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The Effectiveness of Occupational Therapist Guided Remediation Through Handwriting Home Programs

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The Effectiveness of Occupational Therapist Guided Remediation

through Handwriting Home Programs

Capstone Project Report

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Abstract

There is extensive research on the evolution of handwriting instruction, programs, the neuromotor components, the complexity of performance, and the long term effects of both adequate and inferior performance to occupational performance. The research supports occupational therapy intervention as effective for remediation of poor handwriting. With occupational therapy services limited to only those who receive special education services in schools, supplemental handwriting instruction and remediation responsibilities fall to the teachers and parents. This also creates a large unserved segment of children who struggle under traditional instructional approaches. Parents and teachers have instructional support needs related to current evidence based practice handwriting methods.

What has not been explored or researched, is the effect or role home programs can potentially play in improving skill mastery, with parents as the primary supplemental educators. Occupational performance coaching is a recognized and effective intervention, due to the emphasis on therapist and parent collaboration to improve student achievement. Despite extensive literature review, there are no current research studies that evaluate the effectiveness of parent coaching to improve kindergarten student's alphabet letter formation.

The purpose of this quasi-experimental research is to measure two preselected group pretest-posttest outcome measures of the effectiveness of an occupational therapist guided, home handwriting instruction program of student performance, with legible alphabet letter formation. This research is a significant first step in the attempt to improve student performance through the exploration of innovative service delivery models, parent involvement, team collaboration, and improved educational outcomes for the children, through legible handwriting.

Section 1: Nature of Project and Problem Identification

Introduction

The ability to write as a means to convey knowledge is the cornerstone of all educational occupations. The inability to write limits access to education, creates an educational disparity, and has lifelong consequences. Without a consistent approach to early evidence based instruction, even marginal writing success becomes problematic as poor performance becomes automatic. “Poor handwriting has detrimental effects on academic performance, social interactions, and affects successful participation in everyday school activities” (Preminger, Weiss, & Weintraub, 2004, p. 193). Over the past 30 years handwriting instruction has taken a back seat in elementary schools in favor of a whole language approach to literacy development, and teacher education programs have placed less emphasis on handwriting instructional techniques (Graham & Weintraub, 1996; Marr & Dimeo, 2006). This has resulted in an eclectic approach to handwriting instruction in today’s classrooms. Being able to write well is vital for school performance, and yet the research shows that most teachers do not have a strong base of knowledge of instructional methods or a unified, consistent approach within schools or districts that can facilitate mastery. Teacher survey research results from the identified rural school district, and historical research data indicate that between 70 and 88% of teachers report poor preparation to teach handwriting (Asher, 2006; Donica, Larson, & Zinn, 2012; Frances, 2008; Graham, Harris, Mason, Fink-Chorzempa, Moran, & Sadler, 2008; Kemmis & Dunn, 1996; Poole, 2016; Sheffield, 1996).

With a decreased curricular emphasis on handwriting instruction, inadequate teacher preparation in evidence based instructional practices, and limited instructional time in the school day, proficiency in handwriting and legible alphabet letter formation is compromised.

Occupational therapists are often identified as the handwriting remediation experts, and yet most children do not have access to occupational therapy services.

With occupational therapy services limited to only those who receive special education services, supplemental instruction and remediation responsibilities fall to the teachers and parents. Parents are not typically equipped with knowledge regarding research based intervention, or effective teaching methods to help their children improve alphabet letter formation skills. In addition, parents often are without the support and guidance of a home instruction program and school collaboration. Since poor handwriting has detrimental effects on academic performance and future occupational performance, occupational therapists have a responsibility to initiate a collaborative approach to remediation interventions, that are based on proven instructional practices, founded on current theoretical models of teaching and learning, and meet the needs of the child, parent, teacher, and therapist.

Problem Statement

This research will address the problem of poor alphabet letter formation; focused on the 25% to 30% of kindergarten children who do not receive occupational therapy services, and demonstrate handwriting difficulties of sufficient magnitude to directly impact overall writing, and academic performance in kindergarten (Donica, Larson, & Zinn, 2012; Graham, et al, 2008; Hammerschmidt, & Sudsawad, 2004; Parikh, 2015; Poole, 2016).

Purpose

The purpose of this quasi-experimental research is to examine the effectiveness of a parent taught, occupational therapist guided, home handwriting instruction program on the outcome measure of student performance, with the production of legible alphabet letter forms.

Research Objectives

1. This pilot study seeks to define and identify the scope, and characteristics of those children who do not meet kindergarten performance standards in writing, alphabet letter formation, or handwriting skills by the end of the school year, through initial parent survey data.
2. Explore parent perceptions of the beneficial components and continued barriers to improved student handwriting performance, following the implementation of a home handwriting instruction program, through post-program parent survey data.
3. Explore parent perceptions of their instructional needs, training, and support required to serve as the child's supplemental educator, through post-program parent survey data.
4. Investigate the effectiveness of an occupational therapist guided home handwriting instruction program, as a viable intervention strategy for the 28.3% of unserved kindergarten students, for improved alphabet letter formation skills and handwriting performance, as measured by pre-test and posttest handwriting evaluation comparative data analysis (Poole, 2016).

Theoretical Framework

Handwriting performance is the culmination of a complex system of physical, environmental, and task components. The ability to write with automaticity is vital for the child to be able to use the cognitive processing of information for academic learning, rather than for alphabet letter formation (Graham, Harris, & Fink, 2000; Sheffield, 1996; Spear-Swearling, 2006). This remedial intervention approach to improve the automaticity of alphabet letter formation is grounded in the principles of developmental theory, motor learning theory, dynamic systems theory, the theory of Optimal Challenge Point, and the skill acquisition theory.

Mackay, McCluskey, and Mayes (2010) found that the most effective remediation programs are based on the principles of motor learning theory, with an emphasis on specific skills training. According to Kaplan (2010) it is the practice and experience of performing an action that leads to more permanent changes. It is those permanent changes in movement patterns that facilitate the automaticity in handwriting. Motor learning occurs through developmental stages, and is influenced by the type of task, type of feedback, style, and frequency of practice. Based on the principles of motor learning theory, the kindergarten children participating in remedial instruction have been introduced to the requirements of alphabet letter formation in the classroom, but their performance is inconsistent. Correct alphabet letter form has not reached the level of automaticity.

The home program is designed to aid the children in the transition from a cognitive stage to the associative stage of development, whereby they can demonstrate greater consistency of performance through distributed practice, intrinsic and extrinsic feedback, with a functional approach, and within their natural context of home (Poole, 1991; Zwicker & Harris, 2009). Practice is the most significant determinant to success in writing, as defined by Motor Learning Theory, Dynamic Systems Theory, and the Theory of Optimal Challenge Point (Hoy, Egan, & Feder, 2011; Kaplan, 2010; Mackay, McCluskey, & Mayes, 2010; Poole, 1991; Roston, 2010; Zwicker & Harris, 2009; Zylstra & Pfeiffer, 2016). According to Zwicker and Harris (2009) and Hoy, Egan, and Feder (2011) the optimal frequency of task-specific practice sessions varies from ten, to at least twenty for optimal learning and generalization to occur. In contrast, Feder, Racine, and Majnemer (2008, as cited in Hoy, et al., 2011) concluded that it is the handwriting practice alone that impacted improved performance, not the amount of time or methods. This concept was also supported in the works of Schneck, Shasby, Myers, and DePoy-Smith (2012).

According to the dynamic systems theory “practice and experience alter the formation of movement patterns through interaction with the environment and the demands of the task” (Zwicker & Harris, 2009, p. 30). This interaction between the person, a prescribed task, and the environment play key roles in either promoting, or inhibiting movement, and learning. Kaplan (2010) further expands this premise by explaining that a change in any one of the component interactions has the ability to create change in the others. New movement patterns are created with changes in the task, person, or environment. The occupational therapist designing the remediation intervention must consider practice session parameters, modification of the dynamic systems involved in the task, and consider the level of difficulty of the task, to create learning opportunities that meet the requirements for sustained knowledge. “The optimal challenge point is the degree of functional task difficulty a student needs to optimize the learning of a specific discrete motor skill” (Roston, 2010, p. 435).

The skill acquisition theory further expands on the relationship and interaction between the environment and the child’s behavior as it relates to learning new skills. Acquisition theory is based on the principles of learning and behavioral theory. Therapist interventions influence the teaching-learning process; through activity analysis, behavioral shaping, and reinforcement, to acquire new skills that improve or optimize performance in a given environment (Luebeen & Royeen, 2010). The therapist is able to build on student strengths and modes of intelligence to adapt the environment or instructional methods to promote learning that is child centered. The handwriting program enables the child to learn the skills required to function optimally in their school environment. By analyzing the component problems, and remediating specific skills, the child’s behavior and learning are positively influenced, and reinforced until letter formation mastery is obtained.

Significance of the Study

Through an occupational therapy lens, the significance of this project is the exploration of alternative occupational therapy practice and roles, to attempt to improve access to research based intervention strategies to those children who are identified as struggling writers, and who need additional instruction to master the mechanics of alphabet letter formation, beyond the traditional classroom experience. The use of home programs is a common practice in occupational therapy, and yet there is a void of research that indicates the effectiveness of this practice, as it relates to improving handwriting skills. Parental influence is at the heart of child development and learning. Therefore, it is important to create a community of shared stakeholders, who are agreeable to explore options that meet the needs of the child and their parents, even if they include non-traditional approaches. The outcome measures of home instruction programs will add to the body of knowledge for practitioners who would potentially use home instruction methods to reach an unserved population of children.

The research is also significant with regard to state and local education goals, that reflect a commitment to excellence in student and school performance standards. The school district research site developed a five-year strategic plan in 2015 that included six primary system wide goals. Goal number one, objective two reads “Teachers will utilize and implement effective instructional practices, by consistently using non-negotiable practices, fully implementing data teams on each campus, provide training in best practices for data analysis, and by highlighting innovative teaching practices” (Whitfield County Schools, 2015, p. 4). The scope and intent of this research project supports and guides instructional practices, parent involvement, data collection, evidence based decision making, training, and informs future innovative teaching practices.

The focus on researching effective handwriting instruction methods for students who struggle to be able to form legible alphabet letters, plays a significant role in achievement toward kindergarten grade level standards of performance. According the Georgia Kindergarten Inventory of Developing Skills (GKIDS) assessment, handwriting is evaluated in standards ELACCKL 1a, 2c, 2d, and ELACCKW 1, 2, and 3 (Georgia Department of Education, 2016a). The children who receive ratings of “not yet demonstrated, emerging, and progressing” at the year-end assessment are the identified participants of this research. These are children who fail to meet grade level English Language Arts standards of performance, and will require remediation to succeed with future writing endeavors.

The Georgia School Performance Assessment standard 4, Instruction standard 4, Professional Learning standard 2, Leadership standards 4 - 6, and Family and Community Engagement standards 1-5, are supported by this research plan design. This research plan and remediation program seeks to improve collaboration, supports leadership, enhances collective performance, impacts student learning through research based instructional practices, improves collaborative screening, and assessment analysis skills for student benefit, improves shared decision making, promotes leadership capacity, improves data driven decision making, provides an opportunity for family engagement in school activities that impact student performance, opens communication lines between the school and family, and most importantly, “develops the capacity of families to use support strategies at home that will enhance academic achievement” (Georgia Department of Education, 2016b, p. 49).

As occupational therapists we have the responsibility to “advocate for change to systems and policies” (AOTA, 2015) by improving child access to therapy services through alternative methods of service delivery. The Centennial Vision of Occupational Therapy challenges

therapists to “generate high quality evidence documenting its effectiveness and impact with children and youth” (AOTA, 2007, p. 613) and the need for “research to inform occupational practice with children and youth, in the roles and participation of parents, siblings, and other family members within family centered services” (AOTA, 2006, p. 8).

Summary

With the scope of this problem impacting 25-30% of children in the designated school district, there is a potential for over 3,000 children to fail to write with sufficient legibility to impact overall academic performance. There is extensive research on the evolution of handwriting instruction, programs, the neuromotor components, the complexity of performance, and the long term effects of both adequate and inferior performance to occupational performance. What has not been explored, or researched with any diligence is the effect or role home programs can play in improving skill mastery with parents as the primary supplemental educators. The use of home programs is a common practice in occupational therapy, and yet there is minimal research that indicates the effectiveness of this practice, as it relates to improving handwriting skills. Research supports occupational therapy intervention as effective for remediation of poor handwriting. Due to the nature of the referral process, and related service delivery of occupational therapy in the school system, there is a large segment of unserved children who fail to meet the criteria that would afford them the opportunity to benefit from developmentally based instruction methods, and occupational therapist guided intervention services. Guided by developmental theory, motor learning theory, dynamic systems theory, the theory of Optimal Challenge Point, and the skill acquisition theory, a parent instructed home handwriting program will be evaluated for outcome effectiveness as a viable remediation strategy to improve student performance with alphabet letter formation legibility. This research

is designed to glean practical implications for the use of home programs as a means to improve student performance, and add to the body of knowledge for occupational therapy intervention alternatives.

Knowledge of the impact and benefits of proper handwriting on student outcomes will serve to strengthen the base of support for effective evidence based programs. Curriculum design and the education standards teacher's use for instruction are regulated by state and local policies. Improved policies occur through better identification of students who need support, increasing the awareness of needed change, education on research-based best practices, increased availability and implementation of evidence based remediation resources, and the collaboration between schools and parents. As occupational therapists who support the educational progress of our students, we must be knowledgeable of state education standards of performance, school system goals, occupational therapy standards of practice, and the value of research to support these objectives.

This research is a significant first step to improving student performance through the exploration of innovative service delivery models and improved educational outcomes. Academic achievement begins with children being able to write legible alphabet letters. Handwriting proficiency "is really about whether or not we want our children to succeed in life. Handwriting is a fundamental cornerstone for an educated, literate nation" (Berninger, James, Peeverly, Santangelo, & Case-Smith, 2012).

Section 2: Detailed Review of the Literature

Introduction

The purpose of this quasi-experimental research is to examine of the effectiveness of a parent taught, occupational therapist guided, home handwriting instruction program on the outcome measure of student performance, with the production of legible alphabet letter forms. In order to evaluate the effectiveness of home programs, one must first investigate the prevalence of poor handwriting among kindergarten school children, determine if there is a correlation between handwriting abilities and occupational performance, attempt to identify the potential curricular influences on student achievement, and explore the occupational therapist and parent collaborative roles in improving student outcomes. Due to the complexity and interplay of physical, environmental, and social determinants, evaluation of the current research supported best handwriting instructional practices needs to be examined, to design remediation interventions that are evidence based and meet the needs of parents, teachers, therapists, and the child.

The Incidence of Poor Handwriting

In statistical analysis of children ages 5-17, “a sizable group of U.S. children have functional difficulties that place them at risk of experiencing participation restrictions” as a result of poor written expression. The estimates of the number of children affected varies greatly from study to study, depending on the criteria for inclusion, where between 5%-20% of children display a disability in function (Pastor, Reuben, & Loeb, 2009, p. 9). According to Parikh (2015) up to 30% of kindergarten children have handwriting difficulties of sufficient quality to impact self-expression, self-esteem, socialization and academic performance.

The prevalence of struggling writers is cited as up to 23% (Donica, Larson, & Zinn, 2012; Graham, et al., 2008; Hammerschmidt & Sudsawad, 2004), and the access to occupational therapy services to evaluate for underlying difficulties is limited by the design of the qualification process to receive services (Graham, et al., 2008). These incidence statistics were supported by teacher survey data from the designated research school district. According to Poole (2016), the definition of a struggling writer for the purposes of the teacher's surveys, was "a student who demonstrates enough performance errors in letter form, size, spacing, memory of correct form, correct case, and baseline placement to affect written legibility." Based on class size data, teacher reported perceptions of the numbers of students who struggle to write, and according to the provided definition, 25.6% of kindergarten and first grade students in the designated three elementary schools, were identified as struggling writers. From those identified struggling writers, an average of 23.8% of students demonstrated poor handwriting skills of sufficient quality, to directly impact their overall writing (compositional) abilities, and school performance. Only 3.2 percent of identified struggling students qualified for occupational therapy services during the same time frame. With this 22.4% gap in poor student writing performance, and a student population of over 13,000 students, the number of struggling writers could potentially impact almost 3,000 students. The prevalence of the problem is significant. "The early identification of functional difficulties and timely initiation of relevant healthcare, therapies, and educational services can lessen the impact on development (Pastor, Reuben, & Loeb, 2009, p. 1). As a profession, we are called to look for ways to ameliorate this problem of access and advocacy.

The Correlation Between Handwriting and Occupational Performance

According to Graham and Weintraub (1996), handwriting is one of the most important skills that children acquire and use throughout their school years, as part of their occupation as students. Much has been written about the educational ebb and flow of formal handwriting instruction over time. No one has been more vocal, or critical about the cyclical approach to education than Virginia Berninger, as she admonished “education’s tendency to focus on what is stylish at the moment, rather than incorporating a more global approach to training teachers and teaching students” (Sheffield, 1996).

There are at least three reasons handwriting must be carefully taught to all children. First, handwriting allows access to kinesthetic memory, our earliest, strongest and most reliable memory channel. Second, serviceable handwriting needs to be at the spontaneous level so that a student is free to concentrate on spelling, and to focus on higher level thought and written expression. Third, teacher’s judge and grade students based on the appearance of their work, and the world judge’s adults on the quality of their handwriting (Sheffield, 1996, p. 22).

Kids with better handwriting do better in school (Fink, 2014). Children with poor handwriting face obstacles in academic pursuits but also with social interactions, which further limits their activity participation (Preminger, F., Weiss, P., & Weintraub, N., 2004). Good handwriting has not only a predictive effect on school performance, but also has a predictive correlation to adult occupational performance. Good, legible handwriting can be a determinant of success for adults, due to the judgement of personal intelligence and the education level exhibited in personal writing samples (Sheffield, 1996).

Once the child's perception of difficulty and poor habits become established, the impact on future success is further compounded. Therefore, early instruction is vital, and yet, our educational system has not placed an emphasis on proper handwriting in over 40 years. The predisposing factors to poor performance can be tied to a gradual decline in society's view of the importance of written text, especially in our advancing digital world. Despite a gradual decline in formal handwriting instruction over the last few decades, there has been a recent resurgence in interest for children with learning disabilities and attention deficit hyperactivity disorder. In 2012, Berninger, et.al presented research at an educational summit to support the necessity of handwriting in today's schools. During a YouTube video summation of the findings, the authors cited a Florida International University research study of 1,000 Miami-Dade children, which linked good fine motor and writing skills in pre-kindergarten, with higher reading and math skills in later years, than those children who initially exhibited poor handwriting. This study supports the necessity of handwriting instruction, as a predictor of future academic success.

Multiple research studies indicate that there is a direct link between the mechanics of letter formation and reading, memory, impulse control, attention span, composition skills, and ultimately academic success (Fink, 2014; Berninger, James, Peverly, Santangelo, & Case-Smith, 2012). In a policy update for the National Association of State Boards of Education, author David Kysilko (2012) links research data for the "educational benefits of handwriting to cognitive and motor skills development, literacy, brain development, memory, improved written expression abilities, and improved academic outcomes for students with learning disabilities" (p. 2). Further support for unified, research based, direct handwriting instruction lies in the premise that the effort expended to physically write detracts from the use of cognition to learn academic content (Sheffield, 1996). Spear-Swearling (2006) reports that without sufficient writing skills,

students are ineffective for learning because they are expending all of their cognitive resources on writing. The child's attention is diverted from learning, to trying to remember how to write the alphabet letters.

In evaluating electrical brain function during writing tasks, Indiana University researcher Karin James used MRI scans to prove that the “motor sections of the brain are engaged when literate adults look at printed text, whereas keyboarding didn't light up the literacy sections of the brain in the same way handwriting did.” The repeated physical motor action of repetitive letter formation imprints a visual image and motor sequence pattern on the brain (Fink, 2014). Carol Armann (as cited in Fink, 2014) suggested that the physical act of handwriting assists in the transfer and storage of information from short-term to long-term memory.

Curricular Influences on Student Achievement

Multiple researchers cite inadequate teacher knowledge and a lack of formal training to teach handwriting effectively to today's students (Asher, 2006; Donica, Larson, & Zinn, 2012; Frances, 2008; Graham, Harris, Mason, Fink-Chorzempa, Moran, & Sadler, 2008; Kemmis & Dunn, 1996; Sheffield, 1996). Seventy-two point two percent of surveyed teachers from the research setting indicated that they were not adequately prepared to teach handwriting from their college education programs, and yet 81.8% of these teachers reported at least moderate confidence in their ability to effectively teach handwriting from a developmental, and evidence based framework.

Just as teachers use an eclectic array or blend of handwriting instruction methods, occupational therapists do as well. There have been conflicting research studies indicating that the Handwriting Without Tears program is (Donica, 2015) and is not (Schneck, Shasby, Myers,

& DePoy Smith, 2012) the most effective approach for handwriting instruction across ability levels. Teachers indicated formal training knowledge in the D'Nealian (18.2%), Zaner-Bloser (9.1%), and Handwriting Without Tears (9.1%) curriculums, with experience levels ranging from 1 to 20 years. However, seventy percent of teachers in the target school district prefer to use a blend of handwriting approaches and curriculum elements, with 45.5% reporting actual use of blended curriculums for current instruction. The identified school system did not have a system wide preferred curriculum at the time of the teacher survey. They subsequently adopted the Zaner-Bloser approach to handwriting instruction and recommended the use of the Handwriting Without Tears curriculum as an alternative or remediation intervention.

This blend of approaches along with inconsistent curriculum methods inhibits the continuity of handwriting instruction from grade to grade. Early poor, or inconsistent instructional practices, promotes the automaticity of illegible handwriting. Teachers cite the most common problems that contribute to poor or illegible handwriting were due to alphabet letter baseline placement, reversals, spacing, incorrect capitalization, and incorrect letter size (Poole, 2016). All of these identified handwriting legibility problems are related to inadequate letter formation memory, incorrect letter stroke start-position, incorrect stroke sequence, and inadequate repetitive guided practice opportunities. With a system wide, evidence based approach to consistent and unified handwriting instruction, these formation errors could be eliminated.

With regard to perceived curricular problems, teachers identified a lack of a unified system-wide curriculum focus, a varied teacher preference for curriculum methods, and inadequate instruction time as contributing factors to why students struggle, or perform poorly (Poole, 2016). The specific inability to devote dedicated instructional time, was cited by 44% of

teachers in North Carolina (Donica, Larson, & Zinn, 2012) and up to 68.3% of locally surveyed teachers (Poole, 2016).

Occupational Therapist's Role in Handwriting Instruction

School system therapists are frequently called upon to remediate handwriting difficulties in children. Research has shown that occupational therapy intervention improves handwriting legibility and school functional performance, even when compared to control groups without occupational therapy, and adjusted for maturation (Case-Smith, 2002; Graham, Harris, & Fink, 2000; Hammerschmidt & Sudsawad, 2004; Schneck, Shasby, Myers, & DePoy Smith, 2012). Teachers are more likely to modify instruction and student supports prior to consideration of referral for occupational therapy services, despite confidence that therapy is a viable and beneficial modality. Graham, et al. (2008) cites only 2% of struggling writers receive occupational therapy services. Local survey data indicates that only 36% of teachers had students who received services, and of those, there were only one to two per classroom for a system average of 3.2% (Poole, 2016). Due to the nature of the referral process, and service delivery of occupational therapy in the school system, there is a potentially large segment of unserved children who struggle with handwriting in the classroom but fail to meet the criteria that would afford them the opportunity to benefit from developmentally based instruction methods, and occupational therapist guided intervention services. A commonly cited reason for inconsistent occupational therapy referrals is linked to a lack of teacher understanding of the scope of OT practice, and the benefits of collaborative intervention (Donica, Larson, & Zinn, 2012; Hammerschmidt & Sudsawad, 2004; Kemmis & Dunn, 1996).

As occupational therapists, we are challenged through the American Occupational Therapy Association's Centennial Vision (2007) to expand collaboration between educators and

therapists to “create a well-prepared, diverse, work force” through “evidence based decisions” regarding the types of programs and interventions selected. It is vital that we are able to “demonstrate our value to individuals, organizations, and the community to link education, research, and evidence based practices” (p. 614). If our knowledge of handwriting research informs practice, we owe it to the children we do not serve to advocate for handwriting instructional practices that are unified, collaborative, research based, and effective.

Component skill remediation, or a bottom-up approach to remediation is not as effective as a collaborative approach that includes practice sessions in a multitude of contexts (Cramm & Egan, 2015). Best practice remediation evidence supports teacher-therapist collaboration, within all available and natural contexts, extensive practice experiences, and an intentional, holistic, and structured instructional method, based on developmental growth, and motor learning theory (Cramm & Egan, 2015; Graham, Harris, & Fink, 2000; Kemmis & Dunn, 1996, Schneck, Shasby, Myers, & DePoy Smith, 2012). The specific individualization of handwriting instruction that targets only individual and specific skills has not been shown to be as effective as consistent and repetitive practice, which supports a consultative or integrative approach to occupational therapy services in the school environment (Hoy, Egan, & Feder, 2011).

Collaboration and Parent Coaching

“By contributing to the effectiveness of the initial handwriting instruction, occupational therapists can ensure that all students receive proper instruction. Then, only those students who have genuine deficits . . . would be referred for remediation” (Asher, 2006, p. 469). Remediation efforts are designed to target specific functional deficits. Research supports collaborative consultation between teachers and therapists to improve student’s success for compensatory or remedial interventions (Kemmis & Dunn, 1996). This collaboration also needs to include

parents. As a child's first teacher, parents play a pivotal role in learning and development. Unfortunately, parents are not always aware of learning theory or the evidence supported interventions that can improve writing development (Beck, 2002). Parents rely on the outreach and communication from teachers, to be able to meet their child's needs. Without consistent or effective communication regarding the techniques and models used in formal education, parents are limited in their abilities to assist their children with improved performance at home. Parent beliefs about their roles in their children's education also has a direct effect on their level of involvement. Children whose teachers who reach out to those parents, see positive results from the combined efforts (Bartel, 2010, p. 220). "When parents and teachers work together, children receive a message of dual support and mutual respect between home and school" (Beck, 2002, p. 49).

Research on the benefits of parent involvement related to student outcomes and achievement is prevalent. "Parental involvement has been positively linked to indicators of student achievement, including teacher ratings of student competence, grades, and test scores" (Hoover-Dempsey, Walker, Sandler, Whetsel, Green, Wilkins, & Clossen, 2005, p. 105). According to an extensive review of the literature on parent involvement, Cotton and Wikelund (1989) cite a positive relational correlation between student achievement and early intervention. The most significant effects are related to direct parent-child collaboration or tutoring models. The intensity of the parent-child instruction time components has also been shown to positively correlate to student results. It should be noted that while parent training is a key component to success with their child's skill mastery, the scope and focus of the parent training should be specific and succinct, rather than extensive or time consuming, for the best outcomes. In the school system, parent involvement is a key component of local, state, and federal guidelines for

school performance measures, and all Title 1 initiatives. All elementary schools in the designated district are identified as Title 1 schools by the State of Georgia.

Because the achievement gap is really a gap in learning opportunities, it is imperative that cities, schools, and school districts work to provide sufficient opportunities for all parents to know what they need to help their children learn at home and in school, and to give higher priority to making sure they have the resources to do so” (Bartel, 2010, p. 220).

Research supports the importance of parent to teacher, teacher to therapist, and therapist to parent collaboration as essential factors for student success. In an examination of parent perceptions of occupational therapy services, McCall and Schneck (2000) and Benson, Elkins, Wechsler, and Byrd (2015) confirmed parental desires for better communication, inclusion with decision making, support, educational training, and increased involvement with therapeutic interventions.

Occupational Performance Coaching has been identified as an effective intervention for improving academic and life skills. “Occupational Performance Coaching (OPC) is an enablement focused, parent-directed intervention designed for use by occupational therapists working with parents of children with performance difficulties” (Graham, Rodger, and Ziviani, 2010, p. 4). The intent of this approach is to improve a child’s occupational performance by providing parents the support, knowledge, and skill specific training they need to be successful with current and future parenting needs. The difference between traditional home programs and occupational performance coaching lies in the training and empowerment of parents to be able to problem solve solutions, from the knowledge they have acquired from the collaboration. Coaching is a proven intervention to facilitate two-way communication, capacity building, and reciprocal growth (Dunn, Cox, Foster, Mische-Lawson, & Tanquary, 2012).

This research and remediation program attempts to incorporate the triad effect of parent-teacher-therapist coaching, collaboration, and improved communication to improve alphabet letter formation in kindergarten students, for the development of classroom writing skills. It is the improved awareness of student need, and a strengthened alliance of support between parents, teachers, administrators, and therapists that has the power to affect changes in student skill acquisition. Knowledge of the impact and benefits of proper handwriting on student outcomes serves to strengthen the base of support for effective evidence based programs for all children, in the classroom, and in homes across the country.

The Centennial Vision of Occupational Therapy challenges therapists to “generate high quality evidence documenting its effectiveness and impact with children and youth” (AOTA, 2007, 613) and the need for “research to inform occupational practice with children and youth, in the roles and participation of parents, siblings, and other family members within family centered services” (AOTA, 2006, p. 8).

Key Elements of Handwriting Instruction Interventions

Creek (2003, as cited in Kielhofner, 2006) states that it is “not uncommon that experienced occupational therapists use a wide range of techniques that appear to work, rather than appraising the research evidence” (p. 643). If we are to base therapy decisions and educational programs on sound principles we must perform, or be able to cite research that supports the process. While there are a multitude of research studies citing the prevalence of poor handwriting, the importance of direct instruction, a lack of teacher training, the predictive correlation of poor handwriting to adult occupational performance, and its global effect on school performance, but there are very few research studies that attempt to understand the effects

or role that a home program can play in skill mastery, or parent perceptions of the types of needed instructional support, to improve alphabet letter formation in their children.

Graham and Harris (2000) found that students who were at risk for writing problems, and randomly assigned to a control group for extra alphabet letter instruction as an addition to the regular classroom experiences, exceeded their control group peers in handwriting, and in overall writing skills. In the target school district, the provision of extra handwriting lessons or instruction was only identified as a remediation strategy by 36.4% of surveyed teachers (Poole, 2016). The evidence supports remediation programs in general but in order to design or recommend a home program, one must consider the complexity of the task. A remediation program must be based on relevant motor skill components, theoretical frameworks, and research support for the key design elements. Best practices of a home handwriting program incorporate a top-down instructional approach with distributed short periods of daily practice, explicit teaching, multi-modal presentations, self-evaluation, feedback, and opportunities to write from memory to promote automaticity (Cramm & Egan, 2015; Edwards, 2003; Fitzpatrick, Vander Hart, & Cortesa, 2013; Graham, & Harris, 2000; Graham, et al, 2008; Jones, & Christensen, 1999; Zwicker & Harris, 2009).

Practice is the most significant determinant to success in writing (Hoy, Egan, & Feder, 2011; Kaplan, 2010; Mackay, McCluskey, & Mayes, 2010; Poole, 1991; Roston, 2010; Zwicker & Harris, 2009; Zylstra & Pfeiffer, 2016). According to Zwicker and Harris (2009) and Hoy, Egan, and Feder (2011) the frequency of task-specific practice sessions varies from ten, to at least twenty for optimal learning and generalization to occur. In contrast, Feder, Racine, and Majnemer (2008, as cited in Hoy, et al., 2011) concluded that it is the handwriting practice alone that impacted improved performance, not the amount of time or methods. This concept was also

supported in the works of Schneck, Shasby, Myers, and DePoy-Smith (2012). The interaction between the person, a prescribed task, and the environment play key roles in either promoting, or inhibiting movement, and learning according to the dynamic systems theory. With extensive practice, instructor feedback, self-evaluation, and reinforcement, a home handwriting instruction program meets the theoretical framework of the motor learning theory.

A moderate pace of instruction, with complete coverage of all 52 alphabet letters was found to be more effective than a slower pace, with corresponding limited instructional exposure to only uppercase letters. The research group which participated in the moderate paced curriculum performed better with legibility, speed, and the development of handwriting automaticity than the group of children who received a slower pace of instruction (Fitzpatrick, Vander Hart & Cortesa, 2013). Edwards (2003) and Hoy, Egan, and Feder (2011) outlined the best practices for handwriting instruction based on a systematic review of handwriting research extending through 2010. They included teacher modeling, visual cues for sequential stroke formation, removal of visual cues for writing from memory, copying from a model, and verbal letter naming while writing. Each of these strategies targeted various sensory systems to promote memory retention. While not commonly used in school classrooms, students who were provided with visual cues, memory aids, or visual associations demonstrated significant improvement with letter formation. Each handwriting lesson should gradually advance the skills of the learner by providing tracing and copying activities before advancing to writing letters from memory. Child self-evaluation of individual letter accuracy was found to be effective for memory retention and skill refinement.

Marr and Dimeo (2006) cited multiple benefits to summer handwriting instruction based on the results of their own occupational therapist led remediation program. With less time

commitments, parents and children have more time to collaborate for focused and intensive instruction sessions, and greater practice opportunities in the summer. Based on literature reviews, expert opinion, historical perspectives, and an extensive review of both quantitative and qualitative studies related to the best instructional methods and home program design, a program plan of parent led handwriting instruction could be formulated that meets the needs of students, parents, teachers, and therapists.

Summary

Recent and historical literature, along with current survey research from the target school district confirms that 25-30% of children in kindergarten and first grade classrooms have poor handwriting. Despite evidentiary support for occupational therapist expertise, and successful outcomes with handwriting interventions, only 3% of students have access to therapy services. Limited access to therapy is driven in part by service delivery models in school systems, and yet all school occupations are affected in some way by a child's handwriting abilities. Based on available data, there is a large unserved population of students who struggle with legible letter formation.

The education profession itself has demonstrated a fluctuating interest or emphasis on the importance of this cornerstone skill. A multitude of studies cite the effects of handwriting skills on the social, emotional, cognitive, educational, and behavioral performance abilities. Children with poor handwriting have overarching achievement limitations. The cognitive and attention requirements to remember how to form alphabet letters interferes with brain function for academic tasks. Through the development of automatic handwriting, the cognitive processes are available for information processing, composition, and problem solving. Automatic handwriting has a global impact on future academic success and lifestyles choices. The fluctuating emphasis

on the importance of handwriting has contributed to poor student performance, in part due to teachers limited experience with handwriting instruction methods and the dedicated time required to teach the content. Teachers use of a blend of instructional approaches. The lack of a unified curriculum has the capacity to perpetuate poor letter formation, which can result in the automaticity of illegible handwriting, from teacher to teacher, and grade to grade. With greater teacher support, training, and knowledge of effective instructional strategies, the problem of poor performance could be significantly improved.

Occupational therapists have a unique ability and responsibility to facilitate handwriting curriculum policy analysis, and offer opportunities for empowering changes in instruction, outreach, service delivery models, and collaborative problem solving for remediation. Despite direct service limitations for individual children, therapists often serve as a collaborative team member in many classrooms. With advanced knowledge in the complexity of the developmental progression of handwriting development, occupational therapists are able to design, instruct, and recommend instructional experiences that are evaluated to be effective, and which support the collaborative efforts between schools and parents.

Parents have needs related to training, confidence, and communication in the education of their children. Coaching is a recognized and effective intervention to meet student, parent, and teacher needs for improved skill mastery. The principles of occupational performance coaching are particularly relevant for this research plan due to the emphasis on therapist and parent collaboration, and parent empowerment to affect change in their children's handwriting skills. Despite extensive literature review, there are no current research studies that evaluate the effectiveness of parent coaching, with an occupational therapist guided home handwriting instruction program, to improve kindergarten student's alphabet letter formation.

There are some clear, research supported guidelines for the home handwriting program design, and inclusion criteria. The most important contributing factor to improve handwriting skills is distributed, intentional, short daily practice sessions. The program should also include a top-down approach with specific skill instructions, multi-modal presentations, constructive feedback, the opportunity for self-evaluation, writing from a model and then from memory, a moderate pace, instruction that includes all uppercase and lowercase alphabet letters, a duration of 10-20 sessions, short but comprehensive instructions, teacher modeling, visual and memory cues, verbal letter naming when writing, and the use of a gradual system of skill advancement.

The literature review supports local data on the prevalence of poor handwriting skills among kindergarten children. Current research identified common contributing factors to poor performance, the correlation between handwriting skills and occupational performance, the role of occupational therapy to remediate the problem, the value of parental empowerment to effect change in student achievement, and the best practice components of a home remediation program to improve student handwriting. Without evidentiary literature support for the use of an occupational therapist guided, home handwriting program as an effective remediation intervention, further research is needed to determine the parental benefit and viability of such programs as a means to reach the unserved population of students, who struggle with alphabet letter formation in kindergarten.

Section 3: Methods

Project Design

This quasi-experimental research is designed to measure two preselected group pretest-posttest outcome measures of the effectiveness of an occupational therapist guided, home

handwriting instruction program of student performance, with legible alphabet letter formation. Through a pragmatic worldview, this research study attempts to use multiple sources of data to focus on the practical implications of using home programs as an effective intervention for improving handwriting skills, through parent empowerment as the agents of change (Creswell, 2013).

The pilot study will define common characteristics of those who struggle to write legibly at the end of kindergarten, through a standardized pretest handwriting assessment and parent perception surveys. The experimental and control groups will be comprised of children identified as having poor letter formation legibility, from screening and kindergarten grade level assessments, and generated by teacher referral. Following parental consent, both groups will be administered a standardized handwriting assessment to obtain baseline quantitative data. The control group will participate in both pre-test and posttest evaluations, but will not participate in the occupational therapist guided remediation program, due to parent request. The experimental group of children will complete the initial handwriting evaluation, undergo a 7-week remediation program, have their parents participate in the study as the supplemental educators and to provide additional survey data, and complete a final handwriting evaluation to measure the change effect. The inclusion of a control group strengthens the validity of the study by elimination of the maturation effect variable. Based on the comparative measures of standardized handwriting performance for both groups, and parent perceptions of using a supplemental program to improve handwriting legibility, the research seeks to explore the effectiveness of home programs, parent coaching, and the potential viability of occupational therapist guided home programs as a potential means to improve access to occupational therapy expertise, through non-traditional service delivery models. Through parent survey research and participation/instruction

time logs, the study examines parent perceptions of the child's initial abilities, letter formation progress, ease of the program, time commitment involved for performance results, the instructional needs of the parents, and their confidence level as the supplemental educator. The design of the intervention plan, participant selection, and parent agreement for research participation will inherently improve the collaborative efforts between teachers, parents, and therapists to impact the handwriting performance of those children who do not receive OT services, and yet "do not meet" the performance standard of alphabet letter formation legibility on traditional kindergarten performance measures (Georgia Department of Education, 2016a). Prior to implementation, approval to conduct research will be obtained from the identified school district, the involved elementary school administrators, and followed by Institutional Review Board approval through Eastern Kentucky University.

Taylor, Suarez-Balcazar, Forsyth, and Kielhofner (2006) identified principles for implementing research in Occupational Therapy. Based on the remediation program and research design, the research explores the notion that an occupational therapist designed home program of handwriting instruction strategies can improve student quality of life, empower parents, and provide support for the long term occupational benefits of correct letter formation in handwriting. The aim of the plan is to explore alternative methods for children and parents to learn how to learn in non-traditional ways. The research combined with the program implementation should improve teaching and learning skills for all participants.

Mills (2007) justifies action research in education as a means to promote reflection, "as persuasive and authoritative, as relevant for practical application, which adds evidence support to teaching practices, and challenges the intractability of reform of the educational system" (p. 13). Occupational therapists use action research to inform practice, while simultaneously using

evidence based practices to stimulate further research (Taylor, et al., 2006). This quasi-experimental plan blends the principles of education and occupational therapy research to explore commonly used home program practices as the basis for evidential validation, and to attempt to inform future therapy interventions.

The selection of a quasi-experimental design was dictated by the inability to randomize the subject participant groups. The sample size was significantly limited by the selection criteria, in an attempt to minimize as many confounding variables as possible. Comparative group research, whether true experimental or a quasi-experimental, attempts to evaluate causality of an intervention. As a pilot effectiveness study, this plan meets the criteria for quasi-experimental research due to the administration of one planned independent variable (the home program), the confounding variables being minimized by the inclusion criteria, the dependent variable (handwriting evaluation test scores) is standardized and given to all child participants, and the “experimental hypothesis tested is the probability of a causal effect,” (Nelson, 2006, p. 65). The small non-randomized sample of child participants disqualifies it from a true experimental design. The confounding variables that would have an impact on the results include multiple parent variations in the delivery of the home program, from the way it was designed.

Setting

The setting includes three public school kindergarten classes, from three different rural elementary schools that the participant children attend, and their homes in northwest Georgia. The rationale for the selection of these particular classes and elementary schools is based on investigator knowledge of the subjects prior handwriting instructional exposure. In each of the classrooms, the occupational therapist led the initial weekly handwriting instruction sessions based on the Handwriting Without Tears curriculum design, which was then replicated by the

teacher in daily classroom review and practice sessions throughout the rest of the week. By alleviating variables in the teachers' handwriting instruction methods, letter sequence instruction, knowledge, materials, instructional language, and consistency using the Handwriting Without Tears program, these classrooms were purposefully selected to address fidelity to alleviate some potential Type 1 errors. With parents as the primary supplemental educators of the program, the children's homes or natural context serve as the primary setting of the research study.

Participants

A sample of convenience with kindergarten children will be selected who attend three specific rural elementary schools in northwest Georgia, and who also meet the inclusion criteria of attending a school classroom where:

- a) knowledge of alphabet letter formation was guided by the Handwriting Without Tears (HWT) program and delivered at least in part, by an occupational therapist,
- b) the primary teacher followed the principles of HWT in daily handwriting practice,
- c) the child was referred by their home room teacher based on poor handwriting skills,
- d) the child's parent(s) agreed to participate in the supplemental remediation program,
- e) the parent(s) agree to participate with survey research and participation logs,
- f) the parent agrees for their child to participate in two standardized handwriting evaluations.

Participant referrals will be generated by teachers, as a result of poor student alphabet letter formation, as measured by poor classroom work samples, those who "did not meet" end of the year handwriting standards on the Georgia Kindergarten Inventory of Developing Skills (GKIDS) assessment in ELACCKL 1a, 2c, 2d, and ELACCKW 1, 2, and 3 (Georgia Department

of Education, 2016a), or those who score below a 60% on the Screener of Handwriting Proficiency at the end of the year collection data point (Handwriting Without Tears, 2015). Identified and referred children who meet the criteria for inclusion, whose parents decline to participate in the remediation program, but agree to allow participation in two evaluations of handwriting performance over time, will be included as the control group. The experimental group will be comprised of children whose parents agree to both pretest and post-test evaluations, and participation in the 7-week remediation program. Exclusion criteria for both groups will include those students who have physical motor impairments, educational, or medical diagnoses that inhibit motor control of utensils, or receive more than two-hours per day of special education services.

Methods

Students in the target classrooms receive consistent weekly handwriting instruction using the Handwriting without Tears curriculum from the occupational therapist. The teachers were trained on, and use the Screener for Handwriting Proficiency to collect three points of performance data in September or October, January, and April. The screener results identify the children who struggle with alphabet memory, orientation, and baseline placement. The teachers also administer the GKIDS assessment in the same three time frames. Based on the combination of these two types of assessments and observed classroom performance, the teachers will generate a list of students who would benefit from remedial instruction.

The child's homeroom teacher will make the initial parent contact to inform parents of their child's difficulty with handwriting and poor alphabet letter formation. During an end of the year parent conference, the teacher and therapist will offer parents the opportunity to participate in the summer remediation program, with consent to participate in the research study. Written

information regarding the remediation program design and research study will be provided to the parents for consideration. The conference will provide an opportunity to discuss the child's current performance difficulties, testing results, purpose and methods of the proposed program, and the parent's participation role in the research. "The Parental Consent Agreement for Minor's Participation in a Research Project" will be included in the handout materials. The consent agreement outlines the specific requirements for both the parent and child, with regard to time commitment, purpose of the research, program specifics, potential benefits and associated risks, timelines, and expectations, with consideration of the parent's native language. Parents will be given the information to consider, and asked to return the consent agreement with an enclosed preferred contact card. The teacher will collect the informed consent documents and forward them to the researcher. The parent contact form will include the students date of birth, parent names, preferred contact methods, and phone or email addresses, as well as a calendar for the parents to select the best day for remediation program training.

To address confidentiality, following receipt of the parent consent for either remediation and/or research participation for only the evaluations, a research volunteer will generate and label the contact form and informed consent document with a random identifier code, to set up participant files. The volunteer will generate four more code labels for the pre-test, posttest, and two parent surveys. For comparative data analysis, the corresponding codes will be used to replace student names for all quantitative data elements. The code will be created and stored in a password protected computer. One printed copy of the matched codes with identifier information will be placed in a research file and locked with the participant files. After the student handwriting evaluations are completed by the researcher, they will be given to the research volunteer to label with the assigned random code, and filed in a locked cabinet. The

researcher will be blind to the participant's identifying information and corresponding survey responses, and individual test scores. The parents will be identifiable by a first name and phone number only. All correspondence and contact with the researcher, for questions or guidance throughout program implementation, will be made by the parents or therapist using the provided identifier code, or first names. The research volunteer will use reported parent preferences to set up the training session, which will be provided by the researcher. By having an independent person contact parents and set up the training sessions, the researcher will be blind to their identity, other than their first names or random code.

Prior to the implementation of the home program, each child will be evaluated using the Test of Handwriting Skills-Revised to obtain baseline performance data. Each child will be asked for assent to participate using a designated written script. Following the reading of the assent agreement, whereby the child indicates agreement, the researcher will write the word "Agreed" on the top of the child's standardized handwriting evaluation form. After the handwriting evaluations are completed, they will be given to the research volunteer to assign the random code label, with the last number as a designated "dash 1" to indicate a pre-test, and then filed in a locked cabinet. Once all evaluations are completed, the random coded tests will be scored as a group by the researcher and returned back to the locked cabinet.

At the completion of the training session, each experimental group parent will complete Survey One to identify the common characteristics among their children, previous handwriting instruction exposure, and the perceptions of their child's alphabet letter formation difficulties. Completed surveys will be given to the volunteer to affix the random identifier codes. Parents will keep a running daily log of the amount of time spent in instruction, and their child's participation with lesson completion. In order for the researcher to contact the parent

participants to check on program progress, and to answer implementation questions, the volunteer will create a master contact list of phone numbers or email addresses linked to the adult participant first names. The first three weeks of remediation will focus on review of uppercase letters. The fourth week will coincide with the fourth of July holiday, so it is designed as a review week. Weeks five through seven will concentrate on lowercase letter form. Parent phone contact will take place two weeks from the start of the program, and then again at four weeks, to check for understanding, difficulties, needs, or additional resources. The final phone or email contact will occur between week six and seven of the program, to remind the parents to complete the post program parent survey and instruction time log, and return them in the provided self-addressed envelope. Parents who declined to participate in the summer remediation program, but consented to the evaluations of their child's handwriting performance, will be contacted by the volunteer to ask the questions from Survey One by phone or email in late May or early June, 2017.

A posttest evaluation (Test of Handwriting Skills-Revised) will be performed for all student participants within the first 3 weeks of August, at their home schools. Following evaluation, the volunteer will assign the corresponding random code to each posttest evaluation, with an added number "dash 2" to reflect the post test, for correct comparative analysis and confidentiality. Once all evaluations are completed, the random coded tests will be scored as a group. The volunteer will monitor the return of the second completed Parent Survey from the experimental group parents, and make additional inquiries, to improve the response rate. The children will return to school approximately one to two weeks after the program is completed.

Comparative data analysis will be performed to answer the primary research question of the effectiveness of a home handwriting instruction program on student performance with alphabet letter formation. Group data analysis measures will address the overarching research question of program effectiveness.

1. Were both groups essentially the same (handwriting pretest scores) before the intervention, despite a lack of randomization?
2. What gains in handwriting evaluation scores is attributed to maturation, as measured by the control group change scores?
3. Did the experimental group mean handwriting evaluation scores change more than the control group?
4. As a group, were there individual subtest mean scores that improved more than others, as measured by the THS-R subtest change scores from the experimental group?

The survey questions will be analyzed to determine the mean percentage of each response with regard to common characteristics from Survey One, and parent perceptions of the intervention program from Survey Two.

Outcome Measures

All students whose parents sign consent forms for the remediation program and/or only the evaluation, will be evaluated using The Test of Handwriting Skills-Revised (THS-R) to determine baseline, and outcome levels of performance with the formation of upper- and lowercase letters, words, and sentences. Alphabet letter formation is assessed based on memory in alphabet sequence, from a copied model, and from dictation, out of alphabetical sequence, for

both cases. The THS-R also measures the speed of handwriting and includes number formation, but for the purposes of this research project those subtests will not be included.

“The THS is a test to measure how a child produces motorically with his or her hand, letters of the alphabet and numbers from memory and by copying, it is not a test to measure a child’s memory of language symbols. The purpose of the THS is to assess a child’s handwriting skills, both weaknesses and strengths, the purpose is also to plan, based on the area(s) of weakness, a remedial program. The goal of remediation is to improve a child’s legibility of letters and words and numbers (Milone, 2007, p. 11).

The THS-R was designed to recognize the elements of D’Nealian, Palmer, and Zaner-Bloser as the most common instructional curriculums used in today’s classrooms. This is significant due to the recent transition of the curriculum model in the research setting, from D’Nealian to Zaner- Bloser this school year. The THS-R measures ten subtests of handwriting, for children from 5 to 18 years of age. It provides normative data, standard scores, scaled scores, percentile rank, and stanines. In manuscript subtests “the median reliability coefficients ranged from .51 to .74, and the reliability for the total sample ranged from .51 to .78 (Milone, 2007, p. 17). Zylstra and Pfeiffer (2016) report “the corrected test-retest correlation is documented as .82 for the total test score and .49-.82 for individual subtests” (p. 4).

In order to define, identify the scope, and common characteristics of those struggling hand writers at the end of kindergarten, two parent surveys will be included in the home instruction packet. The first parent survey will address the research objective of exploration of the common characteristics of the children who struggle with legible alphabet letter formation, for both the control, and experimental groups of children. The survey is designed to establish demographic data, the child’s prior experiences, influences, and the parent perceptions of their

child's handwriting problem areas. This survey will be completed before the start of the remediation program, and include a matching code to the post program parent survey.

Based on the remaining research objectives, the second (post program) survey will explore the effects of collaborative remedial interventions, parent coaching, and attempt to determine if an occupational therapist designed home program is a beneficial and effective intervention strategy to improve student handwriting performance, from a parent perspective. The second survey will be provided to only the parents of the experimental group. The questions explore the parent experience with using the program, the programs perceived effectiveness, child's performance, time studies, component evaluation of the instructional kit, and the parent's confidence as the supplemental educator, with the instructional program. Parent survey research will complement the quantitative pretest-posttest outcome measures, for a comprehensive view of the home program components, effectiveness of the instructional methods, and the training program. Both parent surveys will use numerical response selections and Likert scales for comparative numerical analysis.

Data Analysis

To answer the research question of the effectiveness of the intervention, the mean change (posttest minus pre-test values) in participant overall scores will be compared between the two groups. In a comparable study using the same THS-R evaluation measure, and a two group pre-test posttest intervention design, Zylstra and Pfeiffer (2016) used independent *t* tests to ensure that the two groups' handwriting legibility scores were not significantly different before the experimental group began the remediation program. To ensure homogeneity of the two groups, independent *t* tests will be performed in the same manner for this research plan. A *t* test will also be used to "determine whether handwriting legibility gain scores for the intervention group are

significantly greater than handwriting legibility gain scores for the control group” (Zylstra & Pfeiffer, 2016, p. 5). The full scale THS-R score, and individual subtest scores will be calculated for both tests of each participant, to determine the mean gain of the group, the standard deviation, and *t* test results. According to Cohen (1988, as cited in Marr & Dimeo, 2006, p. 12), effect sizes of .50 or greater indicate an improvement [in performance] that is clinically valuable.” The subtest scores will be evaluated for effect size. Additional statistical analysis may be performed to address the small samples size, and to correct for random assignment, rather than random selection of the participants in the designated groups.

To analyze the parent survey data responses, each answer will correspond to a numerical value. The numerical values of the initial parent survey responses will provide the mean results of student demographic, instructional exposure, and common characteristics for the entire child participant population. The final parent survey will also include numerical values for answer selection to be able to generate group results regarding the parent participants perceived effectiveness, ease of use with the program, beneficial elements, instructional material satisfaction, and student progress. These Likert scale and limited numerical response questions/answers will be used to generate group mean scores for each survey question. Standard deviation scores will be calculated for each of the parent rating values.

Ethical Considerations

The importance of a collaborative approach with the teacher and parents serves to build trust and instill a level of confidence in the therapist’s ability to identify the child’s difficulties and create a remediation plan to meet those needs. Through the informational materials and collaborative conference, the parents will be introduced to the concept and availability of supplemental instructional resources, and the ability to participate in the research study. The

introduction letter will include information regarding the purpose of the study, and explanation of the process and procedures as well as a consent agreement. Potential issues of ethics are minimized with the inclusion of an informed consent agreement document, as well as education regarding the purpose of the interventions, and research study objectives (Creswell, 2014). Since the consent form will be included in the informational packet and discussed at the conference, the parents have an opportunity to ask specific questions of the researcher, and have time after the meeting to consider participation, there should be no external pressure to participate, which is an important ethical consideration for obtaining research participants.

In selection of the research participants it is “critical that the persons who make up the sample in an experiment are representative of the population from which they are drawn” (Nelson, 2006, p. 66). Since the students are selected from three different schools and classrooms, and they are randomly placed in these individual kindergarten classrooms, they should be representative of the demographic population of the school locations. In addition to parental consent signature documents, the children will be asked to assent to participation as well. A scripted assent document will be read and marked for agreement prior to any active research participation. Both parent and child consent agreements indicate that participation is entirely voluntary, and the consent may be withdrawn at any time.

The pre-test and posttest will be administered to all participants. The participant inclusion criteria were very specific which limited numbers, but was designed to target a specific population of children who do not respond to traditional educational methods, and do not receive occupational therapy services, but have all been instructed in the same manner, to reduce the effect of experience and exposure variables.

The research plan and home program participation demonstrate no greater risk of harm than would be experienced during an ordinary school day for the children, and no more harmful than a typical day parenting a kindergarten child for the adult participants. While unlikely, the child may be identified as having difficulty with handwriting among his/her peers, but will perform the remedial activities at home, and over the summer which minimizes exposure. To minimize or protect against the potential risk of parental feelings of inadequacy, they will be specifically trained by the researcher on how to instruct the handwriting lessons. The child's remedial instruction is taking place outside the school environment, and confidentiality measures are in place to protect the child and parent identities. For further protection, each child will be evaluated using a standardized norm-referenced evaluation instrument; the home program is a recognized evidence based handwriting instruction method, and the researcher will be blind to participant and parent identifiable data or responses.

Fidelity

With the use of a parent instructed home program of handwriting intervention, there are potential problems that the program will not be administered as planned. According to Nelson (2006) this creates a "problem of fidelity, where all participants are receiving the exact same experience" (p. 67). There exists a potential problem of delivery, where there is variance in the amount of time parents spend on the instruction, a problem of receipt where the child does not fully engage with the parent as an instructor, and the potential problem of enactment, where both the parent and child do not follow the instructions for the proper use of the materials. Ultimately, when the variable being measured is not standardized and monitored, such as with a home program, every one of these problems of fidelity have a potential to exist. The threats to validity and fidelity are addressed through a) standardized parent training, b) standard instructional

materials, c) specific lesson instructions, d) a provided visual and written outline sequence of the daily prescribed lessons, e) the use of an evidence based curriculum, f) the use of a parent time log to monitor instructional time, and f) a test- retest reliable evaluation instrument, which was used for a similar research study involving kindergarten students, and a handwriting remediation program.

Limitations

This researcher acknowledges a small sample size as a limitation for generalization. The design of this study includes elements of the previously cited works of Marr and Dimeo (2006) whereby the authors evaluated the outcomes of a summer handwriting course with pre-test posttest outcome measures, but with occupational therapist provided instruction, as opposed to parent instruction. They also used the Handwriting Without Tears curriculum and parent survey data to assess outcomes. Marr and Dimeo (2006) recommended an alternative assessment measure from the use of the Evaluation Tool of Children's Handwriting (ETCH), more instructional opportunities, and adding a control group, all of which this study has incorporated to improve validity. The selection of the Test of Handwriting Skills-Revised was chosen as an alternative to the ETCH, to specifically address its design compliment for the Zaner-Bloser and D'Nealian teaching curriculums, and its specific use with children from age five, as opposed to alternative cited measures that were developed for children beginning at age six (Milone, 2007). Selecting kindergarten participants who have turned six before May 1, 2017 could have negatively affected the already small sample size.

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Appendix I Timeline of Project Procedures

Month	Activities
November	<ol style="list-style-type: none"> 1. Complete school system request to conduct research 2. Develop letters of informed consent. 3. Develop a parent survey to address objective one- exploration of the common characteristics of struggling hand writer. 4. Develop a post-program parent survey of perceived benefit of the program for the parents, based on objective two. <p>Complete IRB Proposal-Final submission by January</p>
December	<ol style="list-style-type: none"> 1. Contact HWT to discuss the use of their methods and materials for the research plan, and determine if they will provide the materials for each summer kit. 2. Or, negotiate with other schools to see if they will allow students to borrow their handwriting materials for the summer program. 3. Complete Research proposal 4. Develop parent tracking logs of student participation. 5. Develop the parent information brochure
January	Help teachers perform mid-year screening using the HWT screener
February	
March	
April	<ol style="list-style-type: none"> 1. Obtain end of year screening results from the teachers. 2. Identify students who fail to meet kindergarten standard for legible letter formation based on the HWT screener and/or the GKIDS assessment. 3. Develop parent training course.
May	<ol style="list-style-type: none"> 1. Meet with parents and teachers to describe the research plan and available summer instructional program to determine group participants. 2. Obtain informed consent signatures for parent and child participants. 3. Get permission to evaluate the students with the handwriting assessment tool. 4. Get student assent to participate in the program and/or evaluation. 5. Evaluate student participants with HW evaluation tool (THS-R). 6. Create student instructional materials (individual kits). 7. Develop parent instruction manual. 8. Schedule training course with parents. 9. Have volunteer devise and code all participant identifiable documents.

June	<ol style="list-style-type: none"> 1. Train parents on the 6-week program (June 1) 2. Obtain pre-program parent survey data with training program. 3. Begin 7-week remediation program on June 5, 2017, to last until July 21. 4. Week 2 parent contact 6/14-6/16/17 to check on progress/ concerns/ problems. 5. Week 4 parent contact between 6/28-6/30/17 to discuss mid-program review needs.
July	<ol style="list-style-type: none"> 1. Final parent contact between 7/17-7/21 to remind completion of post program parent survey. 2. Collect program materials and parent survey forms 7/24-7/28/17.
August	<p>Return to school the first week of August</p> <ol style="list-style-type: none"> 1. The posttest THS-R Handwriting evaluation for both groups will occur between 8/07-8/18/17 for each student.
September	<p>Compilation of research data and finalize the capstone document.</p>