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## A Comparison of the Effectiveness of Two Handwriting Programs on Legibility in First Grade Students

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A COMPARISON OF THE EFFECTIVENESS OF TWO HANDWRITING PROGRAMS ON  
HANDWRITING LEGIBILITY IN FIRST GRADE STUDENTS

Presented in Partial Fulfillment of the  
Requirements for the Degree of  
Doctor of Occupational Therapy

Eastern Kentucky University  
College of Health Sciences  
Department of Occupational Science and Occupational Therapy

M. Whitney Cook  
2021

**EASTERN KENTUCKY UNIVERSITY  
COLLEGE OF HEALTH SCIENCES  
DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY**

This project, written by Whitney Cook under direction of Dr. Julie Duckart, Faculty Mentor, and approved by members of the project committee, has been presented and accepted in partial fulfillment of requirements for the degree of

DOCTOR OF OCCUPATIONAL THERAPY

CAPSTONE COMMITTEE



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December 1, 2021

Date



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December 3, 2021

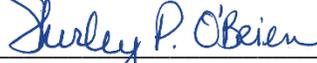
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**EASTERN KENTUCKY UNIVERSITY  
COLLEGE OF HEALTH SCIENCES  
DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY**

Certification

We hereby certify that this Capstone project, submitted by Whitney Cook, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the project requirement for the Doctor of Occupational Therapy degree.

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12-07-21  
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Date

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## Executive Summary

**Background:** Handwriting is one of the most utilized forms of written communication and there is a lack of research comparing the effectiveness of two different handwriting programs in elementary aged students.

**Purpose:** The purpose of this Doctor of Occupational Therapy (OTD) Capstone project was to compare the efficacy of two handwriting programs implemented in first grade classes at one elementary school in central Kentucky. The research question that guided this Capstone Project was: Which of the following handwriting programs were more effective in achieving handwriting legibility in first grade students: Handwriting Without Tears or Write Start?

**Theoretical Framework:** The theoretical frameworks and scientific underpinnings that guided this capstone project were the Conceptual Model for Performance in Handwriting, the Developmental Theory and Ayres Sensory Integration.

**Methods:** A pre-experimental design comparing pretest and posttest data was utilized to analyze results using descriptive statistics and jamovi in first grade students. Students in each classroom received six sessions of handwriting interventions that last twenty minutes each. One classroom received Handwriting Without Tears instruction while the other classroom received Write Start instruction.

**Results:** Statistical significance was found for improvement in handwriting legibility in students who received the Handwriting Without Tears intervention. Both programs, Handwriting Without Tears and Write Start, demonstrated clinical significance and improvement in student handwriting legibility.

**Conclusions:** The use of handwriting programs can provide a positive impact on handwriting legibility in first grade students. A hybrid model combining methods from Handwriting Without Tears and Write Start could be implemented to provide instruction to students on handwriting skills.

## **Acknowledgements**

Thank you to my wonderful family including my husband, Daniel, my son, Cooper, and my parents, Wayne and Paula Joslin. Your love, support and encouragement have helped me through this exciting and challenging journey. Thank you to Dr. Julie Duckart for your help with the Capstone project and for always cheering me on and being so positive. Thank you to Dr. Jennifer Hight for your assistance with this project and for your eye for attention to detail. Lastly, thank you to Dr. Dana Howell for your guidance and support throughout the Capstone project as well. Each of you have played a major role in an exciting time in my professional career and I am so thankful for you.

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**DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY**

**CERTIFICATION OF AUTHORSHIP**

Submitted to (Faculty Mentor's Name): Julie Duckart

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Title of Submission: A Comparison of Effectiveness of Two Handwriting Programs on Handwriting  
Legibility in First Grade Students

*Certification of Authorship: I hereby certify that I am the author of this document and that any assistance I received in its preparation is fully acknowledged and disclosed in the document. I have also cited all sources from which I obtained data, ideas, or words that are copied directly or paraphrased in the document. Sources are properly credited according to accepted standards for professional publications. I also certify that this paper was prepared by me for this purpose.*



Student's Signature: \_\_\_\_\_

Date of Submission: December 2, 2021

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## **Section 1: Nature of Project and Problem Identification**

### **Introduction**

Optimal functioning in the school setting requires efficient fine motor skills (Schneck & Case-Smith, 2010). First grade students spend a large portion (approximately 45-55%) of their school day engaging in fine motor activities, with the majority of them being paper-pencil tasks (McHale & Cermak, 1992). By the time a typically developing child has reached the age to attend first grade (six to seven years old), they are expected to perform the following skills that are necessary for handwriting: reach to and across midline, reach with full range of motion of bilateral upper extremities, grasp objects using various grasp patterns, release objects freely and into small containers, in-hand manipulation of items, bilateral skills such as stabilizing their paper while they color and use classroom tools appropriately (Schneck & Case-Smith, 2010). Students are also expected to demonstrate appropriate trunk control and posture with their feet firmly planted on the floor in order to complete skillful, coordinated fine motor movements (Schneck & Case-Smith, 2010). Handwriting skills that are expected of children who are six to seven years old include producing legible uppercase and lowercase letters using a consistent style and produce letters with a recognizable letter formation sequence as well as appropriate letter orientation (Chu, 1997).

Handwriting is one of the most utilized forms of written communication (Cahill, 2009). However, multiple elementary students (approximately ten to thirty percent) have handwriting concerns (Banumathe et al., 2016). Decreased legibility has also been found to lead to lowered academic performance which can also put students at risk for lowered self-esteem (Banumathe et al., 2016). Occupational therapists (OTs) who work in school-based settings play a large role in facilitating handwriting development and remediation. Occupational therapists often target

cognitive, fine motor, visual motor, and processing skills to address handwriting performance in elementary-aged students.

There are many handwriting programs and evidence to support the programs in improving handwriting and fine motor skills. Handwriting Without Tears is a multi-sensory handwriting program that utilizes a coaching model for the classroom teacher to implement in whole class sessions. Marr and Dimeo (2006) studied the impact of Handwriting Without Tears interventions for one hour per day over a two week period and found that it had a significant impact on students in grades 1-6 and their legibility of writing uppercase and lowercase letters of the alphabet. The D'Nealian handwriting program is a continuous stroke, manuscript-cursive program that incorporates auditory, visual, tactile and kinesthetic elements to instruct children on handwriting. Peterson and Nelson (2003) studied the impact of the D'Nealian handwriting program on legibility in first grade students and discovered that it had a positive impact on their handwriting legibility. Write Start is a combination of multi-sensory techniques, activities that address visual motor skills, letter formation and positive peer modeling/feedback in a small group setting. Case-Smith, Weaver, and Holland (2014) studied the impact of Write Start on elementary students and found that it had a positive correlation on students' handwriting legibility. Despite the overwhelming evidence studying the effectiveness of one handwriting program, evidence is lacking comparing the effectiveness of handwriting programs against one another. The lack of evidence comparing two programs indicates the need to conduct research comparing handwriting programs to assist OTs, teachers, parents and school administrators in choosing the most appropriate handwriting program for their students.

### **Problem Statement**

The problem that this project addressed is the lack of evidence that compares the effectiveness of Handwriting Without Tears and Write Start to determine which of the two are

more effective in addressing handwriting legibility in first grade students. Handwriting programs are one means of improving handwriting performance. However, not all elementary schools have a handwriting program in place. In schools without a handwriting program, each teacher uniquely attempts to teach students how to perform handwriting in their own classroom. A referral is often made to Occupational Therapy when a student has difficulty with handwriting skills. Therefore, in an effort to decrease unnecessary referrals for handwriting to Occupational Therapy and to determine the best fit for a school's handwriting program, comparing two handwriting programs' effectiveness on student handwriting legibility, research is warranted.

### **Purpose Statement**

The purpose of this Doctor of Occupational Therapy (OTD) Capstone project was to compare the efficacy of two handwriting programs implemented in first grade classes at one elementary school in central Kentucky.

### **Research Question**

The research question that guided this Capstone Project was:

Which of the following handwriting programs were more effective in achieving handwriting legibility in first grade students: Handwriting Without Tears or Write Start?

### **Theoretical Framework**

The theoretical frameworks and scientific underpinnings that guided this capstone project were the Conceptual Model for Performance in Handwriting, the Developmental Theory and Ayres Sensory Integration. The Conceptual Model for Performance in Handwriting (CMPH) guides evaluation and intervention of handwriting in children by attending to performance components, functional capacities and contexts of handwriting (Chu, 1997). The three main functional components that are assessed, analyzed and targeted using the CMPH include:

sensorimotor functions, cognitive functions and psychosocial functions. The functional capacities that are addressed with this model include: biomechanical/ergonomic factors, quality of writing, and general observations of the child and their reactions to others and their environment. The contexts that are included in the CMPH are the temporal aspects associated with handwriting (age of child, time of day, time of year, etc.) and environmental aspects associated with handwriting (physical, social, cultural and spiritual). The key concept to the CMPH is understanding that there is a dynamic, interactive relationship that occurs between performance areas, performance contexts and performance components that have an impact on handwriting (Chu, 1997).

The CMPH laid the foundational groundwork to guide this capstone project because it directed the researcher to consider functional components of the participants (incorporation of sensorimotor components into the interventions, cognitive functions and the speed of which the lead researcher delivered the interventions that was appropriate for each participant, as well as their psychosocial functions). It also led the researcher to consider each participant's functional capacities. Examples included: participants' sitting balance and posture, the ergonomic design of their chairs/desks, the quality of each participant's handwriting via informal observations as well as formal assessments such as The Print Tool, and informal observations of the participants' responses to their peer and teacher feedback of their handwriting performance. Contexts that were observed and analyzed guided by the CMPH included the temporal aspects of the participants' ages, the time of day the interventions occurred (1:30p, directly after recess), and the time of the school year (first three months of the school year in the fall). The environmental aspects of the context included the physical classroom and limiting distractions, the social aspect of encouraging students to interact with their peers to give and receive feedback on their

handwriting performance, as well as the cultural expectation that students in first grade should learn how to write legibility and appropriately. The CMPH guided the lead researcher to be mindful of the interactive relationship of students' performance areas, performance contexts and performance components and how these interactions can affect each individual's handwriting performance (Chu, 1997).

Developmental theory views child development through patterns or sequences that are characteristics of children (Kramer & Hinojosa, 2010). Through an Occupational Therapy perspective, child development is viewed as how children engage in valued occupations that are appropriate for their age (Kramer & Hinojosa, 2010). Developmental theory provides an understanding that child development is dynamic and is a continuous progression of change in response to the internal environment (a child's mind and body) as well as the external environment (objects and physical settings), (Kramer & Hinojosa, 2010). Motor progression, according developmental theory occurs in a sequential, proximal to distal manner in the human body. Motor learning, or achieving a new motor skill, can occur via practicing the new skill as well as understanding/knowing the result of the new skill (Kramer & Hinojosa, 2010). The Developmental theory was a supplementary guidance of this capstone project because it provided the researcher with the opportunity to demonstrate their knowledge and understanding of basic child development as well as to incorporate opportunities for children to experience motor learning in hopes of improving their handwriting legibility.

Ayres Sensory Integration (ASI) is a framework that was founded on the principles of neuroscience and aims to provide an understanding of how sensory and motor foundations contribute to human behavior (Lane et al., 2019). AOTA (2008) states that as children grow and develop, they refine their ability to register, modulate, and discriminate sensory information to

support development of fine motor skills (along with emotional regulation, gross motor, social and play skills). ASI principles address all of the sensory systems, however for this capstone the main sensory components that were targeted were praxis, tactile, auditory, and visual input. Ackerley et al. (2012) concluded that tactile sensations provide stimulation to the posterior parietal cortex and then is integrated with visual and motor signals. Praxis consists of ideation, motor planning, and execution (Lane et al., 2012). When addressing praxis using ASI, there is an emphasis on visual input along with a somatosensory component (Lane et al., 2012). Interventions in both classrooms incorporated an ASI approach including praxis, tactile, auditory and visual input (to be discussed later) to address handwriting legibility in the students' performance.

### **Significance of the Study**

Absence of handwriting programs results in decreased student handwriting legibility, development of improper pencil grasps and letter formation, and lack of consistency across grades and classes. This project determined which of the two previously mentioned handwriting programs was more effective and will be recommended for all elementary classes that was the setting for this study and teachers to use the same program based on the results of this Capstone. This project was significant for students, teachers, para-educators, administration, special educators, and parents/guardians of students at the elementary school where the study took place. This project was also significant for Occupational Therapy delivery in school-based settings to guide practitioners on how to compare the effectiveness between two handwriting programs when choosing the most appropriate one for individual schools.

The service delivery using the Write Start program occurred through collaboration and co-teaching and the service delivery for Handwriting Without Tears occurred through a co-

teaching and coaching model. It is hoped that if a formal handwriting program is implemented at the elementary school where the study occurred, the OT will see a decrease in unnecessary referrals for Occupational Therapy services as well as improved handwriting skills and legibility in elementary students.

## **Summary**

First grade students spend a lot of time of their school day engaging in paper to pencil tasks and handwriting is one of the most commonly utilized forms of written communication. There is a copious amount of evidence that explores the effectiveness of a single handwriting program on handwriting legibility in children, however the amount of research that compares two handwriting programs against each other is lacking. The purpose of this capstone presentation was to compare the effectiveness of two handwriting programs on handwriting legibility in first grade students. The research study was guided by principles of the Conceptual Model for Performance in Handwriting, Developmental theory, and Ayres Sensory Integration. This study was important in assisting the school in determining which handwriting program to use for the entire elementary school. The section that follows in this report is a detailed review of the literature related to handwriting.

## **Section 2: Detailed Review of the Literature**

Ten to thirty percent of elementary students struggle with handwriting skills (Banumathe et al., 2016). Decreased legibility can lead to lowered academic performance which can also put students at risk for lowered self-esteem (Banumathe et al., 2016). Taking notes in an accurate, legible, and swift manner during a lecture can lead to an increased ability retain the content (Kramer & Hinojosa, 2010). Research indicates that implementation of formal, program-based handwriting is effective in improving handwriting skills for both general education and special education students (Engel et al., 2018). Students who have more legible handwriting have been found to have better grades, express themselves more fluently, and can complete their homework in a more timely fashion than students who have decrease legible handwriting (Kramer & Hinojosa, 2010).

### **Assessment of Handwriting**

One of the initial steps to conduct prior to implementation of a handwriting program is to determine the methods to evaluate and assess the students' performance at baseline so that data may be collected throughout the process in order to compare and determine students' potential progress or lack thereof. Informal methods of assessment include observation of students' performance skills that include but are not limited to: pencil grasp, visual scanning, postural stability, fine motor skills, legibility, and writing speed (Banumathe et al., 2016). Formal methods that can be used to collect data include but are not limited to: Berry's Developmental Test of Visual Motor Integration and Bruininks Oseretsky Test of Motor Proficiency, Test of Visual Perceptual Skills, Developmental Test of Visual Perception, The Test of Handwriting Skills-Revised, and The Print Tool (Banumathe et al., 2016; Donica, 2015).

### **Handwriting Programs**

Many handwriting programs have been developed and studied to determine their impact on handwriting performance in children. Write Start is a handwriting program that is co-taught by teachers and OTs in small group settings, that includes one on one support, self-modeling, peer-modeling, and feedback provided frequently throughout (Case-Smith, Holland, & Bishop, 2011; Engel et al., 2018). Handwriting Without Tears is a curriculum that is based on sensorimotor learning, and instruction that is play-based to teach print and cursive handwriting skills (Engel et al, 2018; Olsen, 2003; Olesen & Knapton, 2008). Handwriting Without Tears – Get Set for School a modification of Handwriting Without Tears that also promotes sensorimotor learning and uses a play-based approach to teach preschoolers pre-writing skills, body awareness and fine motor skills (Engel et al., 2018; Olsen & Knapton, 2008). The Peterson Direct Handwriting Curriculum uses rhythm and sequencing of movement to develop movement patterns to promote the connection between writing and reading fluency (Engel et al., 2018; Nelson, 2006). Fine Motor and Early Writing Pre-K Curriculum is a handwriting readiness program that utilizes teaching at small stations workbooks, sensory activities and writing tools that have been adapted (Donica et al., 2013; Engel et al., 2018).

Size Matters Handwriting Program is a program that places an emphasis on letter sizing and its approach includes direct instruction, self-critique/self-monitoring, parental/guardian involvement, and mnemonics (Engel et al., 2018; Moskowitz, 2009). Write Direction aims to target formation of letters via movements of the body/kinesthetic awareness and learning, along with visual-motor skills (Engel et al., 2018; Taras et al., 2011). Handwriting Clubs is an intervention that uses school clubs to focus on handwriting skills via intensive practice or visual-perceptual-motor skills (Engel et al., 2018; Howe et al., 2013). The Explicit Handwriting

Program targets cursive handwriting skills through digital/dexterity exercises and metacognitive skills (Engel et al., 2018; Kaiser et al., 2011).

### ***Handwriting Without Tears***

Jan Olsen is an OT who created and developed Handwriting Without Tears in 1977. Interventions for HWT include teachers instructing their students on printing and multisensory activities using the *Handwriting Without Tears First Grade Printing Teacher's Guide and Workbook* (Olsen & Knapton, 2008). Multi-sensory activities used as part of the HWT program include: wooden shapes to form capital letters, chalk and chalkboard, Roll a Dough, and Rock, Rap, Tap and Learn musical CD (Olsen, 2008). For the HWT interventions, the OT can fulfil the role of “coach” for the adults working with the students and delivers the interventions via consultative method (Donica, 2015). It is also appropriate for an OT to directly provide the interventions using Handwriting Without Tears. Elementary aged students who received the HWT instruction (as compared to students who received standard handwriting instruction) demonstrated improvement in handwriting performance (Donica, 2015).

### ***Write Start***

Write Start is a handwriting program that was developed by teachers in the classroom (Case-Smith et al., 2014). Four first grade classrooms implemented the Write Start program over twenty-four sessions and found to have a higher improvement in regards to writing fluency in comparison to other first grade classrooms who only received standard handwriting instruction (Case-Smith et al., 2014). Small group instructions for the students in stations where they were introduced to modeled letter formation and they were encouraged to perform self-evaluation of their writing, peer evaluation of others' writing, as well as positive peer modeling (Case-Smith et al., 2014). Activities that also occur at stations focus on the following skills that are necessary

for handwriting development: motor planning, visual motor integration, in hand manipulation and cognitive learning (Case-Smith et al., 2014). Evidence indicates the effectiveness of the Write Start program for students who were identified as at-risk for handwriting and writing skills (Case-Smith, et al., 2014).

### **Role of Occupational Therapy with Handwriting**

Over the years, the role of OT in the school-based practice realm has expanded from one-on-one work with individual students, to now include whole class general education collaboration and instruction (Donica, 2015). Occupational therapists have now become a valuable team member when working with students in Early Intervention Services (EIS) as well as Response to Intervention (RtI) (Donica, 2015). Evidence suggests that a multi-sensory handwriting approach using the program Handwriting Without Tears (HWT) is effective on handwriting legibility with elementary aged students (Donica, 2015). A phenomenological study aimed at understanding kindergarten teachers' perceptions of handwriting programs indicated that the lack of the program and formal handwriting training negatively impacted their handwriting teaching skills to their students (Nye & Sood, 2018).

Grajo, Candler, and Sarafian (2020) conducted a systematic review that included forty-six studies which focused on students 5-21 years old to determine the effectiveness of Occupational Therapy and students' academic performance. After the articles were reviewed using PRISMA guidelines the following three themes were identified: interventions of Occupational Therapy to support participation and learning in the classroom, interventions to support motivation and participation in reading/literacy/comprehension, and interventions to support handwriting skills (Grajo et al., 2020). Moderate evidence was found to support yoga, creative activities and peer support interventions for academic performance. Strong evidence

supported Occupational Therapy interventions and handwriting in regard to students' academic performance (Grajo et al., 2020). Researchers concluded that further rigorous research needs to be conducted to investigate the effect of Occupational Therapy and student academic performance (Grajo et al., 2020).

Piller and Torrez (2019) conducted a two phased research study aimed to define and evaluate the effectiveness of fine motor interventions that OTs use to address handwriting. 157 participants had their therapy notes analyzed from Occupational Therapy sessions along with pre/post-test data collected using the BOT-2. Results indicated that OTs most commonly used interventions to address fine motor coordination in regard to handwriting includes: cognitive-based approach, multi-sensory approach, and motor approach (Piller & Torrez, 2019). Pre/post-test data indicates that the participants experienced an improvement in their Fine Manual Control subtest scores of the BOT-2, indicating the effectiveness of the Occupational Therapy interventions (Piller & Torrez, 2019). Implications for future Occupational Therapy use include the blueprint for specific and appropriate evidence-based approaches for OTs to use when working on fine motor skills in regard to handwriting skills with children.

Patton, Hutton, and MacCobb (2015) examined the collaboration between OTs and teachers who work with students who have Down Syndrome. Teachers implemented HWT program with the OT consulting on various interventions and collaborating with the teachers. Results indicated that teachers collaborating with the OTs to teach HWT was beneficial, particularly in regards to Occupational Therapy support as well as training the teachers received from OTs on HWT (Patton et al., 2015). Recommendations for practice include increasing collaboration time between educators and OTs. Occupational therapists should be utilized more frequently on a consultative basis to educate teachers on handwriting interventions, and there are

many more opportunities for OTs and teachers to collaborate for further research (Patton et al., 2015).

### **Summary**

In summary, literature supports the role of Occupational Therapy to address handwriting and fine motor skills in the school-based setting. Multiple studies have been conducted to indicate the effectiveness of handwriting programs on handwriting legibility and data suggests that the use of handwriting programs improves student handwriting performance. The following section will include the description of the methods utilized in this study.

## **Section 3: Methods**

### **Research Design**

This study was a pre-experimental two-group pretest-posttest. Data was collected with no randomization before and after the handwriting interventions occurred (one first grade classroom received the Write Start program, the other first grade class received HWT). Randomization of participants did not occur due to logistical reasons however, both first grade classrooms were anticipated to be equivalent in areas of student knowledge and academic performance. The two-group pretest-posttest design offers more rigor than the one-group pretest-posttest design because it allows for comparison between two groups as a whole as well as it provides opportunity for comparison of participants within each group (Taylor, 2017). The design of this study allowed for comparison of the handwriting programs on handwriting legibility for the classrooms as a whole and it also provided opportunities to compare the impact of the program on individual legibility performance. It was also conducted to determine change over a six-week time period of intervention.

### **Setting**

The setting for this study was at an elementary school in central Kentucky. Enrollment is approximately 720 students and it serves students kindergarten through twelfth grade. For the purpose of this study, the setting will be considered both first grade classrooms at the elementary school. This setting was chosen for the research study as the lead researcher is the OT at this school and had already developed a relationship with the teachers prior to the start of the study.

### **Participants**

Participants for this study included: both first grade teachers, first grade students, para-educators, the OT, administration at the elementary school, the special educator who has first grade students, three master's level Occupational Therapy students from Eastern Kentucky

University and the researcher's OTD mentor, Dr. Julie Duckart. Participants for this study were selected through the use of convenience sampling (use of subjects that are readily available and easily accessible, Taylor, 2017). The first grade students ranged in ages six years old to seven years old and included both male and female students. All students in both first-grade classrooms were given the opportunity to participate in the study as long as guardians provided written permission/consent and the student provided consent as well. These students come from a mix of various socioeconomic statuses.

### **Recruitment**

Recruitment for this study occurred via printed materials including a flyer with background information about the study and contact information with the lead researcher's e-mail address on it as well a document titled "Parent/Guardian Permission for a Child to Participate in a Research Study" that was approved by Eastern Kentucky University's Institutional Review Board (See Appendix A). This document included the following information about the study: purpose, time length, what the child will be asked to do, risks, benefits, cost, primary researcher, confidentiality of participants' information, and contact information for the lead researcher. This document also included the permission slip for the parent/guardian to sign, the Child Assent Script asking the children if they agree to participate (then had them circle a picture of a smiley/frown face holding a yes or no sign to indicate their answer), as well as child signature page to indicate their agreement to participate in the study if they were seven years of age or older (see Appendix B). All of the printed materials were distributed by placing a copy in each of the children's backpacks to be sent home to guardians during the first week of school (see Appendix C). Once parents/guardians read the printed materials and they along with the students completed the forms, they were sent back to school in

the backpack and the OT was able to retrieve the paperwork and store it in a locked file cabinet that was also locked in an office at the school.

### **Inclusion/Exclusion Criteria**

Inclusion criteria for this research included students who were currently enrolled in first grade who provided written parental consent. Students from both female and male genders, all educational performance abilities, and various socioeconomic status were included. Exclusion criteria included students whose parents did not provide consent for the study.

### **Project Methods**

Data collection occurred via pretest and posttest methods. Each first grader participating in the study was administered The Print Tool prior to the handwriting interventions and following the completion of the six handwriting interventions. For the administration of the Print Tool, students were taken into separate, quiet settings so as to provide an environment that had less distractions than the general classroom. The following researchers conducted administration of the Print Tool: the lead researcher, the OTD Capstone Mentor, and three Master's level Occupational Therapy students. All researchers had been instructed on how to properly administer this assessment. Other data collection included informal observations during interventions and teachers completing a brief survey.

Interventions occurred each week for twenty minutes over six school weeks. Interventions for the Write Start classroom included small group instruction on uppercase letter formation then lowercase letter formation. Students were introduced to four to six letters during each session. First, students observed the lead instructor model the formation of the letter for the entire class on the large dry erase board at the front of the class. Second, each student received their own personal small container of sand and they completed their warmup activity of tracing

the letter in the sand in small groups as their “adult” at each table modeled the letter formation. Next, students wrote their letter on lined hi-liter paper, copying from their visual cue of a worksheet with arrows for each letter indicating how to form the letter. Fourth, the students wrote their letter on lined hi-liter paper, copying from their visual cue of a worksheet without arrows for each letter. Lastly, students were encouraged to share their work with peers in their small group to receive feedback from classmates and adults as well as to promote reflection on their handwriting skills.

Interventions in the Handwriting Without Tears classroom also occurred weekly for twenty-minute sessions over six school weeks. This intervention occurred as whole class instruction using the “Wet, Dry, Try” method from HWT. During each intervention session, the students were introduced to four to six uppercase letters. Lowercase letters were not included in the interventions due to time constraints. Initially, the lead instructor would model the appropriate letter formation of one uppercase letter. Next, the letter would be written in front of each student on their own “Wet, Dry, Try” board so that they could see up-close modeling of the letter formation. Third, the student would use a small water-soaked sponge to trace and erase the letter. Fourth, the student would use a small piece of a paper towel to trace and dry the letter. Fifth, the student would then use a small piece of chalk to write the letter on their “Wet, Dry, Try” board using the appropriate letter formation. Lastly, students would be encouraged to hold

up their letters written on their boards for their peers and adults in the room to see as well as to provide them feedback.

### **Outcome Measures**

The Print Tool and descriptive statistics was used to analyze results. The Print Tool is a non-standardized assessment tool that evaluates a student's performance of writing uppercase letters, lowercase letters, and numbers (Banumathe et al., 2016). Its components include: memory, orientation, placement, writing a sentence and total composite performance. The Print Tool is an appropriate assessment to be used with any handwriting curriculum or program to provide baseline data and to track student progress. Donica & Holt (2018) evaluated the validity of The Print Tool as a means to assess students' baseline and progress performance in their handwriting. Researchers concluded that The Print Tool demonstrates strong concurrent validity (Donica & Holt, 2018).

Pretest and posttest data were analyzed using jamovi statistical analysis software, version 2.0 (The jamovi Project, 2021). Jamovi is an open-source free statistical analysis package that conducts basis statistics such as descriptive statistics and tests of association such as t-tests. Alpha was set at  $p \leq .05$  *a priori*. Paired t-tests were used to determine if there were significant differences between pretest and posttest scores for both programs using aggregate data of the two classrooms. Paired t-tests were performed separately by classroom to determine if there were significant differences between the pretest and posttest data for the Handwriting Without Tears classroom and the Write Start program. Independent t-tests were used to determine if there were significant differences between pretest to posttest change and Individualized Planned Program (IEP) status and gender.

*Table 1: Timeline of Project Procedures*

<b><u>Date</u></b>	<b><u>Procedures Completed</u></b>
July 2020	Needs Assessment, teacher interview
May 2021	IRB application submitted; approval received
August 2021	IRB application revision submitted to add graduate students to the research study; approval received
	Written informed consent received from guardians and their recipients
	Pre-test assessment (The Print Tool) administered to 30 first grade students
August 2021-November 2021	Interventions administered to first grade students
November 2021	Post-test assessment (The Print Tool) administered to 30 first grade students
	Data analyzed through descriptive statistics
	Findings of research study completed

#### Section 4: Results and Discussion

School-based OTs play a large role in facilitating handwriting and fine motor skills in students. However, there is limited research comparing the effectiveness of two handwriting programs to each other. The results of the study “A Comparison of the Effectiveness of Two Handwriting Programs on Legibility in First Grade Students” demonstrated a positive correlation (statistically and clinically) between both handwriting programs and handwriting legibility in first grade students. Clinical observations indicated improved letter memory, writing on the line, sizing, spacing, and appropriate sequencing to form the letters. This study also achieved a positive observable change in the school community to promote the profession of Occupational Therapy. The following objective for this project was to, “determine the more effective program (Handwriting Without Tears vs. Write Start) on handwriting legibility in first graders.” Through interventions, pretest and posttest assessment, data collection and statistical analysis, this objective was clearly met. The findings of this study indicate that when the two handwriting programs are compared for the effectiveness of handwriting legibility in first grade students, Handwriting Without Tears is the more effective program. The statistical analyses of both data sets as well as demographic information are listed in Table 2.

*Table 2: Sample Demographics*

	HWT	Write Start
Total Participants	15	16
Mean of Age	6.44	6.40
Males	7	9
Females	8	7
IEP's	3	2

Data indicates that HWT demonstrated a statistically significant impact on handwriting while Write Start did not. The HWT intervention also resulted in a large effect size whereas Write Start demonstrated a small effect size. The large effect size of HWT could have been due to the small sample size of the students enrolled in the study as well as the short length of the study and could have limited generalizability to all first-grade students. However, clinical observations indicated that both programs produced a positive effect on handwriting legibility in both classrooms regardless of the handwriting program that was utilized. Handwriting Without Tears has been an established handwriting program for 44 years and it was developed by an OT. It has many resources available to teach appropriate letter formation, sizing, placement on the line, legibility and pencil grasp as well as it uses consistent terminology to deliver the instruction. It also provides workshops for therapists, parents and educators to sharpen their ability to teach the handwriting program. These traits could have led to a potential positive impact on the HWT classroom, as the lead researcher utilized these resources and has attended HWT training sessions.

Write Start was created 13 years ago and has very limited resources available to its consumers. Their website has free worksheets that detail appropriate sequencing to complete letter formation with a few suggestions of small group activities to address cognitive, dexterity, and visual motor skills. Write Start did not offer any formal training at the time of this study. These traits could have had a limited impact on the instruction of Write Start in the classroom with the students.

### **Strengths**

This study was considered to have multiple strengths. One example includes strong buy-in from both teachers. Both teachers were enthusiastic about the handwriting interventions and

worked to carry them over in their classroom during instruction time in the absence of the lead researcher. Student engagement was also a strength, as the students were eager to learn appropriate letter formation and to engage in the learning process. The incorporation of multi-sensory components was another strength as the use of multi-sensory approaches to address handwriting is supported by the literature. Similar groups at baseline was another strength, as both groups had a similar balance of male to female student ratios and they also had similar numbers of students who received special education services and students who did not.

### **Limitations**

Despite the strengths, this study also had some limitations. One of them included not having the same teacher for both classes. Each classroom was led by their own teacher, therefore could be exposed to different teaching styles, motivation levels, and approaches. The length of the intervention time (twenty minutes) could also be considered a limitation for this study as well as the number of interventions (six). Small sample sizes are a limitation as they limit the generalizability of the findings. The assessment “The Print Tool” that was used to collect data was created by Learning Without Tears, which is also the company that created Handwriting Without Tears. The assessment could have been geared more towards HWT, therefore providing somewhat skewed results of the students’ handwriting performance as HWT addresses letter formation, sizing, spacing, placement on the line and Write Start addresses formation and placement on the line. The COVID-19 pandemic was also a limitation for this study as some students had to miss some of the intervention sessions due to being quarantined. The use of masks and facial coverings could also have impacted the clarity of verbal instructions during the intervention and assessment sessions.

## **Implications for Future Practice**

Implications for future practice include the use of formal handwriting programs to target handwriting performance in students. When comparing the two programs, statistical data suggests that HWT could be more effective in regard to handwriting legibility. However, due to the clinical improvements noted, an argument could be made to utilize a hybrid model, combining both HWT and Write Start components. Suggested principles to utilize from HWT would include specific letter formation sequencing, consistent terminology, and the incorporation of multi-sensory components. Approaches from Write Start that could be beneficial in the hybrid model would include small group instruction, frequent peer modeling and peer feedback, multi-sensory activities, and activities that target fine motor skills, visual motor skills, and cognitive skills. Future implications for the setting of this study could be the use of the handwriting hybrid model throughout the entire elementary school. The hope would be that with the incorporation of the hybrid model, student legibility would improve, faculty/staff would use consistent terminology through all grades, and a decrease of unnecessary referrals to occupational therapy would occur. Overall, this study is projected to impact the field of occupational therapy by adding to the growing body of research on handwriting by comparing two handwriting programs. As mentioned previously, there is limited research comparing two handwriting programs, so this project can promote the continuation of comparing multiple handwriting programs to determine the most effective one. This project can also add to the field of Occupational Therapy through the possibility of utilizing a hybrid handwriting program, which has also limited research. Further research could be conducted to determine the effectiveness of combining multiple handwriting programs on student handwriting legibility.

## Summary

This pre-experimental study was conducted to add to the limited body of literature comparing two handwriting programs of their effects on handwriting legibility in elementary aged students. Students in one classroom received six sessions of Handwriting Without Tears instruction for twenty-minute sessions, while the other classroom received six sessions of Write Start instruction for twenty-minute sessions. Descriptive statistics were used along with jamovi to analyze the data from the pretest and posttest scores of student performance of The Print Tool. Handwriting Without Tears demonstrated statistically significant effects on handwriting legibility while both handwriting programs were found to have clinically significant improvements on student handwriting legibility. Strengths of the study included: similar groups at baseline, teacher buy-in, student engagement, and the incorporation of multi-sensory components. Limitations of the study included: short intervention length, the use of The Print Tool which was created by the same company that created Handwriting Without Tears, and the COVID-19 pandemic. Implications for future practice include the suggested use of a hybrid handwriting program, combining components of Handwriting Without Tears and Write Start to address handwriting legibility in first grade students.

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## Appendices

### Appendix A

#### Institutional Review Board Approval, Guardian Permission Form

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### Parent/Guardian Permission for a Child to Participate in a Research Study

A Comparison of the Effectiveness of Two Handwriting Programs on Handwriting Legibility in First Grade Students



Institutional Review Board  
Protocol Number

4032

Approval Valid

7/14/21-5/15/23

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#### Key Information

Your child is being invited to participate in a research study. This document includes important information you should know about the study. Before providing permission for your child to participate, please read this entire document and ask any questions you have.

##### Does my child have to participate?

If you decide to permit your child to take part in the study, it should be because you really want to allow him or her to volunteer. Your permission allows us to ask your child to participate, but he or she does not have to participate, even if you grant permission. Your child will not lose any benefits or rights he or she would normally have if you choose not to grant permission or if your child chooses not to participate. Your child can stop at any time during the study and still keep the benefits and rights he or she had before volunteering. If you decide to grant permission for your child's participation and your child chooses to participate, he or she will be one of about 50 people in the study.

##### What is the purpose of the study?

The purpose of the study is to compare the effectiveness of two handwriting programs (Write Start and Handwriting Without Tears). By doing this study, we hope to learn which of the two handwriting programs are more effective in improving handwriting legibility in first grade students.

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

The research procedures will be conducted at Model Laboratory School. Each sessions will take about twenty minutes. The total amount of time your child will be asked to volunteer for this study is 160 minutes over the next 8 weeks.

##### What will my child be asked to do?

Your child will be administered the Print Tool before and after completing the six handwriting intervention sessions. During the 6, twenty minute sessions, students will engage in multi-sensory activities as well as participate in handwriting instruction aimed at improving their fine motor skills, their legibility and letter formation. The handwriting intervention sessions will occur once per week during your child's Center Time in the classroom and this will not distract from other instructional time.

##### Are there reasons why my child should not take part in this study?

Students who are not in the first grade at Model Laboratory School should not take part in this study.

##### What are the possible risks and discomforts?

To the best of our knowledge, the things your child will be doing have no more risk of harm or discomfort than he or she would experience in everyday life.

Although we have made every effort to minimize this, your child may find some questions we ask (or some procedures we ask him or her to do) to be upsetting or stressful. If so, we can tell you and your child about some people who may be able to help with these feelings.

Your child may, however, experience a previously unknown risk or side effect.

##### What are the benefits of taking part in this study?

There is no guarantee that your child will get any benefit from taking part in this study. However, some people have experienced improved handwriting legibility when engaging in multi-sensory handwriting interventions. We cannot and do

not guarantee that your child will receive any benefits from this study. Your child's participation is expected to provide benefits to others by determining which of the two handwriting programs (Handwriting Without Tears and Write Start) are more effective in improving handwriting legibility in first grade students.

**If my child doesn't take part in this study, are there other choices?**

If your child does not participate in the study, there are no other choices except to not take part in the study.

Now that you have some key information about the study, please continue reading if you are interested in allowing your child to participate. Other important details about the study are provided below.

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## **Other Important Details**

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**Who is doing the study?**

The person in charge of this study is Whitney Cook, MS, OTR/L at Eastern Kentucky University. If the PI is a student, add the following statement: He/She is being guided in this research by Dr. Julie Duckart, PhD. There may be other people on the research team assisting at different times during the study.

**What will it cost for my child to participate?**

There are no costs associated with taking part in this study.

**Will my child receive any payment or reward for taking part in the study?**

Your child will not receive any payment or reward for taking part in this study.

**Who will see the information my child gives?**

Your child's information will be combined with information from other people taking part in the study. When we write up the study to share it with other researchers, we will write about this combined information. Your child will not be identified in these written materials.

**Can my child's taking part in the study end early?**

If your child decides to take part in the study with your permission, he or she will still have the right to decide at any time that he or she no longer wants to participate. Your child will not be treated differently if he or she decides to stop taking part in the study.

The individuals conducting the study may need to end your child's participation in the study. They may do this if your child is not able to follow the directions given, if they find that your child's being in the study is more of a risk than benefit to him or her, or if the University or agency funding the study decides to stop the study early for a variety of scientific reasons.

**What happens if my child gets hurt or sick during the study?**

If you believe your child gets hurt or sick because of something that is done during the study, you should contact Whitney Cook, MS, OTR/L at (859) 622-3766 immediately. It is important for you to understand that Eastern Kentucky University will not pay for the cost of any care or treatment that might be necessary because your child gets hurt or sick while taking part in this study. Also, Eastern Kentucky University will not pay for any wages you may lose if your child is harmed by this study. These costs will be your responsibility.

Usually, medical costs that result from research-related harm cannot be included as regular medical costs. Therefore, the costs related to your child's care and treatment because of something that is done during the study will be your responsibility. You should ask your insurer if you have any questions about your insurer's willingness to pay under these circumstances.

**What if I have questions?**

Before you decide whether to accept this invitation to grant permission for your child to take part in the study, please ask any questions that come to mind now. Later, if you have questions about the study, you can contact the investigator, Whitney Cook, MS, OTR/L at [whitney.cook@eku.edu](mailto:whitney.cook@eku.edu). If you have any questions about your rights or your child's rights as

a research volunteer, you can contact the staff in the Division of Sponsored Programs at Eastern Kentucky University at 859-622-3636.

#### **What else do I need to know?**

You will be told if any new information is learned which may affect your child's condition or influence your willingness to allow your child to continue taking part in this study.

We will give you a copy of this permission form to take with you.

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### **Permission**

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Before you decide whether to accept this invitation to give permission for your child to take part in the study, please ask any questions that come to mind now. Later, if you have questions about the study, you can contact the investigator, Whitney Cook at [whitney.cook@eku.edu](mailto:whitney.cook@eku.edu). If you have any questions about your child's rights as a research volunteer, you can contact the staff in the Division of Sponsored Programs at Eastern Kentucky University at 859-622-3636.

If you would like to give permission for your child to participate, please read the statement below, write your name and your child's name, and sign.

*I have thoroughly read this document, understand its contents, have been given an opportunity to have my questions answered, and give permission for my child to participate in this study if he/she chooses to participate.*

\_\_\_\_\_  
Parent/Guardian's Name                      Date

\_\_\_\_\_  
Child's Name                                      Date

\_\_\_\_\_  
Parent/Guardian's Signature                      Date

\_\_\_\_\_  
Witness Signature                                      Date

## Appendix B

### Child Assent Forms

#### **Assent Script**

(for children under the age of 7)

A Comparison of the Effectiveness of Two Handwriting Programs on Handwriting Legibility in First Grade Students

**EKU**  
Institutional Review Board  
Protocol Number  
4032  
Approval Valid  
7/14/21-5/15/23

I am conducting research about handwriting programs and would like to ask for your help because you can be a very helpful part in helping me understand how these programs affect handwriting skills. If you decide to participate in this project, I will ask you to participate in fun activities and games as well as perform handwriting tasks.

Your parents know that I am asking you if you want to participate, but it is up to you to decide if you want to do this. You should not feel like you have to participate, and no one will be upset with you if say no. Even if you say yes now, but decide you want to stop later, no one will be upset with you. All you have to do is tell me that you want to stop.

The potential risk for this study is very minimal. By participating in this study, your handwriting skills might get better.

Do you have any questions for me?

Do you want to participate? Circle one.



## Assent Form for Child's Participation in a Research Project

(for children between the ages of 7 and 12)



Institutional Review Board

Protocol Number

4032

Approval Valid

7/14/21-5/15/23

A Comparison of the Effectiveness of Two Handwriting Programs on Handwriting Legibility in First Grade Students

I am conducting research about handwriting programs and would like to ask for your help because you can be a very helpful part in helping me understand how these programs affect handwriting skills. If you decide to participate in this project, I will ask you to participate in fun activities and games as well as perform handwriting tasks.

Your parents know that I am asking you if you want to participate, but it is up to you to decide if you want to do this. You should not feel like you have to participate, and no one will be upset with you if say no. Even if you say yes now but decide you want to stop later, no one will be upset with you. All you have to do is tell me that you want to stop.

The potential risk for this study is very minimal. By participating in this study, your handwriting skills might get better.

*If you want to participate, you can write your name on the line below. If you have any questions, please ask me before you write your name. If you do not want to participate, please do not write your name.*

\_\_\_\_\_  
Child's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness Signature

\_\_\_\_\_  
Date

## Appendix C

## Letter of Support from School Setting



**MODEL LABORATORY SCHOOL**  
AT EASTERN KENTUCKY UNIVERSITY

November 9, 2020

To Whom it May Concern:

Whitney Cook, OTR/L has been our Occupational Therapist at Model Laboratory School for three years. She is currently working on her Doctorate of Occupational Therapy. One of her graduation requirements is to complete a Capstone Project which involves conducting research and as the Assistant Superintendent at Model Laboratory School, **I approve and support her conducting this research at Model.**

The area of research that Ms. Cook would like to address at Model Laboratory school involves evaluating the effectiveness of handwriting interventions with first grade students. She plans to conduct a quasi-experimental study comparing the effectiveness of two handwriting programs in our first grade classrooms. The two handwriting programs that will be used include Write Start and Handwriting Without Tears. Each first grade teacher will implement one of the handwriting programs into their daily classwork for twenty minutes per day. The expected time period for the research is six to eight weeks total. Only students who have written parental consent will be included in the research study and no identifying information will be included.

If you have any further questions about the study, please email Ms. Cook at: [whitney.cook@eku.edu](mailto:whitney.cook@eku.edu). If you have any questions for myself, please feel free to contact me at [kim.puckett@eku.edu](mailto:kim.puckett@eku.edu). In summary, **I approve and support her conducting this research at Model.**

Best regards,

A handwritten signature in black ink that reads 'Kim Puckett'. The signature is written in a cursive style with a large, looped 'K' and 'P'.

Kim Puckett  
Assistant Superintendent, Student Services  
Model Laboratory School  
Eastern Kentucky University  
521 Lancaster Avenue  
Richmond, Kentucky 40475