ($p < 0.05$)

handwriting readiness skills based on pre and post-test data from the Shore, HWT[®] Check Readiness, and LAP-3 Pre-Writing domain assessment tools.

Results of this study support the use of the HWT[®] – GSS program with preschoolers who show pre-writing deficits at a reduced frequency and intensity, without the need for additional small group help. For this study, whole class HWT[®] – GSS instruction was modified and occurred during fifteen minute sessions twice a week over a five month period. The teacher's guide outlines the program at the frequency of five days per week. However, due to the flexibility of the program, preschool teachers have the opportunity to implement HWT[®] – GSS program within their classroom based on their specific schedule and academic calendar. Implementing this handwriting readiness curriculum provides even the underperforming preschooler with the exposure necessary to improve their handwriting readiness.

Clinical Application

For this study, the Handwriting Without Tears[®] – GSS program was carried out by an occupational therapist and two occupational therapy graduate students. However, the pre-writing curriculum was originally developed for implementation by trained educators in the preschool setting. The findings of this study support the use of the HWT[®] – GSS program within an inclusion model where preschoolers can learn and interact among their peers. Handwriting Without Tears[®] training workshops, the HWT[®] – GSS Teacher's Guide and other HWT[®] products provide the information and tools necessary for preschool teachers to successfully implement the program. With the HWT[®] – GSS program implemented at the whole class level by school educators, the role of the occupational therapist can be more focused on those children who have more complex fine motor deficits. In these cases, small group or individual intervention sessions are warranted in order to provide skilled occupational therapy services.

In circumstance, the role of the occupational therapist can be to provide consultation and to educate preschool teachers on the developmentally based, multisensory HWT[®] – GSS curriculum and how to implement it within their setting. Handwriting readiness programs will continue to be an important focus within the preschool scope due to the handwriting expectations and demands placed on children in their kindergarten year. The occupational therapist should provide workshops and in-service presentations on the use of the HWT[®] – GSS curriculum to preschool administrators and directors as a means of advocating for staff training as well as use of the program. The therapist also should be available to provide follow-up on fine motor deficits that are beyond the scope of regular programming.

Limitations

This study was designed to specifically investigate the effectiveness of supplemental Handwriting Without Tears[®] – GSS instruction in a preschool curriculum with at-risk preschoolers who have pre-writing deficits. Due to the nature of the study and the small sample size, general extrapolation of the results to large scales implications should be made only with caution. With a total sample size of ten children, results obtained from this study are difficult to generalize to other preschool Head Start populations or to any other preschool populations/settings.

Another limitation of this study was the inability to adequately control the learning environment. The supplemental small group instruction took place in the Head Start classroom, while the remaining students were involved in center activities. In center activities, all other children were engaging in free play, which was inevitably distracting to the group receiving supplemental instruction. There were numerous distractions including the other children in the room, noise level, and other activities going on. Another learning environment limitation was

the involvement of other instructors in overall instruction. Although the Head Start teachers have experience with the HWT[®] – GSS curriculum, they may have different instruction styles from the instructors who lead from more of the occupational therapy perspective. In order to minimize this limitation, investigators provided the teachers with recommended review activities that were sensorimotor-based and appropriate for where the children were in the outlined curriculum. The BOT-2 is designed to assess a child's strengths and weaknesses in motor areas based on age-specific normative data. It has been established that because of the change in the child's age during the five month course of this study, the BOT-2 may not have been the best indicator of changes in fine motor control due to the change in age referenced normative values between pre-test to post-test scoring sessions.

Conclusion

To better identify true changes in this young age group, the investigators adopted the HWT[®] – GSS, and demonstrated its effectiveness in improving handwriting readiness skills of preschoolers with and without pre-writing deficits in a rural Head Start program. The need for additional small group exposure beyond twice weekly whole class instruction was not supported. However, the long term benefits of the HWT[®] – GSS curriculum and the sustainability of the curriculum within a Head Start program from a teacher implemented inclusion model has yet to be determined. Future research should address these uncertainties in order to establish a preschool protocol for handwriting readiness intervention for those children that are at-risk in the educational setting.

HWT[®] – GSS remains effective in improving handwriting readiness skills of lower performing preschool students, even when administered in a modified schedule at the whole class instruction level. The results of this study offer positive insight into the implementation of

the occupational therapy-based HWT[®] – GSS curriculum in a general classroom setting, given educator competence with the program and availability of trained occupational therapy practitioners for consultation as needed.

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APPENDIX A: University and Medical Center Institutional Review Board Revision Form

UMCIRB #:

UNIVERSITY AND MEDICAL CENTER INSTITUTIONAL REVIEW BOARD
REVISION FORM

RECEIVED
SEP 24 2009
UMCIRB

UMCIRB #: 60617

Date this form was completed: 9-21-09

Title of research: Handwriting With Tears Program For 4 year Olds

Principal Investigator:

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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): NA

Fund	Organization	Account	Program	Activity (optional)
		73059		

Version of the most currently approved protocol: X See attached Proposal

Version of the most currently approved consent document: X see attach consent form

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 checked="" type="checkbox"/> Other Pitt County Head Start Center | |

The following items are being submitted for review and approval:

Protocol: version or date 9-21-09

Consent: parent permission forms - version or date 9-21-09

Additional material: version or date

Complete the following:

- Level of IRB review required by sponsor: full expedited
- Revision effects on risk analysis: increased no change decreased
- Provide an explanation if there has been a greater than 60 day delay in the submission of this revision to the UMCIRB.
- Does this revision add any procedures, tests or medications? yes ??? No If yes, describe the additional information:
 - One change is for pre-testing and post-testing, the *Peabody Developmental Motor Scale-2* will not be used but replaced with the *Shore Handwriting Screening for Early Handwriting Development (SHS)* for pre-testing and post-testing of all participants in the 2009-2010 study. See attached SHS assessment.

UMCIRB #:

3. Following pre-testing the 4 year old Head Start classroom, ten to twelve students that are below average on the Shore Handwriting Screening and/or the Bruininks Osteresky Test of Motor Proficiency-2 and/or the Check Readiness, and/or the Learning Accomplish Profile – 3 will be randomly selected to be part of the study. Five to six of these low functioning students will be randomly selected to be the experimental group who will be provided with additional small group help/review sessions. The session will be provided 1-2 times per week during class center time lasting approximately 10 minutes. The Pre-K Handwriting Without Tears curriculum covered with the whole class will be reinforced with the experimental group during their small group sessions. The control group will be the remaining 5-6 low functioning children.
4. Six children that participated in 2008-2009 study (experimental group) did not meet the new Kindergarten cutoff date. These 6 students are once again attending Head Start. The 2009-2010 study would like to make these students a sub-group and continue offering them the *Pre-K Handwriting Without Tears Program*. The study would then make 6 students from the 2008-2009 study who presently attend regular Kindergarten the control group. The experimental and control subset group will receive additional post-test at the beginning of school year 2009 and a second post-testing in the spring. See attached parent permission form for these two sub-groups and the updated project proposal.

5. Have participants been locally enrolled in this research study? yes no NA

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

It's the start of a new school year and there's a new group of 4 year old students attending the Pitt County Head Start Program. This year's study wanted to offer pre-writing intervention in a format that follows the typical pre-school schedule by using daily center time 1-2 times a week. This small group time will reinforce what was shared with the whole class earlier in the week.

Six children that participated in 2008-2009 study (experimental group) did not meet the new Kindergarten cutoff date. These 6 students are once again attending Head Start. The 2009-2010 study would like to make these returning students a sub-group and continue offering them the *Pre-K Handwriting Without Tears Program*. It will require post-testing of 12 students from the 2008-2009 study (experimental group- students attending Head Start again and control group – students who are attending kindergarten) in September 2009 and March 2010.

I also have two new, first year, occupational therapy, graduate students for research assistance. They are Melissa Jones and Melissa Maxwell. They have completed the IRB online training.

Carol A. Lust Carol A. Lust 9/24/09
Principal Investigator Signature Print Date

Box for Office Use Only

The above revision has been reviewed by:		
<input type="checkbox"/> Full committee review on _____	<input checked="" type="checkbox"/> Expedited review on <u>10-1-09</u>	
The following action has been taken:		
<input checked="" type="checkbox"/> Approval for period of <u>exempt</u> to _____		
<input checked="" type="checkbox"/> Approval by expedited review according to category <u>45 CFR 46.110, Exempt #1</u>		
<input type="checkbox"/> See separate correspondence for further required action		
<u>Michelle F. Eble</u>	<u>Michelle F. Eble</u>	<u>10/1/2009</u>
Signature	Print	Date

APPENDIX B: Parental Consent Form

TO: Head Start - **4 Year Old** Classroom Parents/Caregivers
FROM: Zantra Best, Head Start Program Director
Carol A. Lust Ed.D., OTR/L
East Carolina University – Research Investigator
SENT: 9-21-09
RE: Participating in a Pre-K Handwriting Program & Administering 3-4 Developmental Assessments

Students from our class have been invited to participate in a study with East Carolina University's Department of Occupational Therapy. For five months, starting in September 2009 and ending in March 2010, your child may be randomly selected to participate in a pre-k handwriting program. The multi-sensory activities will be used to develop body awareness, good habits, coloring, drawing and handwriting skills. Music is an important part of the program. The program prepares the child in a playful and fun way to be ready for writing in kindergarten. There will be adult supervision at all times. If your child asks not to participate in the program, he or she will be immediately resume regular classroom/center activities. To determine the strength of this new pre-writing program, we'd like your permission to give your child 3 to 4 developmental assessments in the areas of fine motor and pre-writing using the *Learning Accomplishment Profile – Pre-Writing, (LAP-3)*, *Bruininks-Oseretsky Test of Motor Proficiency, (BOT-2) – Fine Manual Control*, the Pre-K Handwriting Without Tears - Readiness Check and the *Shore Handwriting Screening for Early Handwriting Development*. Each assessment will take approximately 10-20 minutes to administer. As Pitt County's - Head Start director, I have approved this project, and we are ready to start. This program will not disrupt our regular day and we believe students will really enjoy it. Please complete the permission form(s) below and return it to school tomorrow. If you have questions, give me a call at 707-8022 / 752-1569

CHECK ONE: _____

_____ **Yes**, my child _____
has permission to participate in the ECU, pre-K handwriting program and be evaluated in September 2009 and March 2010 using the Learning Accomplishment Profile – Pre-Writing, (LAP-3), Bruininks -Oseretsky Test of Motor Proficiency, (BOT-2) – Fine Manual Control and Manual Coordination., the Pre-K Handwriting Without Tears - Readiness Check, and the *Shore Handwriting Screening for Early Handwriting Development*.

_____ **No**, my child _____
may not participate in the ECU, pre-K handwriting program and be evaluated in September 2009 and March 2010 using the Learning Accomplishment Profile – Pre-Writing, (LAP-3), Bruininks-Oseretsky Test of Motor Proficiency, (BOT-2) – Fine Manual Control and Manual Coordination., plus the Pre-K Handwriting Without Tears - Readiness Check, and the *Shore Handwriting Screening for Early Handwriting Development*

Parent/Guardian signature: _____

Date: _____

APPENDIX C: Shore Score Sheet

Control or Experimental (circle)
Pre or Post – Test (circle)

Name: _____
Age: _____

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 = 4
Switches hands 1 time = 2
Inconsistent dominance = 1

Comments:

_____ 2c. Hand Control
Mature pencil grasp pattern (2 choices) = 4 pts
Transitional pencil grasp pattern (2 choices) = 2
Immature pencil grasp pattern (2 choices) = 1

Comments:

_____ 2d. Vertical Lines on page A
All single vertical lines = 4 pts
1-2 Vertical lines present but more than 1 line (line up & down 2xs) = 2pts

Comments:

_____ 2e. Rotate Pencil to Erase
Can rotate pencil with 1 hand without dropping = 4 pts
Used 2 hands to rotate = 2 pts
Other hand helped in unusual or awkward way = 1 pts
Unable to do = 0

Comments:

_____ 3a. Copies 1st Row of Shapes on page A
Accurately draws 4 out of 4 shapes = 4
Accurately draws 3 out of 4 shapes = 3
Accurately draws 2 out of 4 shapes = 2

Accurately draws 1 out of 4 shapes = 1

Comments:

- _____ 3b. Copies 2nd Row of Shapes on page A
Accurately draws 4 out of 4 shapes = 4
Accurately draws 3 out of 4 shapes = 3
Accurately draws 2 out of 4 shapes = 2
Accurately draws 1 out of 4 shapes = 1

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
Accurately draws 3 out of 4 letters = 3
Accurately draws 2 out of 4 letters = 2
Accurately draws 1 out of 4 Letters = 1

Comments:

- _____ 5a. Coloring the Balloon on page C
Colors within ¼" of the line = 4
Colors within ½" to 1" of the line = 2
Greater than 1" outside of the line = 1
Incomplete and/or primitive scribbling = 0

Comments:

- _____ 5b. Non – Dominant Hand on Paper during Coloring
Hand held paper 100% of time = 4pts
Hand held paper 50% of time = 2 pts

Comments:

- _____ 5c. Cut out Square on page C
Cuts out square with 4 corners = 4
Cuts out square with rounded or other angled corners = 3
Cuts out square but it does not remember a square = 2
Attempts to cut out square but can only make snipes or single line cut = 1
Unable to do = 0

Comments:

- _____ 5d. Scissor Grip
Mature grip = 4
Immature grip but able to open and close blades and cut = 2
Not able to hold scissors = 0

_____ Total Points (possible 58) = _____ %

APPENDIX D: HWT[®] Check Readiness Score Sheet

Control or Experimental (circle)

Participant's Name: _____

Scoring the HWT Check Readiness

Pre and Post – Test

- _____ 1. (6) Name picture: Count the number of pluses (+ identified - not able to name)
- _____ 2. (6) Name colors: Count the number of pluses marks (+ identified - not able to name)
- _____ 3a. Fill in color: Yes = 2pts Somewhat = 1pt Not Yet = 0 pts
- _____ 3b. Attempts to stay in lines: Yes = 2pts Somewhat = 1pt Not Yet = 0 pts
- _____ 4a. Crayon grip Standard = 2pts Alternate = 1 pts Palm = 0 pts
- _____ 4b. Hand preference: Report L = left R= right
- _____ 4c. Holds paper: Yes = 2pts Somewhat = 1pt Not Yet = 0 pts
- _____ 5a. (6) Name Shapes: Count the number of pluses: (+ identified, - not able to name)
- _____ 5b. Trace Shape: Put plus mark in Rt. hand corner of box for correctly tracing, count the number of pluses: (+ traced - not able to correctly trace)
- _____ 6. Copy Shape: Count the number of pluses: (+ copied, - not able to copy)
- _____ 7. (10) Draw a Person: Count the number of pluses for total body parts.
- _____ 8. (10) Name 10 letters: Count the number of pluses for letters correctly named
- _____ 9. (9) Name 9 numbers: Count the number of pluses for numbers correctly named
- _____ 10. Write name using capital letters

_____ % (Total Points: / 61 possible)

APPENDIX E: HWT[®] Intervention Schedule

Head Start Schedule 2009-2010				
Monday	Tuesday	Wednesday	Thursday	Friday
10/26	10/27 Pre-testing	10/28 Intro: Magic C Bunny Hello Song (Track 7) Intro to wood pieces	10/29 Head Start Closed	10/30 Head Start Closed
11/2	11/3 Fieldwork	11/4 Review names of wood pieces Rub wood pieces	11/5 Tap Song (Track 19) Wood Piece Pokey (Track 25) Directionality with wood pieces Pre-testing	11/6 Intro of Mat Man with wood pieces
11/9	11/10 Fieldwork	11/11 Veteran's Day – Head Start closed	11/12 Tap Song (Track 19) Mat Man with wood pieces	11/13 Head Start 2 hour delay
11/16	11/17 Tap Song (Track 19) Wood Piece Pokey (Track 25)	11/18 Draw Mat Man – first watch it drawn in circle, then draw at tables	11/19 Crayon Song (Track 5) Aim & Scribble (WB 5)	11/20 Complete LAP pre-tests Draw Mat Man

Monday	Tuesday	Wednesday	Thursday	Friday
11/23	11/24 Thanksgiving Break	11/25 Thanksgiving Break	11/26 Thanksgiving Break	11/27 Thanksgiving Break
11/30	12/1 Where do you start your letters? (Track 1) Capitals with Letter Cards – F demonstration (TG 42)	12/2 The Ant, The Bug, and the Bee (Track 14) Coloring activity (WB 9)	12/3 Bird Legs (Track 12) Coloring Activity – vertical & horizontal lines (WB 22-23)	12/4 Review names of thumb, pointer, tall man - Crayon song Coloring activity (WB 10-11)
12/7 Review names of thumb, pointer, tall man - Crayon song Coloring activity (WB 10-11)	12/8 Where do you start your letters (Track 1) Capital letter cards – L, F, E	12/9 Capital letter cards H, I, T	12/10 Review capital letters A,B,C Using capital letter cards and showing children. “Where do you start your letters?” Song Track 1	12/11 Review capital letters D,E,F
12/14 Review capital letters H,I,J	12/15 Review capital letters K,L,M	12/16 Review capital letters N,O,P	12/17 Review capital letters Q,R,S	12/18 Review capital letters T,U,V
12/21 Head Start Holiday Break	12/22 Head Start Holiday Break	12/23 Head Start Holiday Break	12/24 Head Start Holiday Break	12/25 Head Start Holiday Break

Monday	Tuesday	Wednesday	Thursday	Friday
12/28 Head Start Holiday Break	12/29 Head Start Holiday Break	12/30 Head Start Holiday Break	12/31 Head Start Holiday Break	1/1 Head Start Holiday Break
1/4 Children return Review capital letters W,X,Y,Z	1/5 Coloring Pictures Red & Green Pre-K Workbook pages 10-11 Using flip crayon	1/6 Coloring Pictures Yellow & Purple Pre-K Workbook pages 12-13 Using flip crayon	1/7 Coloring Pictures Blue & Orange Pre-K Workbook pages 14-15 Using flip crayon	1/8 Coloring Pictures Pink & Brown Pre-K Workbook pages 16-17 Using flip crayon
1/11	1/12 Where do you start your letters? (Track 1) Coloring Pictures Gray & Black Pre-K Workbook pgs. 18 & 19	1/13 Sing Mat Man Song & leader will build as class sings (circle) Crayon Song (Track 5) Mat Man Workbook pgs. 20-21	1/14 Experimental Group Activities: Hello Hand, Review Grip, Shapes using wooden pieces (TG p. 25)	1/15 Pre-Test new student using Shore & Check Readiness
1/18 MLK Day: State Holiday	1/19 Tracing letters L & F Pre-K Workbook pages 24-27 Teacher's Guide pg. 79-80	1/20 Tracing letters E & H Pre-K Workbook pages 28-31 Teacher's Guide pg 81-82	1/21 Experimental Group Activities: Making letters L & F using Wet, Dry, Try and Roll-a-dough	1/22
1/25 Writing letters L, F & E Using Stamp & See screen with letter templates	1/26	1/27 Experimental Group Activities: Making letters E & H using Stamp & See screen and Roll-a-dough	1/28 Experimental Group Activities: Introducing letters T & I with easel, children practice using Wet, Dry, Try	1/29 Introduce Letters T & I with wooden pieces (at tables). Use cookie sheet with magnetic wooden pieces

Monday	Tuesday	Wednesday	Thursday	Friday
2/1 Snow	2/2 Snow	2/3 Tracing letters T & I Pre-K Workbook pages 32 & 33 Sing The Ant, the Bug & the Bee (Track 14)	2/4 Experimental Group Activities: Making the letter U using the slate and Roll-a-dough; review naming other letters	2/5 Tracing Letter U Pre-K Workbook page 35 The Rain Song Track 24 (Possibly Workbook page 34)
2/8	2/9 Introducing Letter C with Magic C Bunny Magic C Song Track 6 Pre-K Workbook pages 36-37	2/10 Experimental Group Activities: Review Letter C & Introduce letter O with Stamp & See and Wet-Dry-Try	2/11 Introducing Letters O & Q by showing wooden pieces and showing on easel (circle time) Pre-K Workbook pages 38-41	2/12 Experimental Group Activities: Review Letter Q. Introduce Letter G using Stamp & See Screen (possibly Wet-Dry-Try)
2/15 Introduce Letter G with wooden pieces and cookie sheet Stamp & See with G and Magic C letters	2/16 Experimental Group Activities: Review Magic C Letters & L, E, F, H with Stamp & See Screen and magnets Work on identification of letters	2/17 Build Mat Man as a group while singing Mat Man Song Tracing Letter G Pre-K Workbook page 42-43	2/18 Experimental Group Activities: Introduce Letter S Wooden pieces then Roll-a-dough	2/19
2/22 Introduce Letters S & J on chalkboard in circle, then Stamp & See Screen Mrs. O'Kelley read Mat Man Hats book	2/23 Experimental Group Activities: Introduce Letter D with wooden pieces and Roll-a-Dough, Review letter J with Roll-a-Dough	2/24 Tracing Letters S & J Pre-K Workbook pages 44-47 Song Track 1 "Where Do You Start Your Letters?"	2/25 Experimental Group Activities: Review letters S, J & D with Stamp & See Screen Practice writing names on strips	2/26 Mrs. O'Kelley: Review names of letters L, F, E, H, T, I, U, C, O, Q, G, S, J

Monday	Tuesday	Wednesday	Thursday	Friday
3/1 Fieldwork Mrs. O’Kelley: “Where Do You Start Your Letters?” Song Track 1	3/2 Dr. Lust Introduce letter D using chalkboard in circle and/or wooden pieces on cookie sheet Pre-K Workbook pages 48-49	3/3 Fieldwork Mrs. O’Kelley: Spiders Love to Party Song Track 15	3/4 Dr. Donica Introduce letters P & B with wooden pieces; children work at tables. Use the cookie sheet to cue them. Tap, tap, tap Song Track 19	3/5 Fieldwork Mrs. O’Kelley: Mat Man Shapes book
3/8 Dr. Lust: Mat Man in circle with song; Pre-K Workbook tracing Letters P & B pages 50 & 51	3/9 ECU Spring Break Mrs. O’Kelley: Skip to My Lou Song Track 21	3/10 ECU Spring Break Experimental Group Activities: Review P & B with Wet, Dry, Try	3/11 ECU Spring Break	3/12 ECU Spring Break
3/15 Introduce Letters P & B with mats & wooden pieces in circle. Pre-K Workbook tracing Letters P & B pages 50 & 51	3/16	3/17 Introduce Letter R using wooden pieces and cookie dough sheet; Tracing Letter R Pre-K Workbook pages 52 & 53	3/18	3/19 Experimental Group Activities: Review Letter R, Introduce K & A using wooden pieces and Stamp & See Screen
3/22 Song Track 1 “Where Do You Start Your Letters?” Introduce Letters K & A to class using Stamp & See Screen	3/23 Experimental Group Activities: Introduce Letter V & M using wooden pieces & Roll-a-Dough	3/24 Tracing Letters K & A Pre-K Workbook pages 54-57; Begin Shore post-testing	3/25 Head Start closed	3/26 Head Start closed
3/29 POST-TEST Shore & Check Readiness Experimental Group Activities: Pre-K Workbook pages 58-61 Tracing name; review names of letters	3/30 POST-TEST BOT-2 & Check Readiness or Shore Experimental Group: Review Letters K, A, V using Stamp & See Screen; Introduce Letter N using wooden pieces	3/31 POST-TEST BOT-2 and LAP-3	4/1 POST-TEST BOT-2 and LAP-3	4/2 Good Friday – Head Start closed

Monday	Tuesday	Wednesday	Thursday	Friday
4/5 Head Start Spring Break	4/6 Head Start Spring Break	4/7 Head Start Spring Break	4/8 Head Start Spring Break	4/9 Head Start Spring Break
4/12 POST-TEST Introducing & Tracing Letters W & X Pre-K Workbook pages 68 & 69.	4/13 POST-TEST Introducing & Tracing Letters Y & Z Pre-K Workbook pages 70 & 71.	4/14	4/15	4/16
4/19	4/20	4/21	4/22	4/23
4/26	4/27	4/28	4/29	4/30