AN ANALYSIS OF THE EFFECTIVENESS OF CURRICULUM EMBEDDED HANDWRITING INSTRUCTION AND ITS IMPACT ON STUDENT LEARNING

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Abstract

Common Core Standards bring increased educational demands with focused expectations for the production of quality writing however explicit handwriting instruction has minimal presence in today’s elementary school classrooms. The purpose of this study was to investigate the effect of handwriting instruction, using the Handwriting Without Tears handwriting curriculum, on student achievement. Performance on measures of handwriting legibility, written literacy, and basic literacy skills were compared between two groups; students receiving Handwriting Without Tears curriculum instruction and those who were receiving typical classroom instruction. Participants included a total of 789 Kindergarten and First-grade students from two Central Valley school districts in California. Analysis indicated significant differences between the two groups for handwriting legibility and Written Literacy. Students who received instruction using the Handwriting Without Tears curriculum demonstrated significantly higher performance on specific elements of written literacy as compared to those students who did not receive Handwriting Without Tears curriculum instruction. These findings support the use of specific handwriting instruction for promoting student achievement with written production and written literacy. Implications of
these findings for instructional practices and the development of written literacy as related to academic achievement are addressed.
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CHAPTER 1: INTRODUCTION

National literacy statistics are startling. According to the National Center for Education Statistics, 32 million American adults are illiterate equaling 14% of the U.S. population. Analysis of literacy statistics demonstrates no significant change for 12th grade students between the early 1970s and 2012 or between 2008 and 2012 for students in 12th grade (National Center for Education Statistics [NCES], 2013). Only 35% of fourth-grade students scored at or above proficient in reading performance and statistics demonstrate that students who don't read proficiently by the third or fourth grade are 4 times more likely to drop out of school. Sixty-seven percent of students who cannot read proficiently by the end of fourth grade will end up in jail or will require public assistance such as Welfare (NCES, 2013). The statistics reveal literacy to be a critical factor and issue of concern with societal implications that is a primary focus of educational reform in the United States.

The development of literacy in young children is multifaceted and intimately connected with reading and writing experiences in the home and at school (Bazyk et al., 2009). Emergent literacy theory asserts that speaking, reading, writing and listening abilities are interrelated and develop concurrently. Improvement in one area simultaneously impacts another; exposures to writing experiences are also working to improve a child’s reading skills and vice versa (Teale & Sulzby, 1986). Writing is the primary mode that student’s use to demonstrate knowledge and the primary way that teacher’s evaluate student learning (Cutler & Graham, 2008). Writing, for emergent writers, is constrained by and shaped by a student’s handwriting ability (Bara & Gentaz, 2011; Graham, Harris, & Fink, 2000).
Today, with the evolving curricular focus on literacy, handwriting instruction is being pushed out and becoming an afterthought, gradually losing attention or instructional time in today’s classrooms (Berninger et al., 2006; Bliwise, 2013; Case-Smith, Holland, & Bishop, 2011; Denham, 2006; Graham, 1999; Puranik & Al Otaiba, 2012). Current educational standards for learning contain vague language that is slight in relation to handwriting; A search of The California Common Core State Standards: English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects (2013; CCCSS) for the term “handwriting” revealed zero matches with a result of “Not Found.” A search for the term “print” appears 49 times throughout the K-12 standards. Only 3 of the 49 occurrences are used with reference to the production of printed writing by hand (i.e. handwriting) and are found in the K-5 Anchor standard for Language within the strand: Conventions of Standard English. The first appearance is found in the strand at kindergarten, standard K.L.1.a. “print many upper- and lowercase letters” and then again in first grade, standard 1.L.1.a “print all upper- and lowercase letters” (California Department of Education, 2013). The third and final appearance of the word “print” as related to the production of letters by hand is found within the Conventions of Standard English strand, second grade, standard 2.L.1.g., “create readable documents with legible print” (California Department of Education, 2013; Jones & Hall, 2013). The standards lack specificity and lack detail to qualify the nature of “how” letters should be formed with the term “print.” The term “legible” is not present as a part of the language of the kindergarten or first grade standard but appears in the language of the second grade standard 2.L.1.g. “Legible” is not defined within the standard and is a subjective measure of readability. The lack of reference to handwriting in the education standards, the brief mention and lack of detail regarding letter
formation, and minimal focus on the production or quality of written letters contributes to a conclusion that handwriting instruction is not a prominent feature for concern and does not warrant instructional inclusion as a separate or specific curriculum.

The K-12, *California Common Core State Standards* (CCCS) contain the terms “write” and “writing” in 78 and 297 places, respectively (California Department of Education, 2013). The terms are used to emphasize content and process of analyzing, using, and creating written output as opposed to the process of letter formation or “how” letters are produced as the act of handwriting in the process of demonstrating knowledge through writing. Although limited instructional importance or attention is given to handwriting instruction, handwriting is a foundational skill that influences academic performance (Saperstein, 2012). Literature suggests that handwriting instruction is important, especially for young students as it impacts letter formation and in turn, impacts writing composition skills, and reading (Graham & Harris, 2005a; Graham & Harris, 2005b; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Vander Hart, Fitzpatrick, & Cortesa, 2010). Despite the link between handwriting instruction and learning outcomes suggested within existing literature, very little research exists that empirically examines the effect of classroom embedded handwriting instruction on specific student learning outcomes (Vander Hart et al., 2013).

**Purpose of the Study**

The primary purpose of this study was to examine effects of handwriting instruction on student learning and achievement. This study sought to investigate the effectiveness of the use of a formal handwriting instructional curriculum on handwriting skills, literacy, and written literacy skills of developing writers.
Additional information was gathered on teacher perceptions of participating K-1 elementary school teachers in regard to handwriting instruction in today’s classroom to further inform the findings of this research.

Specifically, this study investigated the effects of using the Handwriting Without Tears Program (a multi-sensory handwriting curriculum), as a formal instructional curriculum that was embedded in the teaching practices and routine of the educational school day, on handwriting skills (transcription skills, writing fluency, writing speed, legibility), elements of literacy (reading, phonics, written literacy, and spelling), and informed by perceptions of K-1 classroom teachers regarding handwriting instruction. The dependent variables within this study included measures of handwriting skills, literacy, written literacy, spelling, reading, and teacher perceptions.

A secondary purpose of this study was to add to the body of research regarding educational instructional practices for the purpose of informing policy decisions, educational pedagogy, and classroom instruction for maximizing student achievement.

**Background**

A review of the educational literature documents illegible handwriting and difficulties with handwriting as significant and problematic, impacting numerous areas of academia and life (Graham, Weintraub, & Berninger, 1998). Only 24% of American students score at the proficient level on writing assessments; national statistics reveal an existence of consistent academic deficiencies, poor literacy skills, and poor writing skills despite the use of a computer to complete the writing assessment (NCES, 2015).

Common practice in early childhood education emphasizes the engagement in writing for the purpose of idea generation, communication, and to begin to
identify oneself as a writer (Graham, Harris, Mason, Fink-Chorzempa, Moran, & Saddler, 2008). When the emphasis is focused on the process of writing and the act of putting a writing instrument to paper the product often results in scribbled forms that approximate letters and that embrace and support the experience of being a writer (Lesiak, 1997; Martinez & Teale, 1987; Sulzby, 1992). This practice, aligning with the theory of emergent literacy, is prevalent in today’s elementary school classrooms and minimizes the importance of correct letter formation (Berninger et al., 2006).

Writing problems begin in the early grades and persist; students identified with writing difficulties in the first grade are highly likely to be classified as Poor writers in the fourth grade (Juel, 1988). The term Poor is commonly encountered throughout the literature in reference to below-standard handwriting or writing performance. The term is generally used as a descriptive term referring to performance that is less than average or expected and is typically used in reference to formation and readability however there is no evidence of a common, specific definition. As children learn to write, handwriting and spelling are strong predictors of writing fluency and can influence compositional quality in the primary grades (Graham et al., 1997; Jones & Christensen, 1999; Juel, 1988). The literature suggests that elementary students specifically taught transcription (handwriting) skills perform about one-half standard deviation (ES = .55) higher than comparison students on measures of writing quality (Graham, McKeown, Kiuhara, & Harris, 2012). Despite the benefits revealed by direct handwriting instruction, researchers have demonstrated the near absence of classroom educational time apportioned to handwriting instruction in the early grades (Kent, Wanzek, & Al Otaiba, 2012; Mehta Foorman, Branum-Martin, & Taylor, 2005; Puranik, Al Otaiba, Folsom, & Gruelich, 2014).
Context of the Study

This study focused on the development of handwriting skills of kindergarten and first grade students and the link to learning outcomes as indicators of student achievement. Educational legislation has focused on student achievement by improving educational outcomes as a means of preparing students for the demands of college and career with 21st century skills. With minimal attention given to the foundational area of handwriting, this study seeks to evaluate the effectiveness of the instructional implementation of HWT and the impact on student achievement.

This study took place in the Central Valley of California that is home to an at-risk group of students, is culturally diverse, encompasses a high percentage of children from low socio-economic status families, is comprised of a high percentage of Free and Reduced Lunch Program recipients, and includes a large number of students for whom English is a second language.

The two participating Districts’ student demographics are closely matched with demographics represented by averages within the state of California. The districts were chosen because each district represents aspects of the Central Valley and also align with demographics representing the State of California. This is beneficial for generalizability of study findings. Additionally, the local Districts were selected based upon the pilot program in process using HWT curriculum, accessibility, and willingness to participate in the study.

District A has traditional, multi-grade schools with a student population that is 90%-95% Free and Reduced Lunch program eligible, 94% minority with the largest group from Hispanic or Latino families, and not currently using a specific embedded handwriting curriculum (NCES, 2015). The two school sites of District A were chosen from the 14 elementary schools within the district because
the two schools are physically located in close proximity to one another and the student population was demographically similar.

District B has individual, grade level specific schools serving a rural area in the Central Valley. District B has a student population that is 60%-65% Free and Reduced Lunch program eligible, 69% minority with the largest group from Hispanic or Latino families, and not currently using a specific embedded handwriting curriculum (NCES, 2015). District B schools are delineated by grade level therefore each school was selected based on grade level.

**Significance of the Study**

Students spend up to 60% of their academic day engaged in tasks that require legible handwriting to demonstrate knowledge (Puranik & AlOtabia, 2012; Rosenblum, Weiss, & Parush, 2003). Despite the availability and use of technology, handwriting is a primary occupation for elementary school children (McMaster, & Roberts, 2016). Literature suggests that handwriting instruction is important, especially for young students as it impacts letter formation and in turn, impacts writing composition skills, and reading (Graham & Harris, 2002; Medwell & Wray, 2014; Vander Hart et al., 2010). Researchers assert that negative academic outcomes can result from poor handwriting for young students (Baker, Gersten, & Graham, 2003; Cahill, 2009; Case-Smith, Holland, & Bishop, 2011; Graham et al., 1997). Educational standards are slight with inclusion of standards that reflect the importance of handwriting therefore it is being left as an educational afterthought with minimal time or attention being given within the instructional day (Feder & Majnemer, 2007; Graham & Perin, 2007; Schlagal, 2007). Studies demonstrate the discrepancy between teacher perceptions and handwriting instructional practices asserting that many teachers believe handwriting to be an important skill however they are unable to adequately
address handwriting instruction (Denham, 2006; Graham et al., 2008; Kolb, 2015). Additionally, studies demonstrate that teacher perceptions and practice are influenced by professional preparation with many teachers in agreement that handwriting had important consequences for students, however they reported that they had not received adequate training or preparation to teach the complex skill of handwriting (Denham, 2006; Graham et al., 2008).

**Theoretical Framework**

The theoretical framework for this study crosses several disciplines in an attempt to synthesize the issues that effect and link handwriting instruction, literacy, and learning outcomes as they relate to the proposed purpose of the study. Theoretical frameworks include neuroscience, cognitive load, and motor learning theory. Each of these different areas provides a different theoretical framework or lens by which handwriting for producing a written product can be examined.

The study of neuroscience provides a biophysical lens to view learning processes and handwriting skill acquisition. Questions regarding the physical and mental act of handwriting in conjunction with brain functioning in relation to motor and cognitive aspects of memory and learning can be formulated. These questions focus attention on the contributions of the handwriting process as it is neurologically connected to memory and learning for young children (Roeltgen, 2003).

Cognitive load theory (CLT) provides a second lens through which handwriting and learning outcomes can be viewed. Cognitive Load Theory is a theory of instructional design and model of research focused on complex instruction (Sweller, 1988; Sweller, Ayres, & Kalyuga, 2011; Van Merriënoer, & Sweller, 2005). The focus of CLT is on matching instructional processes with experiences to maximize working and long-term memory for optimizing learning
with the goal of producing a relatively permanent change in knowledge or behavior (Kirschner, 2002; Mayer, 1982). Considering the limitations of working memory and the learning demands with complex tasks such as handwriting and composition, a researcher is directed to examine and formulate questions that relate to the demands placed on working memory for processing and planning letter formation while simultaneously transcribing thoughts into written content. This lens affords researchers the ability to study the idea of handwriting automaticity with transcription skills for producing letters drawing from long term memory and minimizing the demands on working memory so that greater cognitive capacity is available for thoughts to be produced in writing while minimizing cognitive load (Sweller, 1988; Sweller et al., 2011).

Motor Learning theory provides the third lens through which handwriting and learning outcomes can be viewed. Motor Learning is the acquisition of skillful movement in a coordinated and controlled fashion as a result of the interaction of the individual (the organism), the task, and the context in which the task is being performed; motor learning is the result of a confluence of all functionally related components (Kamm, Thelen, & Jensen, 1990; Guadagnoli, & Lee, 2004; Wolpert, Ghahramani, & Flanagan, 2001). Motor Learning Theory asserts that increasing the adaptability of learning and ease of transfer of skills is achieved differently with children as compared to adults and this motor learning impacts task performance (Poole, 1991; Shumway-Cook & Woolacott, 1995).

**Definitions**

Further delineation is required for several terms used throughout this study.

**Handwriting** - refers to using the hand for letter formation onto a writing surface, paper, or page (Edwards, 2003; Graham et al., 1997; Graham et al., 2000;
Jones & Christensen, 1999). Transcription is another term that is used in the literature to reference the act or process of handwriting.

**Literacy** - is defined by the National Center for Education Statistics as the use of, or the process of using, printed and written information to function in society, achievement of individual goals, and the development of one’s knowledge and potential (NCES, 2013).

**Text-generation** - is defined as the process of translating thought into language at different levels (i.e., words, sentences, discourse) in memory (Berninger, 1999).

**Transcription** - is defined as “translating language representations in memory into written symbols” (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994, p. 273) therefore, transcription skills are technically aligned with the terms handwriting and spelling.

**Writing** - refers to the act or process of expressing knowledge and thoughts (Berninger, 1994; McHale & Cermak, 1992; Parush, Lifshitz, Yochman, & Weintraub, 2010).

**Written expression** – refers to translation in the literature (Hayes, 1996, 2012; Hayes, Flower, Schriver, Stratman, & Carey, 1987). Translation is separated into two sub-categories of text-generation and transcription (Berninger et al., 1994; Berninger, Whitaker, Feng, Swanson, & Abbott, 1996; Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 1992). If one is referring to the cognitive processes of written expression, the literature defines this as a developmental model that includes and refers to both text generation and transcription (Hayes and Berninger, 2009).
Summary

Today’s educational system is placing a primary focus on the development of literacy skills to ensure students are prepared for the demands of college and career in the 21st century. The CCSS are placing a new level of importance on writing with emphasis highlighted by the anchor standards. Unfortunately, the standards for writing are vague and lack detail regarding the foundational elements for teaching the process or act of handwriting, leaving educators uninformed about the importance of allocating instructional time for handwriting. There is limited research that informs educators to change the current practice and the link to learning outcomes for student achievement is not well established in the existing literature.

The purpose of this study was to investigate the effects of a HWT instruction on the learning outcomes of handwriting ability, written literacy, and literacy to promote academic achievement of students in general education kindergarten and first grade classrooms in the Central Valley of California. This study served to inform educators about the instructional elements to be considered worthy of premium instructional time in the classroom to support literacy skills and build a strong foundation for future academic success.

Organization of the Study

This study is organized into five chapters.

Chapter 1 presents an introduction to the study. This chapter presents the purpose, background, context and significance of the study in conjunction with the theoretical framework and some definitions as they apply to this study.

Chapter 2 presents an in-depth and formal literature review of the information as it pertains to this study and provides the basis for chapters 3-5. Components of literacy are presented in relation to current trends and educational
practices with the continuing discussion focused on the role of handwriting as it relates to writing and literacy. Research on components and types of handwriting are presented. The impact of handwriting on academic performance is explored. Current handwriting instruction practices, teacher perceptions about handwriting, and the importance of handwriting instruction are reviewed. The literature served to inform the research questions regarding handwriting instruction and literacy rates that are proposed in chapter 3.

Chapter 3 discusses the methodology for the study, presents the research questions, outlines data collection, and introduces the proposed statistical analysis processes.

Chapter 4 presents results of the research and chapter 5 summarizes the findings with an additional discussion of implications and suggestions for future research.
CHAPTER 2: REVIEW OF THE LITERATURE

Handwriting is an integral part of the education curriculum and a skill that is needed in every stage of life. The literature clearly establishes the need for legible handwriting during childhood and in later life (Graham et al., 2000; Olsen, 2005; Sassoon, 1997).

Research regarding the link between handwriting instruction and academic achievement in a general population of students without identified disabilities is sparse (Bazyk et al., 2009; Case-Smith, Holland, & Bishop, 2011; Edwards, 2003; Kent et al., 2014). Research relating directly to the effectiveness of classroom handwriting instruction, specifically embedded into classroom teaching routines, is limited to a handful of handwriting evaluation studies and lacks a connection to specific learning outcomes (Case-Smith, Holland, & Bishop, 2011; Clark & Luze, 2014; Donica, McCraw, Hudson, & Cason, 2013). A review of the research and reports regarding academic achievement highlight the concerns regarding the disparity in formalized handwriting instruction and the impact on aspects of academic achievement including literacy, reading and writing fluency, spelling, and written literacy (Abbott, Berninger, & Fayol, 2010; Asher, 2006; Berninger, et. al, 1992; Feder & Majnemer, 2007; Graham et al., 2000).

This chapter reviews the literature chronicling the decline of handwriting instruction, the results and extent of poor handwriting, the relationship of handwriting and literacy in the curriculum and of handwriting and achievement, the role of handwriting instruction, preparation to teach handwriting and the neurological processes involved with writing. A final summary concludes the chapter.
The Decline of Handwriting Instruction

In today’s classrooms, demands for academic achievement are high and teachers are not able to devote time to teaching handwriting due to pressures for students attaining high test scores in core academic areas (Berninger et al., 2006; Sedgewick, 1996). In comparison to academic areas such as reading, language-arts, and creative writing, addressing handwriting difficulties is a neglected area with little to no attention for instruction or remediation (Graham et al., 2000; Pikulski, 1994).

As curriculum demands and the use of computers have increased, the attention to and value of handwriting and handwriting instruction has decreased. Handwriting has transitioned from being an art form to an essential skill with handwriting and handwriting instruction becoming an educational afterthought in modern day classrooms (Denham, 2006; Puranik & Al Otaiba, 2012). As a result, handwriting instruction has slowly been removed from school curriculums and educational mindsets over the past 20 years (Graham & Perin, 2007; Hayes, 2012; Schlagal, 2007). However, handwriting and handwriting instruction are important aspects of the educational process. Handwriting is a primary participatory activity of elementary school students (Cahill, 2009). Students rely on the use of legible handwriting to communicate their cognitive abilities, knowledge, learning, and academic skills.

Milone and Wasylyk (1981) refer to handwriting as the neglected R in the educational process. Although views regarding handwriting may have changed, its importance has not. However, these changes in perspective have often been misinterpreted as a change in importance (Berninger, 1999; Berninger et al., 2006; Cahill, 2009).
The last major change in the writing curriculum of American schools involved the introduction of the manuscript style of writing (Peck, Askov & Fairchild, 1980). However, changes in societal needs, the expansion of the school curriculum, and attitudes toward handwriting in general resulted in a writing curriculum that is much less uniform and is based more on tradition, convenience, and past practices rather than on research. In recent years, handwriting instruction has seen its place in the formal school curriculum shrink or even be eliminated (Graham et al., 2000). Schools are not able to devote more time to handwriting because of time pressures in the classroom (Sedgewick, 1996).

Education has continued to evolve in search for superlative pedagogy and effective practice and has included advancements with the addition of technology. Opinions and views concerning handwriting and the role of handwriting instruction within the modern day classroom has transformed in the recent past (Graham & Harris, 2016; Santangelo & Graham, 2016). There was a time in educational history when handwriting was a formally taught, separate curriculum; children spent as much as 75 minutes of class time, per day, on penmanship. Students practiced writing while the teacher provided individual feedback and instruction (Gerszberg, 2003). Today, handwriting exists as an afterthought; the practice trend in education has been to transform handwriting into an element of the language arts curricula. Students are briefly introduced to the letters in combination with language or phonics leaving most students without guided instruction on letter or number formation (Koenke, 1986). The introduction of technological modes of communication and assessment (e.g. computers and voice activated equipment) has lured teachers, administrators, and researchers to dismiss the need for formal handwriting instruction (Wallace & Schomer, 1994).
Schools in the United States continue to add to the curricula of the public school, without extending the school days or times. As a result, the combining of handwriting instruction with other subjects is often viewed as a welcome change. However, the combining of handwriting with other courses appears to be ill advised (Berninger et al., 2006; Graham et al., 2000) as it was found that it decreases the likelihood of explicit instruction, and makes the constancy of instruction more difficulty to track (Ste-Marie, Clark, Findlay, & Latimer, 2004).

According to McHale and Cermak (1992), children spend between 31% and 60% of their classroom time on handwriting or fine motor tasks. Even if used as an embedded curriculum for teaching in context, handwriting requires explicit teaching for proficient skill development (Benbow, Hanft, & Marsh, 1992; Bowen, 2003; Case-Smith, 2005). Often, individual, separate, and explicit handwriting instruction is non-existent because it is viewed as a component of these specific subjects (Cutler & Graham, 2008; Graham et al., 2008; Lifshitz & Har-Zvi, 2015).

An example of past accountability measures that have marginalized the importance of writing include the reauthorization of the Elementary and Secondary School Act of 1965 otherwise known as the No Child Left Behind Act (Jones & Hall, 2013). The reauthorization placed an emphasis on reading and mathematics offering limited motivation for districts to formally address writing skills. Schools have been held accountable for academic performance based upon on a students’ ability to demonstrate academic knowledge via multiple-choice questions that require students to bubble in the correct answer (Saperstein, 2012). Educators have not had accountability or the need for teaching handwriting to educate students in areas of written language; this has not been an area of assessment (Berninger et al., 2006; Steffani & Selvester, 2009).
Combining handwriting as an element of language arts has evolved with an approach known as “Whole Language.” This whole language approach teaches both the content of writing and mechanics of handwriting simultaneously (Dobbie & Askov, 1995). When handwriting is taught in conjunction with spelling, reading, and writing, it is not taught as a separate entity or skill. The transition to whole language writing has been widely accepted by many administrators and teachers because it fits into the curriculum (Asher, 2006). Unfortunately, the emphasis on Whole Language removes detailed instruction addressing foundational skills and leaves struggling writers at risk for further academic difficulties (Asher, 2006; Graham et al., 2008; Olsen, 2005).

**Inconsistency in Teaching Handwriting**

Handwriting education in America has become inconsistent and extremely variable (Asher, 2006; Bowen, 2003; Denham, 2006; Roberts, Derkach-Ferguson, Siever, & Rose, 2014). The manuscript format, the amount of time spent on the subject, and the method in which it is taught vary from school to school (Graham et al, 2008; Kiss 2007). Handwriting is a multifaceted skill and the appropriate instruction of, and assessment of, the subject can be time consuming and difficult (Woodward & Swinth, 2002). Handwriting has become so commonplace that the skill and time required to master it is often underestimated (Greer & Lockman, 1998). As a result, instructional practices and the amount of time allotted to handwriting within the formal school system has declined substantially (Bowen, 2003; Denham, 2006; Graham et al., 2008).

Denham (2006) completed a study designed to examine the perceptions and beliefs held by Alabama public school administrators and teachers regarding the handwriting of regular education children and the handwriting policies of their school. Of the 415 surveys returned, inconsistency was found regarding the
method by which handwriting is taught and 87% of respondents reported no formal system in place to identify children with handwriting problems. Seventy-five percent of the respondents reported beliefs that poor handwriting can affect other areas of academics. Findings revealed a great deal of inconsistency and few formal policies regarding the instruction, assessment, or remediation of handwriting. Overall, Denham’s (2006) study revealed that instructional inconsistencies were present across schools, regions, and the entire state of Alabama.

Graham et al. (2008) completed a study of handwriting instruction practices of 169 teachers in grades 1-3. Of the 169 teachers, 39% agreed that their students’ handwriting was adequate and 76% of the teachers identified problems with overall neatness of student handwriting. The findings revealed that the majority of primary grade teachers in the U.S. are teaching handwriting, however instructional procedures, practices, materials used, and time spent on instruction is highly varied and applied unevenly.

Findings by Graham, Harris, Fink-Chorzempa, and MacArthur (2003) revealed that teachers are teaching handwriting with only 2% of surveyed respondents indicating that they do not teach handwriting at all; almost 50% of teachers surveyed reported daily handwriting instruction, 25% teach handwriting several times a week, and 14% reported teaching handwriting once per week. These findings align with other studies noting that it is common practice to allow the method by which handwriting is assessed and taught to be left to the individual teacher, with little direction from curriculum guidelines or school policy (Denham, 2006; Rosenblau, Weiss, & Parush, 2003; Zubrzycki, 2012).

Cutler and Graham (2008) conducted research on general writing instruction practices in the United States. Surveys were completed by 178 primary
grade teachers regarding their classroom instructional practices for writing. Researchers discovered that most teachers (72%) reported use of an eclectic approach, combining process writing and skills instruction. Analysis of findings exposed considerable variability between teachers in how often specific practices were used, however 90% reported using most of the writing instructional practices that were included in the survey yet only 22% identified handwriting as an included element that is taught several times per week. Recommendations for reforming primary grade writing instruction resulted from the survey study and included increasing the amount of time students spend writing, improving balance between time spent writing, learning writing strategies, teaching writing skills, emphasizing fostering student motivation for writing, capitalizing on the school to home connection for writing, incorporating computers into the writing program, and facilitating teacher preparation for writing instruction through professional development.

Investigations of handwriting instruction practices in elementary school classrooms have found that there are considerable variations among teachers practices with respect to materials used, time spent teaching, and perceptions regarding the importance of handwriting (Cutler & Graham, 2008; Graham et al., 2003; Graham et al., 2008; Rosenblum et al., 2003). As a result of study findings, researchers designed specific recommendations including advocating for taking time for teachers to learn to teach and using time for explicit handwriting instruction in the classroom (Cutler & Graham, 2008; Graham et al., 2003, Graham et al., 2008; Rosenblum et al., 2003).

Although the method varies, the introduction of formal handwriting instruction generally begins in kindergarten with printing or manuscript writing. Many school systems across the country have adopted and chosen to teach the
manuscript writing style referred to as the Zaner-Bloser, or ball and stick method (Barchers, 1994; Bergaman & McLauglin, 1988; Wallace & Schomer, 1994). Some schools have chosen to adopt and teach the D’Nealian method of manuscript writing, a style characterized by a slanted appearance similar to cursive writing (Graham et al., 1998). Yet other schools have chosen to utilize the Italic method of manuscript writing, due to the quick, simple, and loop-free format (Duvall, 1985).

An inconsistency exists in the preferred format of manuscript writing utilized across the country. Despite the adopted method of manuscript instruction, general agreement exists that the transition to cursive writing should occur at the end of the second grade or at the beginning of third grade (Barchers, 1994; Bergaman & McLauglin, & 1988; Duvall, 1985; Graham et al., 1998; Wallace & Schomer, 1994).

**Lack of Handwriting Guideline**

Denham (2006) found that specific recommendations or guidelines for handwriting are missing from federal, state, and local policy. A policy update issued by National Association of State Boards of Education (NASBE) was published in 2012 that documented the debate on handwriting standards, and acknowledged the problematic nature of vague and/or non-existent handwriting standards. Troia and Olinghouse (2013) completed an analysis of the Common Core State Standards that were adopted by 45 states in 2010 and discovered that handwriting was not specifically addressed in a manner that aligned with evidence based practice. The reality exists that today, concise recommendations for handwriting are not forthcoming from national organizations, individual states, or education agencies, and schools lack consistency with policy and practice as applied to handwriting (Donica, Larson, & Zinn, 2012; Jones & Hall, 2013).
The Common Core State Standards (CCSS) do not include specific standards for handwriting (CCSS, 2010). The specific standard (CCSS-L.K.1a) vaguely describes handwriting in the kindergarten year only as the ability to “print many upper and lowercase letters” (CCSS, 2010 p.26) and continues this description into first grade with the standard (CCSS-L.1.1a, CCSS, 2010 p.26) reading, “print all upper- and lowercase letters” (CCSS, 2010, p.26). There is no continuation of this standard element and no mention of letter knowledge or production quality in the corresponding standard in or beyond the second grade. Legibility of written production is not addressed or mentioned within the standards document of the national CCSS (CCSS, 2010).

Individual states are allowed and encouraged to add up to 15% to the CCSS (CCSS, 2010; NASBE, 2012). California Common Core State Standards (CCCSS) continued the standard and detailed quality with the addition of the term “legible” as part of the standard. The CCCSS second grade language standard, under Conventions of Standard English, specific standard L.2.1g is written as “Create readable documents with legible print. CA” (CDE, 2013 p. 32). The third grade course of study includes cursive and shows some valuing of quality handwriting with continued inclusion of the term “legibility.” The specific standard, L.3.1j, is written as “Write legibly in cursive or joined italics, allowing margins and correct spacing between letters in a word and words in a sentence. CA” (CDE, 2013 p36). The California standard is continued into the fourth grade with standard L.4.1h written as “Write fluidly and legibly in cursive or joined italics. CA” (CDE, 2013 p.36). Despite the inclusion of the production of letters and the inclusion of the word legible, the standard remains as vague. The lack of description for or definition of legibility leaves the production process to subjective judgment to determine what should be considered legible. No direction
or indications for legibility are given (CDE, 2013; Jones & Hall, 2013; Kolb, 2015).

Denham (2006) noted that handwriting is addressed by the Alabama Course of Study as a component of the English Language Arts curriculum with no mention of the domains of handwriting, writing speed, or the ergonomics associated with handwriting in the curriculum. This is consistent with the initiative for the adoption of the National Common Core State Standards that has occurred in 45 states nationally (NAESB, 2012; NGA & CCSS, 2010; Jones & Hall, 2013). It is not until third grade, with the start of cursive writing, that legibility and the components of handwriting are mentioned (Denham, 2006). The legibility components of handwriting are not addressed in the practice standards during the formative years of kindergarten through second grade with the production of manuscript writing (CCSS, 2010; Denham, 2006; Donica et al., 2012).

The lack of specificity in handwriting standards stimulated the Utah State Office of Education to develop a committee to research and propose specific handwriting standards that were presented to the Utah State Board of Education in April of 2013 (Jones & Hall, 2013; Utah State Department of Education, 2013). The creation of additional handwriting standards attempted to add specificity and clarity however the standards remain vague without specific definition or curriculum to teach handwriting to elementary students (Jones & Hall, 2013). The impact of increased awareness, emphasis and research regarding the need for handwriting instruction and specific standards is positive and aligns with research supporting the need for handwriting instruction beyond the first 2 years of a students’ academic career (Berninger, 2013; Jones & Hall, 2013; Troia & Olinghouse, 2013).
The Results of Poor Handwriting

Poor handwriting affects academic skills (Mather & Roberts, 1995; Peverly, 2006). Poor handwriting is loosely defined as below-standard handwriting performance that impacts legibility however there is no single definition present in the literature. The term “Poor” is used in reference to aspects of handwriting such as formation, size, or alignment. There is no consistent reference to a specific aspect in order to define handwriting as Poor however several studies speak to the impact of poor handwriting (Asher, 2006; Graham et al., 2000; Graham, Berninger, & Fan, 2007; Graham et al., 2008; Reisman, 1991).

Skills measured on tests and standardized academic assessments can be adversely affected by poor handwriting (Graham et al., 2000). A study by Graham et al. (2008), conducted at Vanderbilt University’s Peabody College, revealed that handwriting difficulties generated lower grades on written assignments and resulted in negative outcomes for both quantity and quality of students’ writing. Additionally, the study revealed that handwriting difficulties negatively influenced and increased the length of time required to complete writing assignments (Graham et al., 2008). Long-term implications for students with writing difficulties may experience negative outcomes; struggling students and children who continue to have difficulty with handwriting beyond first grade are at risk and may not fully develop as writers (Graham, 1999).

Handwriting is a functional skill that is required throughout the lifespan; a skill that is required for educational endeavors, vocational activities, in addition to social undertakings (Asher, 2006; Graham et al., 2008). Educationally, difficulties with handwriting production and legibility can be very costly (Hirshhorn, 2000), can limit the development of proficiency with writing skills, may contribute to difficulties with academic success, may negatively impact self-esteem, and can
even lead to behavioral difficulties (Feder & Majnemer, 2007). Development and demonstration of higher-order skills such as spelling and story composition are limited by illegible handwriting (Mavrogenes & Bezruczko, 1993; McCutchen, 1996). Despite the increasing presence and use of technology, handwriting is still the most immediate and widely used form of communication in classrooms (Olsen, 2005); children spend up to 60% of their classroom day engaged in fine motor and handwriting activities (McHale & Cermak, 1992).

A study completed by Graham, Harris, and Fink (2000) identified handwriting as being causally related to learning to write. Three-hundred ten first grade students from 12 classrooms in one school district were screened to identify students at risk (falling two-thirds standard deviation below the class mean) for handwriting difficulties. Forty-two students were identified and 38 of those students participated in the study. The students were randomly assigned to a handwriting intervention group or a phonological awareness group. Both groups received 27 specific lessons addressing letter knowledge, writing performance, and attitude toward writing. Results demonstrated that the students in the handwriting instruction group performed significantly higher as compared to the phonological awareness intervention group in areas of letter naming, compositional fluency and writing attitude. These findings were maintained over a period of 6 months as evidenced by the handwriting instruction group outperforming the phonological awareness group on letter naming and writing fluency in addition to having a more positive attitude toward writing. Furthermore, students in the handwriting group demonstrated composition at a faster rate.

The consequences of poor handwriting on academic performance are broadly documented in the research literature (Berninger, Abbott, Abbott,
Graham, & Richards, 2002; Clark, 2010; Jones & Christensen, 1999). Children may avoid writing and decide that they cannot write when they experience difficulty successfully mastering handwriting; this may lead to arrested development of writing skills (Graham et al., 2000). In addition, experts assert that self-esteem and other secondary effects on school achievement can result (Engel-Yeger, Nagauker-Yanuv, & Rosenblum, 2009). In fact, students without consistent exposure to handwriting are more likely to have problems retrieving letters from memory, spelling accurately, extracting meaning from text or lecture, and interpreting the context of word and phrases (Saperstein, 2012).

A review of the educational literature documents illegible handwriting and difficulties with handwriting as significant and problematic impacting numerous areas of academia and life (Graham et al., 1998). Graham, Harris, and Fink (2000) detailed areas that are frequently affected by handwriting difficulties. First, a child’s perceptions regarding competency as a student and self-esteem can be influenced by poor handwriting. Competency in subject areas may be impacted by handwriting mistakes and lead to judgment of ability or IQ. Second, the ability to generate and compose ideas via writing processes may be obstructed by handwriting problems. When the focus is directed toward the mechanics of writing during the composition process, children are more likely to edit content and produce shorter written samples. Lastly, overall academic development may be constrained by illegible handwriting. Arrested proficiency in subject matter demanding handwriting skills (composition, spelling, math, etc.) may be the consequence of illegible handwriting (Karlsdottir & Stefansson, 2002).

Saperstein (2012) asserted that handwriting is a foundational skill that can influence students’ reading, writing, language use and critical thinking. Basic literacy concepts of alphabet principles (alphabet knowledge) and phonological
awareness are impacted by handwriting skills (Clark, 2010). Processes of selecting and writing words are much more difficult and involved than the process of reading words (Fitzgerald & Shanahan, 2000). Lower grades and inferior academic performance for students can result in part from handwriting difficulties that impact legibility, writing automaticity and readability (Clark, 2010). Students who struggle with handwriting are likely to write slower, edit produced content to limit writing on paper, and experience difficulty completing assignments (Olive & Kellog, 2002; Sheffield, 1996; Ste-Marie et al., 2004).

Poor handwriting can have an impact on a multitude of areas in a child’s life including self-esteem and other areas of academics. In early years, children develop a sense of self and competency that serves to drive intrinsic motivation and the desire to seek new challenges in addition to contributing to self-confidence; the same process applies to the development of academic competency and self-confidence. If children experience failures beyond their successes, their feelings of competency will tend to be low (Engel-Yeger et al., 2009; Hersey & Blanchard, 1972). Children must have positive and developmentally appropriate academic experiences in the early years otherwise there is a risk of developing pattern of failure that may carry over and continue to impact a student throughout the duration of their academic career or into adult life (Baumeister, Campbell, Krueger, & Vohs, 2003; Sassoon, 2003; Stipek & Mac Iver, 1989). Frustration and negative attitudes, as well as diminished potential, are possible outcomes for children struggling with handwriting problems (Rosenblum et al., 2003).

Children who struggle with handwriting are likely to experience frustration with the majority of academic activities (Graham et al., 2007). This frustration is likely to lead to negative feelings regarding the academic process (Engel-Yeger et al., 2009). Some of these children may respond by simply giving up, having
developed a mind-set that they cannot write (Berninger, Mizokawa, & Bragg 1991). These avoidances affect children's performance in a circular fashion because increased writing may help improve handwriting quality (Graham, 1992).

Unfortunately, some children who have difficulty mastering handwriting skills may avoid writing altogether, resulting in arrested writing development (Berninger et al., 1991; Graham et al., 2008), or become less willing to devote the extra effort needed for planning composition or revising their work (McCutchen, 1996). Students suffer in educational and emotional development when they have difficulty developing their writing skills (Rosenblum et al., 2003).

By the time children exit the elementary school years and begin using computers to compensate for illegible handwriting, they may already have come to the false conclusion that they are not competent in academic areas such as math or spelling. In reality, the difficulty may be due to poor handwriting and not a lack of cognitive understanding (Case-Smith, 2001).

Legible handwriting is needed well beyond the elementary years. Handwriting competency can affect the length of time it takes a person to complete a written assignment, the quality of notes taken during a lecture, and the willingness of an individual to participate in writing activities (Graham et al., 1998). Older students and adults generally have access to computers and word processors; however, it is not reasonable to assume that these will always be available. There are times at which an individual must utilize handwriting, and illegible handwriting can result in serious consequences academically, in the context of career development, and even in personal relationships (Sassoon, 1997).

Students who wish to continue their education past the high school level are often required to take the Scholastic Aptitude Test (SAT). In 2005, the English Language section of the SAT began requiring students to complete a two-page,
handwritten essay (Marr & Dimeo, 2006). With the introduction of this component, legible and rapid handwriting became an issue. Students were allowed 25 minutes to complete this section of the exam. The essay was worth 400 points and was scored on a scale of 0 to 6, with 6 being the highest (Bowen, 2003; Jewell, & Malecki, 2005). Neatness and handwriting are not part of the scoring criteria; however, a panel of high school and college instructors scored the essays.

According to studies performed by Sloan and McGinnins (1982) and Chase (1986), teachers consistently gave higher marks to students with legible handwriting.

The implications of illegible handwriting are apparent when considering skills associated with the language arts. However, other areas of academia, such as mathematics, can also be affected by illegible handwriting (Bushman, 1991; Olsen, 2005). Children who are unable to write legibly may have difficulty spacing numbers and keeping numbers in columns, thus leading to errors during the calculation process (Gerszberg, 2003). In addition to alignment, children who must concentrate on the correct formation of a number are likely to write slower, possibly missing important steps in the calculation process (Karlsdottir, & Stefansson, 2002; Medwell & Wray, 2014; Simner, 1982). As a result, these children will struggle with timed math tests, have difficulty completing the day’s assignment, or submit work that is messy and illegible. The implications of illegible handwriting are found in every aspect of the educational process (Bushman 1991; Harris & Graham, 1992; Graham & Harris 2016; Graham et al., 2000; Jones & Christensen, 1999).

Increased use of technology within education (e.g. tablet use, computerized testing, web-based learning modules, etc.) and the growing reliance on digital resources used as an educational tools may tempt educators to place less
importance on handwriting, and consequently foster the belief that handwriting instruction is no longer necessary (Alonso, 2015; Berninger, Abbott, Augsburger, & García, 2009). Research indicates that handwriting instruction and practice with handwriting supports academic achievement (McCarney, Peters, Jackson, Thomas, & Kirby, 2013) even if students do not intend to use handwriting as the primary mode of communication (Connelly, Gee, & Walsh, 2007; Cunningham & Stanovich, 1990; Rodríguez, & Villarroel, 2016). Several researchers have argued that difficulties with text transcription skills such as handwriting or spelling may constrain young children’s writing development (Berninger, 1999; Graham, 1999; McCutchen, 1988). Baker et al. (2003) found that handwriting was a predictive factor in determining the length and quality of compositions. Handwriting is an essential skill that serves as a solid foundation for academic success related to literacy.

The National Assessment of Educational Progress presents data included in the Nation’s Report Card, 2007 revealing a writing crisis in the United States (Salahu-Din, Persky, & Miller, 2008). The Nation’s Report Card presented results from the National Writing Assessment and demonstrated that only 29% of 8th-grade students and 21% of 12th-grade students who took the assessment were writing at a Proficient level. Data contained and reported in 2007 were comparable to previous findings from 2002 and slightly improved from data collected in 1998. These data exposed the unfortunate reality that the majority of eighth and 12th-grade students who completed the assessment were performing at a basic or below basic level in writing. Performance scores falling in the below proficient range reveals a lack of mastery of the skills required to use written language and communicate clearly (Salahu-Din et al., 2008).
Handwriting is a basic and foundational skill required to proficiently use written language and communicate clearly. Hammerschmidt and Sudsawad (2004) found that the factors that teachers most frequently identified were correct letter formation, directionality, and proper spacing as very important factors for handwriting to be acceptable. Of all 314 participants, 72.7% reported that they graded students on the quality of handwriting (legibility, neatness, writing on the line, etc.) and that good handwriting was either important or very important to them (80%). Although there are academic, emotional, and long-term consequences resulting from poor handwriting and despite the importance teachers placed on individual handwriting components, the main criterion teachers used to determine whether or not a student has handwriting difficulties still concerns the overall readability of a student’s handwriting comparing to the student’s peers.

The Extensive Nature of Handwriting Evaluation and Assessment

The subjective nature of handwriting evaluation and assessment combined with a lack of specific criteria or instructional approach for handwriting contributes to long term writing difficulties (Alston & Taylor, 1987; Armitage & Ratzlaff, 1985; Chase, 1986; Sloan & McGinnins, 1982).

The Extent of Handwriting Problems

Rodgers and Case-Smith (2002) estimate that as many as 25% of regular education children experience handwriting problems. Comparative studies of the handwritten output of children with and without handwriting difficulties reveal differences in the accuracy and readability of letters, words, and sentences (Ferreti, MacArthur, & Dowdy, 2000; Reisman, 1991). The handwriting quality of children with difficulties has been described in studies as "poor" and can be characterized by inappropriate spacing between letters or words, incorrect or inconsistent shaping of letters, poorly graded pencil pressure, letter inversions, and mixing of different letter forms (i.e., script and square) (Hamstra-Bletz & Blote, 1993;

Marr and Cermak (2002) investigated the handwriting consistency of 93 kindergarten students from the beginning of kindergarten year to the middle of the first grade year. The researchers found that 42% of the kindergarteners that were performing in the low handwriting group were still in the low group in first grade. Findings suggest that, without intervention, there is a high probability that these students will continue to demonstrate similar handwriting abilities and patterns. Furthermore, students who do not receive sufficient handwriting instruction, especially those at risk for poorly formed letters, continue to have to focus on how to form letters rather than constructing sentences and spelling words (Berninger et al., 2006; Graham et al. 1997; McCutchen, 2000) and this can be an academic obstacle as children progress into higher grade levels with increasing academic demands (Kandel, & Valdois, 2005; Marr & Cermak, 2002).

A study completed by Rodriguez and Villarroel (2016) analyzed the relationship between handwriting and spelling skills of 276 first grade (n=142) and third grade students (n=134). Results revealed a significant relationship between handwriting and spelling and were consistent with previous studies by Abbott et al. (2010) and Berninger et al. (1991). Spelling processes were found to significantly contribute to handwriting processes with spelling performance being a strong predictor of handwriting performance indicating a strong interdependence between the two skills. Overall, Students who were classified as good handwriters displayed better performance in all spelling and alphabet writing tasks as compared to students with poor handwriting. As aligned with Cognitive Load Theory, prediction was stronger for students in the first grade as compared to students in the third grade. Handwriting and spelling skills have not yet been
automated in Grade 1 therefore task performance demands a high level of
cognitive resources that will not be available to support the two processes working
in parallel. As the process of handwriting increases in automaticity for third grade
level students, cognitive competition is reduced (McCutchen, 2000). Implications
of this research support the need for handwriting instruction in elementary
education programs.

Many school districts provide reading instruction and assume that students
will develop handwriting skills along the way by simply being required to write
yet handwriting remains the primary tool of communication and knowledge
assessment in today’s world (Cahill, 2009; Saperstein, 2012). Handwriting can
impact more than one academic grade or subject (Fitzpatrick, Vander Hart, &
Cortesa, 2013; Jones & Christensen, 1999). Illegible handwriting can result in
difficulty with spelling, math, and any other subject that requires written work
(Harvey, & Henderson, 1997; Lifshitz & Har-Zvi, 2014).

**Handwriting and Literacy**

Literacy has been defined in many ways. The report on Adult Literacy in
America defines literacy as the use of printed and written information for the
acquisition and demonstration of knowledge (Kirsch, 1993). The National
Literacy Act of 1991, defined literacy as “an individual’s ability to read, write, and
speak in English and compute and solve problems at levels of proficiency
necessary to function on the job and in society, to achieve one’s goals, and to
develop one’s knowledge and potential” (U.S. Congress, 1991 p.1). According to
Miriam-Webster’s Online Dictionary (n.d.), literacy is defined as the ability to
read and write. Writing is the means by which individuals demonstrate their
knowledge on paper. While most of the research pertaining to literacy presents a
primary focus on reading, there is another, less studied but additionally important component that involves writing.

According to the U.S. Department of Education, National Institute of Literacy, 14% of the United States’ adult population or 31,000,000 are illiterate (National Center for Education Statistics (NCES, 2013)). In the state of California, 23% of adults or almost 7,000,000 are classified as illiterate (NCES, 2013). Locally, in Fresno County, 27% of adults or 162,000 are illiterate (NCES, 2013).

While these statistics describe the overall averages, marginalized groups such as African Americans demonstrate higher illiteracy rates (NCES, 2012).

As noted in the literature, national statistics reveal, 24% of African American adults and 44% of Hispanic adults are reported to be illiterate (NCES 2012). Forty-four percent of individuals living below the poverty line are described as illiterate with 75% of individuals who receive food stamps reported to score at the two lowest levels of literacy. Twenty-five percent of American children do not develop proficient literacy skills; two-thirds of those individuals will require public assistance or will be incarcerated at some point in their lifetime. Eighty-five percent of the juveniles who face trial in the juvenile court system are functionally illiterate. The highest population of illiterate adults can be found in the prison system, with 64% being identified as illiterate. These statistics reveal a relationship between illiteracy and crime. Everyone who is functionally illiterate may not struggle in life, however there are established relationships between marginalized groups, negative life outcomes such as poverty and incarceration with literacy (NCES 2012, 2013).

Reading and writing are different and require distinctly different skills, however, there is an established relationship between reading and handwriting skills (Steffani, & Selvester, 2009; Troia & Olinghouse, 2013). Graham and
Harris (2016), Beringer et al. (2006), and Richgels (1995) mutually asserted that the ability to write letters and words is intimately linked with reading abilities. Handwriting involves more than simple letter drawing or formation of simple letters and numbers; it is a complex task involving neurological components of memory, spatial awareness, visual perception and fine motor integration (Benbow et al., 1992; Case-Smith, 2005; Greer & Lockman, 1998). Handwriting proficiency requires more than rote practice for success (Marr, Windsor, & Cermak, 2001).

Writing is an important part of language development and literacy (National Association for the Education of Young Children (NAEYC), 2009). Children develop literacy skills through exposure to early reading and through writing and grasp the concept that handwriting is a tool for the creation of meaningful communication (Edwards, 2003; NAEYC, 1998). Printing letters provides children with kinesthetic feedback that, in turn, allows them to identify and differentiate letters as they read (Graham & Harris, 2005a; Marr et al., 2001). If a child is able to correctly and consistently print a particular letter, he or she will be more likely to recognize the letter during the process of reading and writing (James, 2012). He or she will then be better able to focus on the meaning and content of the subject matter instead of focusing on the identification or formation of the individual letters (Jones & Christensen, 1999; McCutchen, 1988; Peverley, 2012). In a comprehensive review of studies completed between 1999 and 2003 to identify effective instructional practices, Graham and Harris (2005) concluded that literacy and reading comprehension are major areas of concern for schools today, giving cause for focused teaching and noted that there is a substantial link between handwriting and written composition.
Handwriting is a learned skill/process and requires instruction for skill development and automaticity. Writing letters and words is interwoven and linked with students’ ability to read words (Berninger et al., 2006; Richgels, 1995). Reading and writing are similar but not identical cognitive processes; reading words is easier than selecting words and then writing them on paper (Fitzgerald & Shanahan, 2000). Reading is a heavily emphasized element of instruction in typical classrooms with handwriting falling to the periphery, often included as a curricular element however neglected in respect to warranting purposeful, dedicated instructional minutes (Denham, 2006; Graham et al., 2000; Graham & Harris, 2016).

A review of the research indicates that handwriting and reading are equal partners in the literacy process (Longcamp, Zerbato-Pou-dou, & Velay, 2005). Graham and MacArthur (2013) suggested increasing the amount of time spent on formal handwriting instruction and noted the benefits of handwriting instruction in support of reading development. The proposal of bringing handwriting instruction and practice into all academic subjects is based on neurological research linking the specific act of handwriting to letter recognition, letter orientation, and letter naming (James & Engelhardt, 2012; Longcamp, Boucard, Gilhodes, & Velay, 2006).

Clark and Luze (2014) conducted a quantitative study that examined the relationship between handwriting skills and performance in reading and writing tasks during the school year. Forty-eight kindergarten students from a Midwestern public school district were assessed using measures of fine motor skills, visual motor skills, and early literacy academic measures as assessed by the Basic Early Literacy Skills (DIBELS) assessment. The results indicated that there were strong significant correlations between measures of handwriting and measures of
academic achievement. This study highlighted the strong relationship between reading and handwriting skills in beginning readers and writers (Clarke & Luze, 2014; Graham et al., 1997). The significant positive correlations suggest that if students scored poorly on the writing measures, they tended to score poorly on the academic measures (Clark & Luze, 2014).

The literature includes several studies that link handwriting and spelling instruction with writing development. Studies by Graham et al. (2000) and Graham, Harris, and Fink-Chorzempa, (2002) found that development of content generation and sentence constructions are influenced by handwriting and spelling skills. Research demonstrates that a significant correlation exists between letter knowledge, spelling, and letter naming in 4- and 5-year old children (Sulzby, Barnhardt, & Hieshima, 1989; Bus et al., 2001). Letter naming is significantly related to handwriting letters and numbers (Molfese, Beswick, Molnar & Jacob-Vessels, 2006).

Both fluency and quality of composition are influenced by handwriting abilities (Graham et al., 2000; Graham et al., 2002). Research suggests that handwriting is central to the creation of imaginative, creative, and well-written text (Graham & Harris 2005b). Research supports the theory that direct instruction improves handwriting skills. In a study completed by Graham et al., (2000), 38 first-grade children with handwriting and writing difficulties participated in 27 sessions to improve the accuracy and fluency of their handwriting. Each session was designed around a 15-minute lesson plan. A control group received instruction in phonological awareness. The results of the study indicated that students in the handwriting condition made statistically significant gains in handwriting and compositional fluency when compared to the control group. Additionally, the results continued to demonstrate a significant
difference after 6 months (Graham et al., 2000). The effects of instruction were similar for students with and without an identified disability. These findings support the supposition that handwriting is related to writing. This research supports the use of explicit and supplemental handwriting instruction as an important element in improving students’ writing abilities in primary grades (Graham et al., 2000).

Research demonstrates a link between handwriting and literacy; while there is abundant research on the link between reading, phonemic awareness and literacy, there are far fewer studies on the relationship between writing and specific handwriting instruction practices as related to written literacy (Asher, 2006; Roberts et al., 2014). Teaching reading skills with explicit reading instruction is a common practice in school districts however it is assumed that handwriting will be acquired as a passive process within reading instruction or self-directed writing practice (Clark, 2010). Historically, research focused on handwriting has been sporadic and not well integrated into the educational arena with the focus of research having been on reading and language development or difficulties, not on handwriting (Berninger & Hooper, 1993). Additionally, much of the research has concentrated on specific populations such as struggling writers or specific aspects of handwriting skill acquisition and still requires a connected link to literacy as related to student achievement (James, 2010; Kaiser, Albaret, & Doudin, 2011). Student achievement is dependent upon command of foundational skills for literacy development- vocabulary, spelling, and printing that includes transcription and text generation (Biemiller, 2003; Berninger, 1999; Roessingh & Elgie, 2014).
Handwriting and Achievement

Research suggests that handwriting is closely linked to academic achievement, especially composition and literacy skills (Berninger et al., 2006; Clarke & Luze, 2014; Sheffield, 1996; Weintraub & Graham, 2000). The ability to generate compositional pieces and translate thoughts, ideas, and knowledge in a clear and concise manner is an essential skill that children must acquire in the early years of their educational experience (Berninger et al. 2009; Roessingh & Elgie, 2014; Persky, Daane, & Jin, 2003). Results of a series of studies carried out in Canada and in the United Kingdom have indicated that difficulties with handwriting in the early years might be used as a predictor of more general learning difficulties later on (Harvey & Henderson, 1997; McCarney et al., 2013; Simner, 1982, 1985, 1986, 1990).

The US education system uses a variety of curricula, materials, and opportunities to actively engage students in learning and facilitating the demonstration of knowledge. Writing is the primary method used for expression of that knowledge (Asher, 2006; Graham, 2000; Graham & Harris, 2005). Writing activities make up 85% of the classroom time spent engaged in fine motor tasks demonstrating learning (Marr, Cermak, Cohn, & Henderson, 2003; McHale & Cermak, 1992). While the importance of writing for demonstration of knowledge has been widely accepted by educators and utilized in daily classroom activities (Feder & Manjemer, 2007; Lust & Donica, 2011), the understanding of how writing supports academic achievement and growth is less understood or accepted by educators (Berninger et al., 2006; Christensen, 2005; Medwell & Wray, 2007). This lack of understanding as to the relationship between handwriting and academic achievement can lead educators to consider handwriting as a non-essential component of daily instruction (Graham, 1999; Lifshitz & Har-Zvi
2015). If educators do not realize the importance of handwriting and the link to academic achievement they may not realize that, like reading and math, handwriting takes direct instruction to teach effectively (Aram & Korat, 2009; Vander Hart et al. 2010; Morrison, Connor & Hindman, 2009; Shatil, Share, & Levin, 2000).

Findings from a study completed by Roessingh and Elgie (2014) suggest improved early literacy outcomes are realized with the provision of direct and explicit handwriting instruction in the early elementary years. Researchers examined expository writing prompt responses of 85 second grade students; the relationship of underlying skills (printing, spelling and vocabulary) and the influence of these skills on the quality of student compositions were analyzed. Handwriting skills were positively and significantly related to compositional writing quality. Results support other studies by Baker et al. (2003), Berninger et al. (2006) and Graham et al. (1997) demonstrating that handwriting is an important building block that requires mastery for proficiency with writing success. The development of foundational skills, including handwriting, is critical for literacy development that underpins all higher order thinking skills identified as essential for 21st century learning (Christensen, 2009; Pontart et al., 2013 Roessingh & Elgie, 2014).

In response to the narrow focus of NCLB, to address the need for improved critical thinking and more sophisticated higher order executive functioning, CCSS were introduced (Common Core State Standards Initiative, 2010). Common Core State Standards (CCSS) have broadened targeted assessment areas and included the addition of higher order questions in combination with the inclusion of assessments of student writing (Jones & Hall, 2013; Rajala, 2011; Troia & Olinghouse, 2013). As a result of the adoption of the CCSS and other state
standards, the emphasis and expectations placed on classroom note-taking and expository writing in grades K–5 are greater than ever (Berninger, 2012; Saperstein, 2012). Several states including California and Utah have realized the benefit and link between handwriting and academic achievement and have added handwriting standards, although vague and imprecise, into required grade level instruction (Troia & Olinghouse, 2013).

Handwriting matters immensely in written communication (Asher, 2006; Sheffield, 1996). Despite the fact that computer use has become commonplace in elementary schools, paper and pencil writing continues to be the primary mode by which children provide information, share knowledge, convey messages, and demonstrate their competency in all areas of academia (Bushman, 1991). As a result, students receive grades based on their abilities to produce written output (Berninger et al., 2006; Clark & Luze, 2014; Graham et al., 2008). Research indicates that the papers with better handwriting received better grades (Briggs, 1980; Markham, 1976; Sloan & McGinnins, 1982). Additionally, research suggests that handwriting is a predictive factor in determining the length and quality of compositions (Baker et al., 2003). It is essential for handwriting to become relatively automatic and efficient to promote writing development and minimize the effort required for the process of handwriting production (Graham et al., 2008).

Research suggests that handwriting is more tied to academic achievement than many educators may realize (Berninger et al., 2006; Christensen, 2005; Medwell & Wray, 2007). Students with poor handwriting are at risk for academic difficulties (Baker et al., 2003; Berninger et al., 1997; Graham, 1999). As students use handwriting across subject areas to demonstrate competencies and learning and because they are evaluated based on their written output throughout their
academic career (Hammerschmidt, & Sudsawad, 2004) it is imperative that educators have knowledge and proficiency with handwriting instruction to support students in scholastic development. (Pontart et al., 2013; Roessingh & Elgie, 2014; Santangelo & Graham, 2016).

The Role of Handwriting Instruction

Students are frequently required to complete essay exams and in class writing assignments. It is important for teachers to understand the basic foundations of the writing process if they are to properly instruct children, especially when a child struggles with the writing (Cahill, 2009; Zubrzycki, 2012; Olsen, 2005; Ste-Marie et al., 2004). Writing across the curriculum, inclusive writing strategies, and writing intensive programs are being implemented at universities and colleges across the country (Boice, 1990; Dossin, 1997; Kennedy, 2002). Instructors of all disciplines have used these types of curricula as general instructional tools to require and encourage increased amounts of in-class writing and count that writing as a substantial portion of a student’s grade without addressing handwriting with formal instructional processes (Graham, 1999; Lifshitz & Har-Zvi, 2015). Experimental studies reveal that teaching handwriting to primary grade children can have a positive impact on handwriting and written expression (Berninger et al., 1997; Graham et al., 2000; Jones & Christensen, 1999). The use of explicit handwriting instruction supports the development of transcription and text generation skills necessary for the production of letters, words, and sentences (Kent et al., 2014).

Handwriting is a skill that requires explicit teaching for proficient skill development (Benbow et al., 1992; Bowen, 2003; Case-Smith, 2005). Although children spend a large amount of time engaged in writing and fine motor activities within the classroom (McHale & Cermak, 1992), Graham and Harris (2005b)
revealed that students who received direct handwriting instruction outperformed control group counter-parts in both handwriting and writing skills. Students who received direct handwriting instruction demonstrated better ability to recognize and name letters (alphabet knowledge) as well as superior ability to write letters of the alphabet and the student skills were sustained over a 6-month period (Graham & Harris, 2005b).

Christensen (2005) demonstrated that students enrolled in a formalized handwriting instruction program showed significant improvement in composing skills. Christensen’s study analyzed the orthographic-motor integration abilities of 114 7-year old children who participated in an eight-week handwriting instruction program. The analysis of orthographic-motor integration abilities for reading and writing and found significant improvements for students who received explicit and formalized handwriting instruction as compared to children who were not receiving the formalized handwriting instruction (Christensen, 2005; Medwell & Wray, 2007).

In order to write and spell correctly, students must learn letter names and sounds (phonemes) (Fitzgerald & Shanahan, 2000). Kindergarten students produced higher level of writing when they possessed more proficient understanding of correspondence between letter sounds and names (Cain, 2007). A study of 48-kindergarten students completed by Clark and Luze (2015) found a positive relationship between reading, writing, and visual-motor and fine-motor skills. Results showed that there were significant correlations between writing scores (e.g., letters and name writing) and Dynamic Indicators of Basic Early Literacy Skills (DIBELS) reading scores. Findings suggest that the ability to accurately write letters of the alphabet was significantly correlated to mid-year academic performance. Implications suggest that early, explicit instruction with
handwriting may have a beneficial effect on early reading (e.g., phonological awareness, alphabetic principle) and is consistent with studies by Graham et al. (2000, 2002) demonstrating the benefits of formalized handwriting and spelling instruction for children who were experiencing difficulty with reading skills, sentence construction, and writing output.

The National Association for the Education of Young Children (NAEYC) is the largest organization dedicated to improving education and quality education for children birth through age eight. The NAEYC asserts that one of the superlative predictors of future academic and occupational success is the level of competency realized in reading and writing. According to NAEYC (2009), a solid foundation for handwriting supports work production in the classroom. Handwriting skills are demonstrated to positively impact foundational skills (e.g. transcription and text generation), grades and predict success in other subjects (Berninger et al., 2006; Graham & Harris, 2016).

Today’s educational system demands proficiency with academic skills (Dombek & Al Otaiba, 2016; Kent et al., 2014). Teachers are expected to teach with an integrated approach that incorporates multiple elements of curriculum to provide students with appropriate depth of knowledge to demonstrate academic proficiency (Kena, 2015) and possess a skill set of information, knowledge, and understanding to be college and career ready (Santangelo & Graham, 2016). Literacy development and capacity are critical and foundational to gaining the 21st century skills needed to be competent, globally competitive, and to meet the demands of daily life (Common Core State Standards Initiative, 2010; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010).
It is evident that curricula are crowded and it is difficult to add additional instructional time (Graham et al., 1992). Denham (2006) revealed that teachers believed that they were doing what they could and what they knew. Denham (2006) further asserted that if teachers truly understood the value of handwriting, felt knowledgeable in teaching the concepts of handwriting, and felt prepared to teach handwriting in meaningful curriculum embedded context, they would realize the value and understand that the instruction would be worthy of instructional time and attention. The research of Graham et al. (1992), Denham (2006), Kolb (2015) and others substantiates the need for improved teacher education and training in regard to handwriting, clearer and more defined policies for the instruction, assessment, and remediation approaches for handwriting, in addition to the need for more involvement from professionals who specialize in handwriting (Jones & Hall, 2013).

**Preparation to Teach Handwriting**

Add-on elements have been included with CCSS to incorporate handwriting standards by some states such as California and Utah (Jones & Hall, 2013), however a continued skill deficit exists with teacher preparation and many teachers have not been specifically trained on handwriting or handwriting instruction (Graham et al. 2008). Bowen (2003) conducted a survey of 200 primary school teachers regarding their professional knowledge about handwriting instruction. Results of the study indicated that 90% of the teachers felt they were not prepared to teach handwriting due to lack of instructional knowledge, competency, and training.

Studies examining handwriting instruction and efficacy of teaching handwriting reveal significant gains in various aspects of handwriting for individuals receiving intervention. Handwriting instruction significantly improves
legibility (Kiss, 2007; Pfeiffer, Rai, Murray, & Brusilovskiy, 2015), letter formation (Marr & Dimeo, 2006), writing speed and fluency (Case-Smith et al., 2011; Case-Smith, Holland, Lane, & White, 2012), letter alignment, size, and spacing (Mackay, McCluskey, & Meyers, 2010). Despite the available body of research, teachers lack professional preparation and may not fully understand the positive impact that handwriting instruction can have on the development of literacy skills and on academic achievement (Berninger, 2012). Few teachers feel that they possess adequate knowledge regarding specific handwriting foundations and many believe that they lack adequate training in order to effectively teach handwriting (Olsen, 2005).

Teachers are not adequately trained to teach handwriting (Dyer, 1992; Troia & Graham, 2003; Olsen, 2005). Donica et al. (2012) found that 65% of the teacher respondents reported never having received any formal handwriting instruction and 95% asserted that preparation for handwriting instruction would be beneficial and should be included in teacher preparation programs. Donica et al. (2012) revealed the need for teacher preparation to teach and address handwriting for students. Tradition, rather than research findings, has served as the basis for the approach of handwriting instruction and for remediation practices to address illegible handwriting in the classroom (Peck et al., 1980). Handwriting instruction is an area that is largely ignored by teacher education programs, curriculum guidelines, and school policy (Dyer, 1992; Graham et al., 2008; Olsen, 2005). As a result, teachers frequently report feeling ill-equipped to teach handwriting (Bowen, 2003) and unprepared to assist students who are struggling with handwriting (Olsen, 2005) resulting in ineffective handwriting instructional practices within the classroom.
Without preparation, teachers frequently do not know what to do with struggling writers. Graham et al. (2008) noted that only 12% of first thru third grade teachers surveyed indicated receiving college-level courses that prepared them for effective handwriting instruction and that 88% of elementary school (first, second, and third grade) teachers were not adequately prepared to teach handwriting. Teachers who are not prepared to teach handwriting will lack the knowledge, skills, and strategies to assist children who struggle with handwriting. This instructional deficit is compounded by the fact that many teachers have never received adequate instruction in handwriting when they were in school (Bowen, 2003).

Deficiency of knowledge and training has been shown to have a negative impact on effective implementation of handwriting instruction (Bowen, 2003; Troia & Graham, 2003). This was supported by findings from a study completed by Denham in 2006. Denham surveyed 315 teachers and administrators at 15 elementary schools in the state of Alabama. Nearly half of teachers and administrators reported no formal training to teach handwriting. The majority of respondents reported beliefs that illegible handwriting impacts academic success and other areas of life. Additionally, the majority of respondents recognized that there is no formal system to address the issue of poor handwriting. Ninety-three percent of respondents reported never using a formalized handwriting curriculum for instruction and 30% reported using no textbook for handwriting instruction or practice. As a result, current research is limited on the overall effectiveness of curriculum embedded handwriting instruction and slight on the impact of classroom embedded handwriting instructional practices as related to learning outcomes.
The results of Denham’s (2006) study support the assertion that teachers do not feel prepared to teach handwriting and do not have a formalized curriculum for explicit teaching of handwriting. Teacher training programs typically do not include or address the subject of handwriting and pre-handwriting skills (Dyer, 1992). Colleges of education seldom teach the methodology of handwriting instruction (Bowen, 2003; Dyer, 1992; Gerszberg, 2003; Olsen, 2005). As a result, teachers’ knowledge of handwriting development is often incomplete and lacking (Graham et al., 1998) leaving teachers feeling unprepared to teach handwriting as a separate skill and untrained for dealing with children who struggle with handwriting. Teachers may be tempted to disregard formalized handwriting instruction altogether based on a belief that children will eventually learn the skill as they are exposed to writing activities (Troia & Graham, 2003).

Direct, explicit instruction of handwriting is believed to be important by teachers of primary-grade level students (Denham, 2006; Graham & Harris, 2005; Kolb, 2015). Graham and Harris (2005a) completed a study including a survey of 153 teachers regarding handwriting instruction and found that 70% of general education teachers responded that direct handwriting instruction was important, 80% of teachers surveyed indicated that they had minimal to no preparation or training in how to teach handwriting. As a result, many teachers indicated they omit explicit handwriting instruction from daily instructional practice (Graham & Harris, 2005a).

Competency with handwriting has been linked to external factors that include the type of instructional procedures and the material used during the instructional process (Marr et al., 2001). Teachers who value and understand the handwriting process actively teach handwriting and are shown to teach more effectively with more time spent on handwriting than those less familiar with the
process (Galloway, 2002). As a result, students of teachers who know how to and
do explicitly teach handwriting processes have better handwriting. Unfortunately,
as a whole, teachers are unprepared to teach handwriting and even less prepared to
address handwriting difficulties (Graham et al., 1998).

Teachers demonstrated a willingness to embrace the allotment of separate
classroom time specifically focused on handwriting instruction if they received
training, had support from administrators, and were provided with appropriate
instructional curricula and materials (Denham, 2006; Graham et al. 2008). To
address the identified gap between deficient teacher preparedness and perceived
importance, professional development programs and supplementary formal
preparation should be incorporated into teacher education programs (Graham et al.
2008). To develop automaticity and fluency with handwriting skills, it is
recommended that explicit instruction for the subject of handwriting is
incorporated into regular class schedules and avoids the use of menial penmanship
drills (Asher, 2006; Ste-Marie et al., 2004).

**Teaching Student Self-Assessment of Handwriting**

Use of effective feedback facilitates self-awareness and supports the
development of self-assessment (Hattie, 2012). Teaching students to evaluate
their own handwriting is an underemphasized element in handwriting instruction
and is one of many methods of handwriting assessment (Graham et al., 2000;
Lifshitz & Har-Zvi, 2015). Bruinsma and Nieuwenhuis (1991) completed a study
examining aspects of student self-assessment of their own handwriting. Students
were asked to evaluate their handwriting according to five defined criteria: slant,
size, space, shape, and general look. Fifty-one percent of the students were not
satisfied with specific aspects of their handwriting, though the general look was
scored as globally legible according to handwriting evaluation scores. The
researchers emphasized the importance of the student’s self-awareness of his/her handwriting as a basis for quality improvement. Results revealed that the use of feedback and self-evaluation is an element that should be included into handwriting instruction programs and is an area for further development and research.

Once a child establishes the perception of letter formation, through appropriate sensory input, he or she is more likely to succeed at paper and pencil tasks (Dyer, 1992). Objective criteria are needed to teach children to successfully document, evaluate, and correct their own handwriting with use of defined elements and scales (Moxley et al., 1990; Olsen, 2005). Even at the initial stages of writing acquisition, self-assessment encourages students to become aware of changes and facilitates improvement in their handwriting (Harris & Graham, 1992).

Students can be effective evaluators of their own handwriting (Stowitschek et al., 1987). An emphasis should be placed on self-assessment with responsibility being placed on the student writer for evaluation of his/her own written product (Bruinsma & Nieuwenhuis, 1991). Supplemental handwriting with appropriate feedback has proven to be a critical factor and should be included as a component of handwriting instructional programs; feedback and self-assessment are beneficial to improving handwriting and preventing long-term writing difficulties (Graham et al., 2000).

**Handwriting Programs**

Several handwriting programs and curricula are available; instructional practices, curriculum use, and teaching approaches are varied. Research regarding the effectiveness and efficacy of various handwriting programs as well as instructional practices is available but is limited and inconsistent. Most research
investigating the effectiveness of direct handwriting instruction reveals benefits and demonstrates overall effectiveness for intervention groups (Graham & Harris, 2005; Jones & Christensen, 1999; Pfeiffer et al., 2015).

Pfeiffer et al. (2015) utilized the Size Matters Handwriting Program (SMHP) embedded within the curriculum to investigate changes in legibility for elementary school children in New York and Massachusetts. The Size Matters Handwriting Program uses principles of motor learning with a child-centered approach and explicit instructions. Researchers used a two-group pre-test/post-test design with half of the students receiving SMHP instruction and half receiving typical classroom instruction. A total of 207 kindergarten, first- and second-grade students from two elementary schools (one in New York, one in Massachusetts) participated. Teachers implemented the SMHP in one 20-minute lesson during the regular instructional day, 5 days per week for a total of 40 sessions. Findings demonstrated significant changes in legibility for all grade levels receiving SMHP instruction; specific improvements were noted in letter formation, alignment, and size qualities as compared to the standard instruction group (Pfeiffer et al., 2015).

Roberts et al. (2014) analyzed the effectiveness of Handwriting Without Tears (HWT) handwriting program on handwriting skills as compared to teacher-designed handwriting instruction for first grade students. Researchers used a quasi-experimental study with a crossover design using repeated measures to evaluate changes in handwriting quality and speed over time. Additionally, the study incorporated teacher and students perceptions that were measured with rating scales, repeated over time for detecting changes as a result of HWT implementation. HWT was implemented 20 minutes daily for a period of 9 weeks. Findings noted that the students who received HWT instruction demonstrated significant improvements in overall quality of handwriting as
compared to teacher-designed instruction. Specific aspects of handwriting including legibility, form, size, alignment, size and spacing as measured by the Minnesota Handwriting Assessment (MHA) were noted to improve significantly. All students demonstrated improvement with HWT intervention.

Of specific interest was the noted improvement in the group of students initially falling in the lower 25% of the group. Higher average changes in MHA total test scores (TTS) were observed in the HWT instruction group as compared with the teacher designed instruction group; results were statistically significant for the second half of the school year. Post-test data revealed students from the lowest performing group achieved TTS close to the same TTS scores as the initially higher achieving group. Students from the lower performing group in handwriting skills benefitted from explicit, regular handwriting instruction using HWT (Roberts et al., 2014).

The recent findings from the studies completed by Roberts et al. (2014) and Pfeiffer et al. (2015) align with findings of other studies investigating the effectiveness of explicit handwriting instruction (Berninger et al., 1997; Denton et al., 2006; Graham et al., 2000; Jones & Christensen, 1999; Jongmans, Linthorst-Bakker, Westenberg, & Smits-Engelsman, 2003; Lockhart & Law, 1994). This research supports the use of curricular embedded handwriting instruction and sets the stage for linking handwriting instructional practices to learning outcomes. Improvement in handwriting as a result of curricular-embedded instruction may have implications for learning outcomes and performance in specific skill areas of handwriting, composition, and other areas of academics.

**Neurological Processes and Writing**

Handwriting is a skill that involves the coordination of many complex neurological processes involving sensory, motor, and cognition (Berninger et al.,
Brain research has contributed to an increased understanding of handwriting, processes, and mechanisms and assists with the identification of links to facets of literacy while appreciating the complexity of the process. Memory, recall, phonological awareness, and other aspects of literacy are linked to the physical aspects of handwriting (Gimenez et al., 2014; James, 2010; James & Engelhardt, 2012; Longcamp et al., 2014).

Students use handwriting as the primary method for communicating information, recording ideas, expressing knowledge, and generating evidence of learning in the classroom (Erhardt & Meade, 2005). Handwriting involves multiple systems and is not solely a motor act (Berninger & Richards, 2002); it is a complex skill requiring integration of perceptual, motor, proprioceptive, kinesthetic, orthographic, and cognitive elements (James & Engelhardt, 2012; Planton, Jucla, Roux, & Démonet, 2013). Given the complex integration demanded by the act of handwriting to produce written output, handwriting requires more synchronization than any other school-based task (Levine, Oberklaid, & Meltzer, 1981).

Motor Aspects

The act of printing letters recruits and coordinates a greater number of brain regions that are known to be involved with reading and letter processing as compared to other actions such as typing, tracing, or visually observing letters (Kersey & James, 2013). A study by James and Engelhardt (2012) sought to identify the specific type (if any) of motor experience required to best generate a writing-perception network in children. Investigators utilized functional Magnetic Resonance Imaging (fMRI) to analyze brain activation regions and patterns of 15 preliterate children between age 4 years, 2 months and 5 years, 0 months as they
engaged in printing, typing, or tracing a presented letter or shape. Findings revealed that the specific motor act of printing letters significantly impacted visual processing of letters. James and Engelhardt (2012) suggested that printing letters serves as a gateway to learning attributes and important characteristics of symbols that are necessary for identification and categorization of letters. The finding that letter perception is facilitated by engagement in handwriting processes (Longcamp et al., 2006) and handwriting practice experiences is vital for letter processing in the brain further supports the position that handwriting should have a solid presence within educational instructional practices for children (Longcamp et al., 2005, 2014; James, 2010; James & Engelhardt, 2012).

Neurologically, the handwriting process involves the graphomotor channel but also depends on recruitment and activation of association (cortices) areas of the brain (James & Engelhardt, 2012; Planton et al., 2013; Zafirah Binti Kosnan, Mat Safri, & Khalid, 2015). The collaborative recruitment and synchronous use of multiple, specific brain regions is required to create and construct precise representations of letterforms for commitment to and retrieval from memory. Planning and producing letters necessitates precise and complete visual motor programs with sequentially ordered component strokes (Hashim et al., 2014). These programs must be created and stored for retrieval as needed. Conscious retrieval of letter forms requires activation of explicit memory in conjunction with orthographic coding and accessing orthographic representations in the process of handwriting for generating written output (Berninger & Richards, 2002).

**Spatial Awareness**

Writing requires specific attention to letter size and position that are production elements of greater importance in comparison to reading or keyboarding (Parush et al., 2010; Weintraub, Gilmour-Grill, & Weiss 2010).
Requirements for visual spatial analysis are more complex for letter production involving perceptual awareness for orientation, motor control for online positioning and understanding relationships for correct production of letterforms with correct size and position in relation to one another (Longcamp et al., 2006).

A study completed by Rosenblum et al. (2003) revealed that the primary distinguishing factor among poor writers was the increased number of spatial errors that were made and the apparent failure to make accommodations for the spatial accuracy constraints of the experimental handwriting tasks thus, implying that poor movement control among the study group of poor handwriters was largely the result of deficiencies in spatial accuracy. Results of the study by Rosenblum et al. (2003) confirm findings of subsequent research that asserts the importance of spatial accuracy. Errors with spatial accuracy characterize poor handwriting is an identified area of difficulty impacting children who struggle with writing with controlling spatial accuracy (Bo et al., 2014).

Separate instruction in reading and handwriting is supported in neurologically related literature (Donica et al., 2013; Glazer & Burke, 1994; Stellakis & Kondyli, 2004). Learning to read letters is a different process and involves different neurological pathways from learning to write letters. Abbott and Berninger (1993) note the neurological separation of handwriting, spelling, and composition; the demands of size and orientation are different for production as compared to perception. The researchers found handwriting to be more directly linked to orthographic coding than fine motor as demonstrated with findings of brain processing as measured by Functional Magnetic Resonance Imaging (fMRI) studies (Graham & Harris, 2010). Handwriting is a learned skill/process and requires instruction for skill development and automaticity. The literature
establishes a strong link between handwriting automaticity and composition (Medwell, Strand, & Wray, 2009).

**Automaticity**

Automaticity of letter production, a neurological aspect of handwriting, has been found to be most strongly predictive of composition success. A study in the UK, completed by Medwell, Strand, and Wray (2009), examined the relationship between handwriting and composition skills of 198 Y6 (equivalent to U.S. first grade) English children. The study revealed that handwriting automaticity was a critical element in composition. Researchers specifically measured handwriting speed and orthographic motor integration in relation to composition ability of the children. Test scores for composition (excluding spelling and handwriting) in relation to the Alphabet Task, a measure of handwriting (speed and Orthographic motor integration), were utilized. The results from the study sample of English Y6 children demonstrated a high proportion of the variance in composition was related to handwriting automaticity (the ability to generate letters automatically). Findings support the suggestion that handwriting is a language act and that orthographic-motor integration (automatic letter production) is more significantly related to composition than speed or neatness. These outcomes strengthen the argument that automaticity of letter production is not only a different measure from speed but is essential for success with developing composition competency (Medwell et al., 2009).

When handwriting is not automatic, it increases the demand on other skill areas, such as memory (Gathercole, Pickering, Knight, & Stegmann, 2004; James & Gauthier, 2009; Rosenblum et al., 2003). Children who labor with the act of letter recall and formations tend to write slowly and, as a result, may forget ideas held in memory, or simply run out of time before they are able to put them on
paper (Medwell & Wray, 2014). As a result, these children can have difficulty mastering higher-level cognitive activities such as idea generation, spelling and vocabulary use, editing, and revising (Berninger et al., 2002; Berninger & Amtmann, 2004). In fact, some studies have suggested that children who experience difficulty with handwriting in the early years are more likely to experience general learning difficulties in later years (Graham et al., 1997; Harvey & Henderson, 1997; Simner, 1982). The reason for this connection is unclear although it is proposed that working memory plays a role (Medwell et al., 2009; Medwell & Wray, 2008). There is question as to whether the learning difficulties occur as a result of the poor handwriting or whether the poor handwriting is a symptom of a learning disability (Berninger et al., 2006; Jones & Christensen, 1999). No matter the origin, writing problems and future problems associated with writing problems are more likely to be prevented if remediation occurs early in development (Berninger & Hooper, 1993).

Handwriting is an effortful activity, requiring conscious attention for letter and number formation for Beginning writers (Berninger, 1999; Graham, 1999) however, handwriting is an automatic task requiring little conscious attention or effort with maturity for adults (Willingham, 1998). Proficiency of handwriting is reflected in the ability to produce legible text with minimum effort; this is increasingly important as written assignments become longer and more frequent (Rosenblum et al., 2003). Automaticity of handwriting processes is required to ensure that the creative thinking process is not limited by the act and process of text generation (Scardamalia, Bereiter, & Goleman, 1982).

Difficulty in the mastery of the mechanical aspects of handwriting may strain working memory and interfere with higher order processes required for the composition of text (Berninger & Graham, 1998). Some authors have proposed
that the act of handwriting among children with difficulties can interfere with the simultaneous execution of composition (Gathercole et al., 2004; Graham, 1990; Medwell & Wray, 2008; Scardamalia et al., 1982). It may be that when letter production is not fully automatic, the act of handwriting makes increased demands on memory and attentional resources, which, crowds out and constrains the higher level cognitive processes required for composition (Berninger & Graham, 1998; Jones & Christensen, 1999). Additionally, some suggest that if handwriting is very slow, children may forget the ideas and plans held in memory before they succeed in transferring them to paper and can cause great frustration to further challenge the process (Graham & Weintraub, 1996).

**Orthographic-motor Integration**

Jones and Christensen (1999) investigated the relationship between handwriting and the ability to generate written text. Reading, orthographic-motor integration (writing speed and accuracy), and written expression were assessed for 114, Australian, year 2 students. Findings revealed the correlation between handwriting and written expression was .73. Results suggest that more than half (53%) of the variance in written expression scores was accounted for by orthographic-motor integration (speed and accuracy in writing letters) when controlling for reading abilities.

A second portion of the study completed by Jones and Christensen (1999) included 38 Grade 1 (year 2 of schooling) students and examined the impact of an intervention designed to enhance students' orthographic-motor integration skills. Half \( n=19 \) of the 38 students were identified with orthographic integration difficulties and half \( n=19 \) students served as the control group without presenting evidence of handwriting difficulties. Prior to the intervention, the control group was significantly superior as compared to the intervention group.
Students identified with orthographic integration difficulties received 7 months of intervention consisting of direct teaching of efficient letter formations and activities for promoting speed and accuracy of writing letters (orthographic-motor integration). Following the 7 months of instruction, there was no measureable discrepancy between the two groups and the differences between the groups had disappeared. From this study, not only can one infer that difficulty with handwriting is responsive to instructional intervention but additionally suggests that improvements in handwriting can generate similar improvements in written expression (Graham et al., 2012; Wallen, Duff, Goyen, & Froude, 2013).

Handwriting is a complex skill that involves the seamless integration of many elements for efficiency and proficiency. Handwriting is a complex human activity that entails an intricate blend of cognitive, kinesthetic, and perceptual-motor components (Bonny, 1992; Reisman, 1993). To produce written text a student must initiate and execute simultaneously a number of motor and cognitive tasks including ideation, planning, text production, spelling, punctuation, grammar, self-monitoring, evaluation, and orthographic-motor integration (Berninger, 1994; Hooper et al., 1993; Jones & Christensen, 1999).

Summary

The literature reviewed indicates that explicit handwriting instruction incorporated into daily instructional practices has a positive impact on elements of writing and therefore will improve qualitative writing outcomes, literacy rates, and ultimately, academic achievement (Asher, 2006; Baker et al., 2003; Berninger et al., 2006; Case-Smith et al., 2012; Coker, 2013; Donica et al., 2013; Graham et al., 2000; Graham & Harris 2005a; Santangelo & Graham, 2016; Pfeiffer et al., 2015; Roberts et al., 2014; Troia & Graham, 2015). Teachers view handwriting instruction as an important component of educational curriculum however the
majority of teachers do not feel adequately trained to effectively teach handwriting to children (Bowen, 2003; Denham, 2006; Donica et al., 2012; Graham et al., 2008). As a result, explicit, formalized handwriting instruction is often an omitted component of the curriculum and lacks designated instructional time in the educational day (Berninger et al., 2002; Graham & Harris, 2005a; Troia & Graham, 2003). Neurological research links the motor act of handwriting with brain development linked to academic skill areas (James, 2012; James & Engelhardt, 2012). When children have patterns of automaticity with the act of handwriting, brain resources are reserved for higher-level cognitive processes (Berninger & Amtmann, 2004; Connelly et al., 2006; Gathercole et al., 2004; McCutchen, 1996; Medwell & Wray, 2008; Medwell & Wray, 2014). Studies demonstrate that children who are successful with the act of handwriting are able to write faster and with better quality as compared to peers who struggle with handwriting skills (Berninger, 2012; Berninger et al., 1997; Graham et al., 1997; Jones & Christensen, 1999; Puranik & Al Otaiba, 2012).

The review of the literature, suggests that implementation of explicit handwriting instruction will positively impact literacy rates (Berninger et al., 2006; Case-Smith et al., 2011; Denton et al., 2006; Kaiser et al., 2011; Mackay et al., 2010). When handwriting is incorporated into educational practices and children are successful with handwriting, they will be able to demonstrate their knowledge (Graham & Harris, 2005a; Medwell & Wray, 2014) and will be motivated to write more content with greater efficiency with a positive result on social-emotional status (Lockhart & Law, 1994; Ritchey, Coker Jr, & Jackson, 2015). The literature supports that premise that classroom embedded use of a curriculum specifically designed for direct handwriting instruction positively impacts the underpinnings of student academic achievement and may result in
improved performance and learning outcomes for students (Graham et al., 1997; Pfeiffer et al., 2015; Roessingh, & Elgie, 2014).
CHAPTER 3: METHODOLOGY

This chapter details the methodology used in this study including the purpose of the study, context of the study, research design, the research question(s), the sample population, the instrument design, data collection, data analysis, and summary.

With the evolving curricular focus on literacy, handwriting instruction is being pushed aside and becoming an afterthought, gradually losing attention or instructional time in today’s classrooms (Kent et al., 2012; Mehta et al., 2005; Puranik et al., 2014). Handwriting is a foundational skill that influences academic performance (Graham et al., 1997; Jones & Christensen, 1999; Juel, 1988; Saperstein, 2012). Although the literature suggests a link between handwriting instruction and learning outcomes, very little research exists that empirically examines the effect of classroom embedded handwriting instructional curricula on specific student learning outcomes (Graham et al., 2000; Pfeiffer et al., 2015; Puranik & Al Otaiba, 2012; Roberts et al., 2014).

**Purpose of the Study**

The primary purpose of this study was to investigate the effectiveness of handwriting instruction on students’ handwriting ability, written literacy, and to address the identified gap in the literature linking handwriting instruction with student achievement by analyzing the effects of the Handwriting Without Tears (HWT) curriculum on handwriting skills, transcription skills, legibility, writing fluency, and elements of literacy including reading, phonics, written literacy, spelling, and vocabulary.

The dependent variables within this study included measures of handwriting skills, literacy, written literacy, spelling, reading, and teacher
perceptions. The independent variable of this study was HWT instruction with two groups: Students who received HWT instruction and students who did not receive HWT instruction. Additional independent variables incorporated to address the research questions included district of attendance: District A or District B and grade level: kindergarten or first grade.

Additionally, this study sought to explore teachers’ perceptions regarding the importance of handwriting instruction and students’ handwriting ability on student learning outcomes and achievement.

**Context of the Study**

A comprehensive review of the literature, presented in Chapter 2 provided strong support for the idea that supplemental handwriting instruction is positively related to a student’s writing ability (Berninger et al., 1997; Graham et al., 2000; Jones & Christensen, 1999).

Studies have supported the effectiveness of both classroom based and pull out handwriting instructional practices on aspects of handwriting quality such as letter formation, size, spacing, and alignment (Berninger et al., 1997, 2006, Case-Smith et al., 2011, 2012; Marr & Dimeo, 2006; Mackay et al., 2010; Pfeiffer et al., 2015; Roberts et al., 2014; Schneck, Shasby, Myers, & DePoy Smith, 2012).

The literature also revealed that the understanding of how writing supports or impacts student academic achievement is less researched, less understood, and less accepted by educators (Berninger et al., 2006; Christensen, 2005; Medwell & Wray, 2007). This lack of understanding as to the relationship between handwriting and academic achievement can lead educators to consider handwriting as a non-essential component of daily instruction (Graham, 1999; Lifshitz & Har-Zvi, 2014). The literature also supports the idea that when teacher perceptions demonstrate value with the importance of teaching handwriting
(Denham, 2006), it is likely that there will be a positive impact on a student's' writing ability and foundational literacy skills (Donica et al., 2012; Graham et al., 2008; Hammerschmidt & Sudsawad, 2004).

Research has suggested that when handwriting instruction is incorporated into educational practices, students writing abilities are increased, allowing them to more effectively demonstrate their academic knowledge (Asher, 2006; Berninger & Amtmann, 2004; Jones & Christensen, 1999).

**Research Questions**

Based on the review of the existing literature, mixed methods design was used for this study. The quantitative research questions focused on the evaluation of the HWT curriculum in a quasi-experimental, pre/post-test format focused on student performance outcomes, comparing those students who received HWT instruction to those students who did not receive HWT instruction. Research question 4 was developed as an exploratory question as District fidelity to implementation was different. The qualitative research questioned focused on how teacher perceptions of handwriting instruction impacts areas of writing and academic achievement.

The following four quantitative research questions and one qualitative research question were developed for this study and are directly related to the current literature and the identified gaps in the existing body of knowledge.

1. Is there a significant difference on Writing Prompt Scores (TNW, WSC, NIE) between students who received HWT instruction and students who did not receive HWT instruction?

2. Is there a significant difference in improvement between handwriting legibility scores of students who received HWT instruction and students who did not receive HWT instruction?
3. Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and students who did not receive HWT instruction when controlling for writing fluency?

4. Is there a significant difference in improvement on the Screener of Handwriting Proficiency (SHP) scores of students who received HWT instruction between District A and District B?

5. How do teacher perceptions influence handwriting instruction in the classroom?

Table 1 provides a summary for each of the developed research questions, identifying the independent variable, dependent variable, level of data, and statistical analysis used.

**Research Design**

A mixed methods approach was used to answer the research questions. A quasi-experimental design was used to address research questions 1 through 4. Subjects for this study were kindergarten and first grade students from four public schools in two school Districts located in the Central Valley of California. Quantitative data on handwriting performance and change in handwriting performance over time were collected from the Screener of Handwriting Proficiency scores. Student outcome data were collected from district DIBELS assessments. A survey was used to gather qualitative data relating to teacher perceptions about importance of handwriting and instruction and how it relates to academic achievement. A quantitative data analysis was used to address questions 1 through 4. Qualitative analysis using grounded theory was used to analyze teacher responses on the teacher perceptions survey for answering question 5.
<table>
<thead>
<tr>
<th>Research Question</th>
<th>Independent Variable</th>
<th>Dependent Variable</th>
<th>Data Level</th>
<th>Statistic Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is there a significant difference on Writing Prompt Scores (TNW, WSC, NIE) between students who received HWT instruction and students who did not receive HWT instruction?</td>
<td>HWT Instruction:</td>
<td>Student Outcome Data:</td>
<td>Student</td>
<td>Factorial MANOVA</td>
</tr>
<tr>
<td></td>
<td>Students receiving HWT</td>
<td>Writing Prompt Scores –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students not receiving HWT</td>
<td>TNW, WSC, NIE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Is there a significant difference in improvement between handwriting legibility scores of students who received HWT instruction and those who did not receive HWT instruction?</td>
<td>HWT Instruction:</td>
<td>Student Outcome Data:</td>
<td>Student</td>
<td>Repeated Measures</td>
</tr>
<tr>
<td></td>
<td>Students receiving HWT</td>
<td>Screener of Handwriting</td>
<td></td>
<td>Factorial ANOVA</td>
</tr>
<tr>
<td></td>
<td>Students not receiving HWT</td>
<td>Proficiency scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and those who did not receive HWT instruction when controlling for writing fluency?</td>
<td>HWT Instruction:</td>
<td>Student Outcome Data:</td>
<td>Student</td>
<td>Factorial MANCOVA</td>
</tr>
<tr>
<td></td>
<td>Students receiving HWT</td>
<td>DIBELS scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students not receiving HWT</td>
<td>Alphabet Task as Covariate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Is there a significant difference in improvement on the Screener of Handwriting Proficiency (SHP) scores of students who received HWT between District A and District B?</td>
<td>HWT Instruction:</td>
<td>Student Outcome Data:</td>
<td>Student</td>
<td>Repeated Measures</td>
</tr>
<tr>
<td></td>
<td>Students receiving HWT</td>
<td>Screener of Handwriting</td>
<td></td>
<td>Factorial ANOVA</td>
</tr>
<tr>
<td></td>
<td>District:</td>
<td>Proficiency Scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>District A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>District B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How do teacher perceptions influence handwriting instruction in the classroom?</td>
<td>Criterion variable is teacher perceptions about handwriting instruction</td>
<td>Student Outcome Data:</td>
<td>Teacher</td>
<td>Qualitative Analysis</td>
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<tr>
<td></td>
<td>n/a</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Participants/Sample

Participating school districts were purposefully selected based on the fact that they were piloting the HWT curriculum and the willingness of the district and school administration to participate in the study. The schools and school districts were chosen due to demographic similarity that closely matches the overall student population of the central valley and the state of California.

Participants for the study were kindergarten and first grade students from two Central Valley School Districts, School District A and School District B. School District A serves a rural area and has a student population that is 60%-65% Free and Reduced Lunch program eligible, and 69% minority with the largest group from Hispanic or Latino families. School District B has a student population that is 90%-95% Free and Reduced Lunch program eligible, and 94% minority with the largest group from Hispanic or Latino families. School District A and School District B student demographics are closely matched with demographics represented by averages within the state of California and closely match each other. In addition, neither school district had an adopted handwriting instruction curriculum.

An overall total of 789 students from 32 classrooms at four schools within the two participating school districts served as the study population (Table 2); students received HWT instruction based on their enrollment in a classroom where the teacher was trained and using the HWT curriculum. Classroom teachers were selected to be trained and utilize the HWT curriculum based on their willingness to participate and in conjunction with principal input. Of the 32 classes participating in this study; 11 classroom teachers were trained and utilizing HWT curriculum for handwriting instruction while 21 classroom teachers were not trained and were not utilizing the HWT curriculum for handwriting instruction.
Table 2

**Total Participants: Detailed Breakdown of Study Population**

<table>
<thead>
<tr>
<th>Population</th>
<th>Kindergarten (n)</th>
<th>First Grade (n)</th>
<th>Total (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>District A</td>
<td>146</td>
<td>140</td>
<td>286</td>
</tr>
<tr>
<td>District B</td>
<td>280</td>
<td>223</td>
<td>503</td>
</tr>
<tr>
<td>Total</td>
<td>462</td>
<td>355</td>
<td>789</td>
</tr>
</tbody>
</table>

Due to the inequitable group sizes between students receiving and students not receiving HWT instruction, a random sample of 320 students was selected for data analysis from the overall study population of 789 students. In order to ensure balanced groups, 160 students were randomly selected from the group of students receiving HWT instruction and 160 students were randomly selected from the group of students who were not receiving HWT instruction but were receiving whatever typical handwriting instruction, if any, that the teacher would normally implement in the classroom. Of the 160 students receiving HWT instruction, there were two equal groups; in each group, 80 of the students were randomly selected from District A and 80 of the students were randomly selected from District B. Of the 160 students selected from classrooms where students were not receiving HWT instruction (they were receiving whatever typical handwriting instruction, if any, that the teacher would normally implement in the classroom), 80 of the students were randomly selected from District A and 80 of the students were randomly selected from District B. This resulted in a final sample size of 320 students with equal groups between districts and between intervention and comparison groups.
Sample size for each research question varied due to missing data. Each research question lists the sample size that was used for analysis. The random sampling process was utilized to ensure balanced representation between students who were receiving HWT instruction and those who were not receiving HWT instruction, to ensure balance between District A and District B, and to meet the assumptions of the statistical measures.

**Instrumentation**

The Screener of Handwriting Proficiency (see Appendix A) was used as a measure of handwriting ability, DIBELS was used to assess literacy skills, a writing prompt (see Appendix B) measured elements of written expression, spelling, and written expression of ideas, the alphabet task was used as a measurement tool of handwriting fluency (see Appendix C), and a teacher perception questionnaire (see Appendix D) was developed to obtain information from participating teachers regarding perceptions and practices of handwriting instruction in the classroom.

**The Screener of Handwriting Proficiency**

The Screener of Handwriting Proficiency (SHP) is a grade level specific, classroom-based tool that can be administered within the educational setting to an entire class as whole group or to individual students by the classroom teacher or anyone who is able to follow the administration guidelines (see Appendix A).

The SHP is designed to assess aspects of student handwriting and foundational elements for basic written literacy. The SHP supports early identification of struggling students, serves to inform teachers and facilitate refinement of handwriting instruction in addition to providing specific information that can be used for remediation to maximize student achievement. The SHP is a
universal tool that can be used with any handwriting curriculum or instruction to gather performance outcome information, as well as plan for appropriate interventions.

The SHP uses dictation and measures five areas to help educators and specialists determine student needs for success in handwriting. The specific areas analyzed are memory, orientation, placement, sentence conventions, and name. Additional notes and observations are made about formation, size, neatness, speed, posture, pencil grip, and helper hand use while completing the Screener. Dictation is used as the student is asked to write letters from memory as they complete the Screener. Studies found correlations to be stronger with letter naming and writing letters from dictation as compared to copying (Molfese et al., 2006: Ritchey, 2006). Dictation is used by the SHP and is preferred over copying as dictation requires the student to recall the letter or number, correctly orient, place, and follow the sequential steps as they write the symbol from memory.

Memory is the ability to remember and write letters and numbers. The screener requires the student to write dictated letters and numbers. This measure captures the students’ ability to remember and distinguish between capital and lowercase forms of letters as well as numbers from dictation. Orientation is the ability to write letters and numbers facing the correct direction, reversals or backward orientation are considered orientation errors. Placement is the ability to place letters and numbers correctly to the baseline. This incorporates awareness of letter appearance and relationship to other letters (case) as well as provides information about motor control and attention to the line. Sentence conventions measure the recognition and use of beginning capitalization, distinct use of lowercase letters in words that are spaced appropriately (close together), space between words, and ending punctuation. Name is a skill that children typically
develop in three stages (all capitals, transitioning mix, title case) and this area measures a child’s place in this developmental trajectory. The SHP face and content validity is high, however, reliability estimates are not available.

**Dynamic Indicators of Basic Early Literacy Skills (DIBELS)**

Classroom teachers administer four measures from the DIBELS during each testing window. These measures included: Letter Naming Fluency (LNF), Initial Sounds Fluency (ISF), Phoneme Segmentation Fluency (PSF), and Nonsense Word Fluency (NWF). Letter Naming Fluency (LNF) measures the number of upper and lower case alphabet letters that the student verbally identifies correctly in one minute. Initial Sounds Fluency (ISF) measures phonological awareness, the student’s skill at identifying and orally producing the initial sounds of a presented word. Phoneme Segmentation Fluency (PSF) measures phonological awareness, the student’s ability to segment three and four phoneme words. Nonsense Word Fluency (NWF) assesses the alphabetic principle of letter-sound correspondence.

Dynamic Indicators of Basic Early Literacy Skills (Good & Kaminiski, 2002) was chosen for use in this study, as both school districts utilized this assessment and, it is norm-referenced, standardized, commonly used, and an individually administered measure for the assessment of early literacy foundational skills related to reading outcomes.

Currently, districts participating in this study collect DIBELS data three times per year. Dynamic Indicators of Basic Early Literacy Skills is based on the essential early literacy domains (e.g., Alphabet Knowledge, Letter Naming Fluency, Initial Sound Fluency, Phonological Awareness and Phoneme Segmentation Fluency). The measure is reported to have face, content validity
criterion related validity. According to Good et al. (2004) predictive reliability estimates for each of the DIBELS subtests range from a low of .38 to a high of .69 (ISF=.38, PFS=.62, NWF =.69). Criterion related reliability estimates for each of the DIBELS subtests range from a low of .33 to a high of .66 (ISF=.33, PFS=.63, NWF =.66).

**Writing Prompt**

A writing prompt (see Appendix B) used from a study by Puranik and Al Otaiba (2012) served to measure elements of written expression, spelling, and handwriting fluency. The writing prompt is utilized to function as a Curriculum-Based Measurement of Written Expression (CBM-W) and was used to gather information regarding students’ writing abilities for evaluating written literacy skills.

The Curriculum-Based Measurement of Written Expression (CBM-W) has three Task Types including copying, dictation, and prompt tasks. Each Task Type has many different Tasks with formats designed to achieve different outcomes. Various Task Types and task formats are appropriate for different grade levels of students. Each type and format is chosen based on elements to be measured; there is no one single correct format for CBM-W task administration (Dombek & Al Otaiba, 2016).

For the purpose of this study, the Prompt Task type with Sentence Task format was used to analyze and score the elements of the writing prompt. Sentence writing tasks are suggested for students in kindergarten and first grade (Coker & Ritchey, 2010). The sentence writing task was elicited with the writing prompt and required the students to independently produce written text, was appropriate for both Kindergarten and First grade students, and was scored on elements of written expression identified as essential for writing success and that
aligned with the CCSS. There are six possible elements that can be scored as for the writing prompt task. The six elements are total words written (TWW), correct letter sequences (CLS), correct word sequences (CWS), incorrect word sequences (IWS), words spelled correctly (WSC), and Numbers of Ideas Expressed (NIE). The following elements were scored from the task with the writing prompt in alignment with the CBM-W and suggested by researchers (Coker & Ritchey, 2010; Dombek & Al Otaiba, 2016; Puranik & Al Otaiba, 2012): Total Words Written (TWW), Words Spelled Correctly (WSC), and Numbers of Ideas Expressed (NIE).

**Alphabet Task**

The alphabet task was used as a measurement tool of Writing Fluency (see Appendix C) and in conjunction with the writing prompt. This alphabet task is an established measure of handwriting fluency (referred to as orthographic-motor integration in the literature), is connected with compositional fluency, and linked to compositional quality (Berninger & Swanson, 1994; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997). This task measured the number of letters of the alphabet that a student can accurately write in a given 60 second interval. Number of letters written and legibility were scored. Scores were used to address research questions and were included in consideration with Literacy skills.

**Teacher Perception Survey**

The Teacher Perception Survey (see Appendix D) was developed by the researcher in collaboration with an expert in survey development and design. The purpose of the survey was to obtain information from participating teachers regarding their thoughts, perceptions, and practices of handwriting instruction in the classroom. The focus of research question 5 was to understand more clearly,
the insights and views surrounding handwriting instruction and teaching practices used by teachers to instruct students in the classroom.

The Teacher Perception Survey contained five questions that were specifically designed as open-ended questions to invite teachers to share their thoughts regarding handwriting instructions and student handwriting as it relates to student learning and academic achievement.

The Teacher Perception Survey regarding handwriting instruction was distributed to the teachers of all kindergarten and first grade classrooms of participating schools within the School District A and B. The survey introduction explained the purpose and served as informed consent for teachers if they chose to continue and complete the survey. Survey Monkey was used as the means for distribution and gathering responses. Response analytics utilized a qualitative analysis process drawing upon principles of grounded theory and employing practices including coding to identify main themes.

**Description of the Intervention**

Handwriting Without Tears (HWT) is the curriculum that teachers implemented as the curriculum for handwriting instruction for this study. The curriculum incorporates hands-on, engaging, joyful, and meaningful multi-sensory elements for optimal student learning of handwriting skills; the curriculum incorporates explicit instruction, meaningful feedback, and is taught with cross-curricular connections so that it is aligned with CCSS (Olsen, 2003; Olsen & Knapton 2008; Olsen & Knapton, 2013a, 2013b). Handwriting Without Tears is a developmentally based handwriting curriculum that contains 36 weeks of specific, daily lessons organized in a sequential format for teachers to follow and implement daily; the teaching guidelines are detailed in the resources section of the HWT Teachers Guides (Olsen & Knapton, 2013a, 2013b).
Teacher Training

The participating teachers who implemented the HWT curriculum attended a 6.5-hour K-1 (Kindergarten to First grade), formal HWT School Based training provided and taught by a HWT national presenter. For this study, each teacher implemented the specific lessons from week one thru week 22 as outlined in the teaching guidelines for each respective grade level. Teachers followed the curriculum lesson plans in sequence as outlined in the HWT teacher's guide for their grade level class. All of the curriculum materials were provided so that teachers had all necessary materials to be able to implement the curriculum with fidelity (see Appendix E).

The primary objectives of the HWT K-1 print workshop teacher training (see Appendix F) were focused on providing teachers with the knowledge, skills, and materials to effectively teach handwriting skills. Emphasis is aimed at developing teachers’ understanding of the curriculum in order to implement the curriculum with fidelity so that they are able to support students in developing effective, consistent motor patterns for letter and number formations, understanding spatial orientation, and proper position of letters and numbers, while developing automaticity for the efficient production of written work so that children can show what they know and feel confident in their abilities (Olsen, 2009). The curriculum promotes teachers implementing a developmentally appropriate approach with active teaching while targeting stages of learning from the Pre-Instructional phase to Stage 1: Imitation, Stage 2: Copying, and Stage 3: Independent Writing.

Lessons taught are sequentially organized with built in review and meaningful practice while utilizing hands-on materials that promote student awareness of top to bottom and left to right spatial awareness to foster the correct
orientation and formation for each letter and number that students learn. Samples of individual lesson plans, lowercase letter a, from the Kindergarten and First Grade Teacher Guides are included as Appendices G and H respectively. Daily lessons require each teacher to use a total of 10 to 15 minutes of classroom time for instruction and student practice (Olsen & Knapton, 2013a, 2013b).

Research supports features of the developmental, sequential, and hands-on aspects of the curriculum (Benson, Salls, & Perry, 2010; Berninger et al., 1997; Denton et al., 2006; Graham & Harris, 1989; Hammerschmidt & Sudsawad, 2004; Jones & Christensen, 1999; Kaiser et al., 2011; Roberts et al., 2014; Sylwester, 1995). Per the HWT curriculum teaching guidelines capital letters are taught first and then lowercase letters are taught, with numbers being taught in the context of math and counting activities. Instructional order of capital and lower-case letters follows developmental principles (vertical orientation and stroke acquisition sequence) in addition to grouping the letters based on of similar formation patterns, stroke difficulty, and frequency of use.

The multisensory lessons incorporate teacher demonstration with modeling of letter formations (visual) while using specific, consistent and simple verbal instructions (auditory) for each letter and number formation as outlined in the specific lessons. The hands-on materials provided were used for building letters (i.e. capital letter cards and wooden pieces on the blue mat) and additional (tactile and kinesthetic) activities (i.e. wet-dry-try on the slate or double line blackboard, finger tracing, and air writing), and using various instructional activities to reinforce letter formations and positions (i.e. hand size & position, letter stories, and teaching with fun voices). The music CD and movement activities were intended to be used as detailed in the lesson plans to teach aspects of handwriting.
including letter formations, numbers and sentences (Olsen & Knapton, 2013a, 2013b).

**Curriculum Implementation: Student Participation**

Students received daily instruction from the classroom teacher that follows the teaching guidelines (see Appendix I & J) for each grade level. Daily lessons are sequenced to address specific letters in the developmentally based teaching order and designed to absorb approximately 15 minutes of classroom time. There are cross-curricular connections built into each student lesson to facilitate application in alignment with Common Core State Standards. Students are exposed to letters with visual introduction and demonstration followed by a multi-sensory learning experience to reinforce understanding of specific letter formations. The final, formalized instructional step involves the student workbook. Students are invited to use what they have learned through built in review activities that reinforce student learning. Students then are encouraged to generalize their learning with use of double line paper and curriculum relevant, instructional worksheets that teachers can design using the A+ worksheet maker. Additional materials were available in the form of “home connections” from online links included within lesson plans as detailed in the grade level specific HWT Teacher’s Guides. The home links are integrated within the curriculum for use by a teacher to send home for parents to be aware of specific strategies for handwriting instruction being used in the classroom (see Appendix K).

**Intervention Fidelity**

The HWT curriculum comprises daily handwriting lessons that are approximately 15 minutes in duration. All materials were provided to and available for each teacher in order to implement HWT instruction with fidelity as
per the HWT Teaching Guidelines outlined in the Resources section of each grade level HWT teacher’s guide. The researcher made intermittent contact with the teachers who were participating in the study to answer any questions and to serve as a resource should implementation assistance be needed. Teachers reported completing implementation and two teachers requested additional supplies (one package of double-line HWT paper and additional short HWT pencils) that were provided upon their request. Teachers were not required to log daily instructional activities. Brief anecdotal exchanges occurred regarding implementation practices at the various sites and classrooms however this was not formally recorded and was intended to be captured with the Survey of Teacher Perceptions distributed to teachers at the conclusion of the study.

**Procedures**

The Steps in the study were as follows:

1. Selected teachers were trained to implement the HWT curriculum by providing all teachers with a HWT, School-Based K-1 workshop in the Fall of 2015 (Workshop Objectives: Appendix F).

2. Selected teachers were provided with all teaching materials necessary to implement the curriculum with fidelity (Appendix E). Each classroom was provided with Print Display Wall cards, desk strips, slates, double-line blackboards, instructional books, double line paper, writing journals and Digital Teaching Tools. Additional materials were provided at the request of the teachers should they have students join their classrooms.

3. The Screener of Handwriting Proficiency (Appendix A) was administered to all students in classrooms that are using HWT and those that are not using HWT curriculum. The screener served to gather baseline, interval, and outcome data pertaining to specific areas
measured by the Screener. The Screener was administered as a pre-test to obtain an initial measure and re-administered as an outcome 4 months later.

4. Curriculum Implementation: To teach their students, teachers utilized lesson plans (Appendices G & H) and followed the sequence outlined in the Teaching Guidelines (Appendices I & J) as detailed in the Resources section of the specific grade-level HWT, Teachers Guides.

5. The grade level Writing Prompt (Appendix B) and Alphabet Task (Appendix C) were administered to all students in participant group and collected for use as an outcome measure.

6. The Teacher Perceptions Survey was administered to all of the teachers of classrooms participating in the study at the conclusion of the study to determine their perceptions of handwriting instruction and serve as a tool to gather information about handwriting instructional practices (Appendix D). Informed consent from the teachers was obtained as part of the survey; Consent is granted with survey completion.

7. Student demographic data were obtained from the respective districts.

8. Student data for pre-post DIBELS were collected from the respective districts and used for the purpose of baseline and outcome data.

9. Student Screener of Handwriting Proficiency (SHP) forms were scored by the researcher, who was trained in scoring the SHP. The scoring packet is presented in Appendix L.

10. All Student Writing Prompt and Alphabet Task worksheets were scored by the researcher using the established scoring criteria for scoring writing prompts (Appendix B) and the Alphabet Task sheets (Appendix C).
The California State University, Fresno Institutional Review Board approved all materials and procedures for this study (archival data and subject data). The participating school districts approved the materials and procedures for participation in this study.

**Data Collection**

As part of the HWT curriculum the Screener of Handwriting Proficiency (see Appendix A) scores were obtained from individual students on the Screener of Handwriting Proficiency worksheets to address research questions 1 and 2, the grade level Writing Prompt (see Appendix B) was administered in the classroom setting and obtained as the writing content measure to answer research questions 1 and 4. Archival DIBELS scores for reading and spelling were collected and used for answering research question 3. The Alphabet task (see Appendix C) was administered in the classroom setting and obtained to serve as the measure of handwriting fluency and was used as the covariate for research question 3. The Teacher Perception Survey (see Appendix D) was administered to participating teachers and was used to address research question four.

**Dynamic Indicators of Basic Early Literacy Skills**

District administration DIBELS testing is completed by individual teachers per district testing windows; DIBELS testing takes place in the beginning of the school year (August/September), mid-school year (December/January), and again in the spring at the end of the school year (April/May) for both districts. Individual student scores were obtained from District A and District B. Student scores from DIBELS testing provided baseline, and middle of year (outcome) measures of student learning. Student scores were entered into a database for further analysis to address the research questions.
Screener of Handwriting Proficiency:

The SHP (see Appendix A) was administered to every student involved in the study. The SHP was administered in accordance with the administration guidelines, within the educational setting to each class as whole group. The initial administration of the SHP occurred at the time delineated by the HWT Teaching Guidelines as noted in the Resources Section of the grade-level HWT Teacher's Guide. Re-administration of the SHP was completed as a pre-test/post-test for use as the measures of student progress. The SHP is typically administered in four-month intervals (up to three times per school year) and, due to the duration and timelines of this study; the SHP was used as baseline and outcome measure without an interval administration. Additionally, the administration of the SHP aligned to DIBELS testing windows.

Screener of Handwriting Proficiency student forms were collected and obtained by the researcher. The SHP student forms were scored per the scoring protocol delineated in the SHP administration and scoring packet (Appendix L). Student SHP forms scoring was completed by three Occupational Therapists that are trained in the use and implementation of the HWT curriculum and the Screener of Handwriting Proficiency use and scoring protocol. The SHP score were used as a measure of handwriting legibility. Student scores were entered into a database for further analysis to address the research questions.

Writing Prompt

A writing prompt (see Appendix B) was administered to every student involved in the study in order to gather information regarding students’ writing abilities for evaluating learning outcomes in written literacy. The writing prompt was administered to the whole class using the given protocol and scripting for each student to complete within the allotted amount of time in the educational
setting. Each of the individual student Writing Prompt responses was scored per the scoring guidelines. Student scores were entered into a database for further analysis to address the research questions.

**Alphabet Task**

The Alphabet Task (see Appendix C) was administered to every student involved in the study in order to gather information regarding students’ handwriting fluency. The Alphabet Task was administered to the whole class using the given protocol and scripting for each student to complete within the allotted amount of time in the educational setting. Each of the individual student Alphabet Task work products was scored per the scoring guidelines. Student scores were entered into a database for further analysis to address the research questions.

**Teacher Perception Survey**

The Teacher Perceptions Survey (TPS) (see Appendix D) was provided to each teacher participant using Survey Monkey as the mode of distribution and response collection. Data analysis was completed using grounded theory with coding to identify emerging themes. The responses obtained from teachers regarding handwriting instruction, beliefs and teaching practices served to inform the researcher about individual teacher perceptions of handwriting, handwriting instruction, classroom practices, and the impact of handwriting on student achievement.

**Data Analysis**

This study sought to address the research questions in order to analyze the effectiveness of handwriting instruction using the HWT curriculum and student learning outcomes in the form of literacy (DIBELS score, reading, spelling, and
writing) among kindergarten and first grade children. Statistical Package for the Social Sciences (SPSS) software program was used for all quantitative statistical analysis.

The research questions and variables (see Table 1, p. 65) were analyzed with the following statistical measures.

Four types of statistical analysis were utilized to respond to the research questions. A Factorial MANOVA examined the students’ written content differences between students receiving HWT instruction and students not receiving HWT instruction. A repeated measures Factorial ANOVA was used to examine the students’ writing legibility differences between students receiving HWT instruction and students not receiving HWT instruction normally taught in the classroom. Two factorial MANCOVAs were used to examine the difference in student learning outcomes between students receiving HWT instruction and students not receiving HWT instruction on measures of student learning outcomes as assessed by DIBELS, while controlling for writing fluency as measured by the Alphabet Task. A repeated measures Factorial ANOVA was used to examine the difference between District A and District B for students who were receiving HWT instruction on measures of handwriting proficiency. Qualitative analysis was utilized to inform findings, provide context, and as a means of exploring teacher perceptions and opinions based on the collected survey responses (see Table 1, p. 65).

**Question Modifications**

Originally, question 3 and 4 were separate questions however due to their similarity question 3 was removed. Specifically, question 3 “Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and students who did not receive HWT
instruction?" was removed as question 4 “Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and students who did not receive HWT instruction when controlling for writing fluency?” examined the same dependent and independent variables, but question 4 added a covariate of writing fluency. As question 4 had the ability to account for more variance question 3 was removed. A new exploratory question was added to examine the difference between District A and District B for only those students who had received HWT instruction. This question was added to statistically examine any differences in implementation outcomes between districts.

**Delimitations**

The population utilized for this study was selected from the Central Valley due to the unique characteristics of the student population. The Central Valley is home to an at-risk group of students that has a high percentage of Free and Reduced Lunch recipients and with a large number of students for whom English is a second Language. The local Districts were selected based upon the pilot program in process using Handwriting Without Tears (HWT) curriculum, accessibility, and willingness to participate in the study. Both districts were identified as appropriate for inclusion in the study due to the lack of an existing handwriting instruction curriculum prior to the pilot program within the participating districts or adopted at the individual school sites. The two school sites of District A were chosen from the 14 elementary schools within the district because the two schools are physically located in close proximity to one another with demographically matched students. District B schools are delineated by grade level therefore each school was selected based on grade level.
Handwriting Without Tears (HWT) was selected for the pilot process and chosen as the focus of this study because it is a specific, focused handwriting instructional curriculum that is separate from literacy curricula. Additionally, HWT was chosen due to the attributes and foundations of the curriculum as they align with neuro-motor development and principles of student learning. The instruments were selected based on review of existing literature and measurement attributes of each as outlined above.

**Limitations**

Limitations of this study include timing of teacher training, timing of the initiation of curriculum instruction, consistency of instructional practices between teachers, variations of administrative support between districts and schools. The HWT curriculum was new for the teachers within this study therefore teacher preparedness was a limitation to fidelity of implementation. Not all teachers felt comfortable and fluent with implementing the curriculum to the fullest extent. There were several teachers that were new to the profession of teaching so they had a greater demand, in general, placed on them during the study and expressed that they would have liked to spend more time implementing the curriculum but their schedule was overcrowded. Despite efforts of the researcher to check in the teachers who were implementing HWT instruction, it was impossible to control teaching factors, timing, or fidelity of implementation.

**Summary**

This study included specific literacy measures in conjunction with writing and handwriting measures from kindergarten and first grade students attending elementary schools of two school districts in the Central Valley of California. Literacy measures from students of classrooms whose teachers were trained and
implementing handwriting instruction using the HWT curriculum and students from classrooms whose teachers were not trained with HWT and who were not implementing the HWT curriculum as handwriting instruction were collected and analyzed to analyze the differences between the two groups. Survey measures were distributed to and collected from the teachers of classrooms at participating school sites within the participant school districts; data were analyzed and coded for identification of categories and emergent themes for informational purposes to inform study findings. Analysis of the data and relationships among these variables will be presented in chapter 4 with a discussion of findings, implications for educators, and suggestions for future research in chapter 5.
CHAPTER 4: RESULTS

This study sought to analyze the effects of the implementation of the Handwriting Without Tears (HWT) Curriculum and the impact on student achievement. Specifically, this study examined the differences in student achievement between students receiving HWT instruction and students not receiving HWT instruction. Additionally, the study examined the differences in handwriting growth between District A and District B for those students who received HWT instruction. Teachers’ perceptions of the importance of handwriting instruction, students’ handwriting ability, and on student learning outcomes and achievement were gathered and explored.

Summary of Methodology

The research questions were informed by a review of the literature. The research questions were formulated to address specific components of student achievement. For the purposes of this study student achievement is expressed as the four specific learning outcomes that include: (a) handwriting legibility skill as measured by student scores on The Screener of Handwriting Proficiency (SHP; see Appendix A), (b) literacy skills from Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminiski, 2002) scores including Letter (b.1) Naming Fluency-LNF, (b.2) Initial Sounds Fluency (ISF), (b.3) Phoneme Segmentation Fluency (PSF), and (b.4) Nonsense Word Fluency (NWF), (c) written literacy skills as measured by Writing Prompt scores, (c.1) total words written (TWW), (c.2) words spelled correctly (WSC), and (c.3) Numbers of Ideas Expressed (NIE), and (d) writing fluency from scores on the Alphabet Task (AT). The study also examined teacher perceptions regarding handwriting and handwriting instruction in relation to student achievement.
This chapter is organized by the five research questions posed in chapter 3. A list of those questions and their respective method of analysis are presented in Table 1 (p. 65).

**Demographics of Participants**

A total of 789 student participants from the two school districts that were included in this study. District A included 286 student participants. Of the 286 student participants from District A, 146 were enrolled in Kindergarten and 140 were enrolled in the First grade. District B included 503 student participants. Of the 503 student participants from District B, 280 were enrolled in Kindergarten and 223 were enrolled in the First grade. Detailed participant demographic information is represented in Table 2.

Due to the inequitable group sizes between students receiving HWT instruction and students not receiving HWT instruction, a random sample of students was selected for data analysis from the study population of 789 student participants. Given the total sample of 789 participants, a minimum of 262 student participants was required for a statistically representative sample with 95% confidence (Patten, 2007). In order to ensure balanced groups, 160 students were randomly selected from the group of students receiving HWT instruction and 160 students were randomly selected from the group of students who were not receiving HWT instruction. Of the 160 students receiving HWT instruction, there were two equal groups; in each group, 80 of the students were randomly selected from District A and 80 of the students were randomly selected from District B. Of the 160 students selected from classrooms where students were not receiving HWT instruction (they were receiving whatever typical handwriting instruction, if any, that the teacher would normally implement in the classroom), 80 of the students were randomly selected from District A and 80 of the students were
randomly selected from District B. A final sample size of 320 students with equal
groups between districts and between intervention and comparison groups (see
Table 3) was utilized for statistical analysis to address quantitative research
questions 1 through 4.

Each quantitative statistical question will provide a sample size utilized to
compute the appropriate statistics. The provided sample size may be different
than the overall sample size as some participants had missing data.

Table 3

<table>
<thead>
<tr>
<th>Population</th>
<th>HWT (n)</th>
<th>No HWT (n)</th>
<th>Total (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>District A</td>
<td>80</td>
<td>80</td>
<td>160</td>
</tr>
<tr>
<td>District B</td>
<td>80</td>
<td>80</td>
<td>160</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
<td>160</td>
<td>320</td>
</tr>
</tbody>
</table>

Screener Data

The Screener of Handwriting Proficiency (SHP; see Appendix A) data were
collected at time intervals from students in each classroom of all participating
teachers. All student screener sheets were collected and scored using the Screener
of Handwriting Proficiency Scoring packet (see Appendix L).

DIBELS Data

The academic achievement data in the form of DIBELS scores for each
student was obtained from the School District Databases for the four participating
schools. Each district reported pre-test and post-test DIBELS for each student.
Writing Prompt Data

Student academic achievement data for written literacy was obtained in the form of a writing prompt and scored for each student participant. Three scores were obtained for each student writing prompt; the three scores included Total Number of Words written (TNW), number of Words Spelled Correctly (WSC), and Number of Ideas Expressed (NIE).

Alphabet Task Data

Student academic achievement data for writing fluency in the form of the Alphabet Task (AT) were obtained and scored for each participant.

Data Analysis

The four stated research questions utilize different statistical procedures based upon the proposed research question and level of data. Table 1 (p. 65) provides a summary of each research question, identifies the independent variable, the dependent variable, the level of data, and the type of statistical analysis computed.

Review of Research Questions

Research Question 1

Is there a significant difference on Writing Prompt Scores (TNW, WSC, NIE) between students who received HWT instruction and students who did not receive HWT instruction?

A Factorial Multivariate Analysis of Variance (MANOVA) was computed to determine the effect of HWT instruction on Written Literacy. Three measures of written literacy served as the dependent variable, TNW, WSC, and NIE. The independent variable was the intervention group with two levels, students who received HWT instruction and students who did not receive HWT instruction. The
descriptive statistics for the Writing Prompt data obtained from participants is presented in Table 4. The table contains the means and standard deviations for the two groups: Those receiving the HWT instruction and those not receiving HWT instruction.

Table 4

Means and Standard Deviations for Writing Prompt Scores by HWT Instruction Status

<table>
<thead>
<tr>
<th>Writing Prompt</th>
<th>HWT (n=157)*</th>
<th>No HWT (n=156)</th>
<th>Total (n=313)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>TNW</td>
<td>39.30</td>
<td>30.72</td>
<td>35.33</td>
</tr>
<tr>
<td>WSC</td>
<td>13.11</td>
<td>11.99</td>
<td>10.53</td>
</tr>
<tr>
<td>NIE</td>
<td>6.60</td>
<td>5.09</td>
<td>5.29</td>
</tr>
</tbody>
</table>

TNW: Total number of Words Written
WSC: Words Spelled Correctly
NIE: Number of Ideas Expressed
* Represents the participants from the random sample with complete data sets. This total represents the number of randomly selected students with complete data sets.

Box's test of equality of covariance matrices (p = .006) indicated there was homogeneity of variance-covariance. The results of the MANOVA indicated statistically significant difference between students who received HWT instruction and students who did not receive HWT on the combined dependent variables, (F(3, 309) = 4.993, p = .002; Pillai’s Trace = .046; partial η² = 4.993; F(3, 309) = 4.993, p = .002; Wilks' Λ = .954; partial η² = 4.993; , F(3, 309) = 4.993, p = .002; Hotelling’s Trace = 0484; partial η² = 4.993; , F(3, 309) = 4.993, p = .002; Roy’s Largest Root = .048; partial η² = 4.993).

Students who received HWT curriculum instruction scored higher in their measures of Written Literacy, TNW, WSC, and NIE (M = 39.30, SD = 30.721; M = 13.11, SD = 11.99 and M = 6.60, SD = 5.09, respectively) than students who did
not receive HWT instruction (M = 35.33, SD = 28.39; M = 10.53, SD = 9.94 and M = 5.49, SD = 4.08, respectively).

As the MANOVA was significant, a Tests of Between Subjects Univariate Analysis of Variances (ANOVA) were computed for each dependent variable. The Results of the ANOVA (presented in Table 4) revealed that there was no statistically significant difference (F(1, 311) = 1.411, p = .236; partial η² = .005) in TNW between students who received HWT curriculum instruction (M = 39.30, SD = 30.721) and students who did not receive HWT instruction (M = 35.33, SD = 28.39). The ANOVA results indicated that there were statistically significant differences in both WSC (F(1, 311) = 4.322, p = .038; partial η² = .014, Adjusted R Squared = .011) and NIE (F(1, 311) = 6.298, p = .013; partial η² = .020, Adjusted R Squared = .017) between students who received HWT curriculum instruction (M = 13.11, SD = 11.99 and M = 6.60, SD = 5.09, respectively) and students who did not receive HWT instruction (M = 10.53, SD = 9.94 and M = 5.49, SD = 4.08, respectively).

Based upon the significant ANOVA results for tests of between-subjects effects, using a post hoc Bonferroni adjusted α level of .025, post-hoc analysis was completed to determine what elements of written literacy were significantly different from each other on HWT instruction status. Pairwise comparisons for WSC indicated significant difference (MD=2.59, p=.038) between students who received HWT instruction (M=13.11) and students who did not receive HWT instruction (M=10.53). There was a significant difference for NIE (MD=1.31, p=.013) between students who received HWT instruction (M=6.60) and students who did not receive HWT instruction (M=5.29). No other pairwise comparisons were significant. Table 5 presents the ANOVA results for Written Literacy: Writing prompt measures scores by HWT instructional status.
Table 5

ANOVA Results for Written Literacy: Writing Prompt Measure scores by HWT Instructional Status

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWT Status</td>
<td>TNW</td>
<td>1234.794</td>
<td>1</td>
<td>1234.794</td>
<td>1.411</td>
<td>.236</td>
</tr>
<tr>
<td></td>
<td>WSC</td>
<td>524.502</td>
<td>1</td>
<td>524.502</td>
<td>4.322</td>
<td>.038</td>
</tr>
<tr>
<td></td>
<td>NIE</td>
<td>134.338</td>
<td>1</td>
<td>134.338</td>
<td>6.298</td>
<td>.013</td>
</tr>
<tr>
<td>Error</td>
<td>TNW</td>
<td>272137.257</td>
<td>311</td>
<td>875.039</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WSC</td>
<td>37738.834</td>
<td>311</td>
<td>121.347</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NIE</td>
<td>6633.739</td>
<td>311</td>
<td>21.330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>TNW</td>
<td>709301.000</td>
<td>313</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WSC</td>
<td>82025.000</td>
<td>313</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NIE</td>
<td>17833.000</td>
<td>313</td>
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</tr>
</tbody>
</table>

a. R Squared = .005 (Adjusted R Squared = .001)
b. R Squared = .014 (Adjusted R Squared = .011)
c. R Squared = .020 (Adjusted R Squared = .017)

Students who received HWT instruction demonstrated significantly higher WSC as compared to students who did not receive HWT instruction. Students who received HWT instruction demonstrated significantly higher NIE as compared to students who did not receive HWT instruction. There were no significant differences revealed on TNW between Students who received HWT instruction and students who did not receive HWT instruction.
Research Question 2

Is there a significant difference in improvement between handwriting legibility scores of students who received HWT instruction and students who did not receive HWT instruction?

A two-way repeated measures Factorial ANOVA was run to determine the effect of Handwriting Instruction with the HWT curriculum over time on Handwriting Legibility as measured by pre-post test Total Scores on the Screener of Handwriting Proficiency. The Screener of Handwriting Proficiency (SHP) Score served as the dependent variable. The independent variable was the intervention group with two levels, students who received HWT instruction and students who did not receive HWT instruction. The descriptive statistics for the SHP data obtained from participants is presented in Table 6. The table contains the Means, Standard Deviation, and Frequencies for Handwriting Legibility as measured and reported in SHP scores by HWT instruction status.

Table 6

<table>
<thead>
<tr>
<th></th>
<th>HWT (n = 151)*</th>
<th>No HWT (n = 148)*</th>
<th>Total (n = 299)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Time 1</td>
<td>77.41</td>
<td>11.25</td>
<td>77.62</td>
</tr>
<tr>
<td>Time 2</td>
<td>88.07</td>
<td>8.35</td>
<td>80.18</td>
</tr>
</tbody>
</table>

* Represents the participants from the random sample with complete data sets. This total represents the number of randomly selected students with complete data sets.

The results of the two-way repeated measures Factorial ANOVA indicated there was a significant multivariate effect between HWT instruction on the SHP score. Sphericity Assumed F(1,297) = 68.509, p<.001, partial η² =.187; Greenhouse-Geisser F(1,297) = 68.509, p<.001, partial η²* =.187; Huynh-Feldt
F(1,297) = 68.509, p<.001, partial η² = .187; and Lower-bound F(1,297) = 68.509, p<.001, partial η² = .187. There was a significant difference between the pre-test mean for students who received HWT instruction (M = 77.41, SD=11.251), and students who did not receive HWT instruction (M=77.62, SD = 11.56), the post test mean for students who received HWT instruction (M = 88.07, SD = 8.35) and students who did not receive HWT instruction (M=80.18, SD = 10.58). There was a significant linear relationship between pre-test and post-test and receiving HWT instruction F(1,297) = 68.509, p<.001, partial Eta squared = .187 as presented in Table 7. The HWT instruction elicited statistically significant changes in Legibility over time.

Table 7

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>Partial Eta Squared</th>
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<tbody>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>HWT instruction status</td>
<td>2207.775</td>
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<td>2207.775</td>
<td>11.942</td>
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<td>.039</td>
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<tr>
<td>Error</td>
<td>5409.814</td>
<td>297</td>
<td>18.019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7614.589</td>
<td>298</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>6527.662</td>
<td>1</td>
<td>6527.662</td>
<td>182.019</td>
<td>.000</td>
<td>.380</td>
</tr>
<tr>
<td>Time X HWT instruction status</td>
<td>2456.892</td>
<td>1</td>
<td>2456.662</td>
<td>68.509</td>
<td>.000</td>
<td>.187</td>
</tr>
<tr>
<td>Error(Time)</td>
<td>106.51</td>
<td>297</td>
<td>35.863</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9091.064</td>
<td>299</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students who received HWT instruction demonstrated significant improvement in handwriting legibility as measured by the SHP as compared to students who did not receive HWT instruction. Figure 1 provides a graphic
representation of the change in handwriting legibility over time between students received HWT instruction and those students did not receive HWT instruction.

Figure 1. Change in legibility over time by HWT status

Research Question 3

Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and students who did not receive HWT instruction when controlling for writing fluency?

To investigate research question 3, a Factorial MANCOVA was conducted to assess differences between independent variable of HWT instruction on four dependent growth variables. Kindergarten and first grade each had two separate measures. Kindergarten students were measured on growth of (First Sound
Fluency) FSF and growth on Letter Naming Fluency (LNF). First grade students were measured on growth of Nonsense Word Fluency-Correct Letter Sounds (CLS) and growth on Nonsense Word Fluency-Whole Word Reading (WWR). The covariate for both factorial MANCOVAs was Writing Fluency. The Alphabet Task was used as the measure of Writing Fluency. Growth for all dependent variables was calculated as the difference between assessment time one and assessment time two for each DIBELS measure.

Measures for Kindergarten and First grade DIBELS are different due to the difference in developmental level of literacy ability. Due to the difference in measures at the respective grade levels, the analysis was completed by grade level. Pre/post scores were used to calculate growth for the respective dependent variables.

Repeat Measure scores for Kindergarten were available for FSF and LNF for District A and District B. The number of kindergarten students from the sample population was 155. Of the 155 kindergarten students, 79 students were from the group who received HWT instruction and 76 students were from the group who did not receive HWT instruction. The DIBELS measures available as pre/post scores for First Grade were CLS and WWR. Pre and post measures for First Grade CLS and WWR were available from District A only. The number of First grade students from the sample population was 76. Of the 76 First grade students, 39 students were in the group who received HWT instruction and 37 students were in the group who had not received HWT instruction. Table 8 presents the means, standard deviations, and frequency for each DIBELS measure by HWT Instruction status.
Table 8

Means and Standard Deviations for Growth in DIBELS Measure by HWT Instruction Status

<table>
<thead>
<tr>
<th>DIBELS</th>
<th>HWT</th>
<th>Sample Size (n)</th>
<th>Mean</th>
<th>SD</th>
<th>No HWT</th>
<th>Sample Size (n)</th>
<th>Mean</th>
<th>SD</th>
<th>Total</th>
<th>Sample Size (n)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSF</td>
<td>14.85</td>
<td>79</td>
<td>14.092</td>
<td>10.59</td>
<td>76</td>
<td>14.48</td>
<td>10.73</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LNF</td>
<td>14.67</td>
<td>79</td>
<td>14.87</td>
<td>13.03</td>
<td>76</td>
<td>14.77</td>
<td>11.98</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLS</td>
<td>22.08</td>
<td>37</td>
<td>17.24</td>
<td>18.48</td>
<td>37</td>
<td>19.66</td>
<td>19.52</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WWR</td>
<td>8.29</td>
<td>37</td>
<td>3.08</td>
<td>8.28</td>
<td>37</td>
<td>5.68</td>
<td>8.25</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Represents the participants from the random sample with complete data sets.

**Sample size is different for FSF & LNF versus CLS & WWR based on grade level and availability of data from respective districts.

Dependent variable: First sound fluency and letter naming fluency. The Box's test of equality of covariance matrices ($p=.280$) indicated there was homogeneity of variance-covariance. The results of the Factorial MANCOVA indicated no statistically significant difference on the combined dependent variables of FSF and LNF between Kindergarten students who received HWT instruction and students who did not receive HWT instruction when controlling for the covariate of the writing fluency on the combined dependent variables, ($F(2, 151) = .082, p = .921$; Pillai’s Trace = .001; partial $\eta^2 = .001$; $F(2, 151) = .082, p = .921$; Wilks' $\Lambda = .999$; partial $\eta^2 = .001$; $F(2, 151) = .082, p = .921$; Hotelling’s Trace = .001; partial $\eta^2 = .001$; $F(2, 151) = .082, p = .921$; Roy’s Largest Root = .001; partial $\eta^2 = .001$).
Mean growth on FSF for kindergarten students who received HTW instruction (M = 14.85, SD = 10.914) was not significantly different when compared to kindergarten students who did not receive HWT instruction (M = 14.09, SD = 10.59) when controlling for writing fluency. Mean growth on LNF for the kindergarten students who received HWT instruction (M = 14.67, SD = 10.96) was not significantly different when compared to kindergarten students who did not receive HWT instruction (M = 14.87, SD = 13.030) when controlling for writing fluency. Despite the non-significance of the multivariate test the ANCOVA tables (see Tables 9 & 10) have been provided for reference.

Table 9

Summary Table for the ANCOVA Using FSF Growth as the Dependent Variable, Writing Fluency as the Covariate, and HWT Instruction Status as the Independent Variable

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Fluency</td>
<td>75.839</td>
<td>1</td>
<td>75.839</td>
<td>.654</td>
<td>.420</td>
</tr>
<tr>
<td>HWT instruction status</td>
<td>16.750</td>
<td>1</td>
<td>16.750</td>
<td>.144</td>
<td>.704</td>
</tr>
<tr>
<td>Error</td>
<td>17624.694</td>
<td>152</td>
<td>115.952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50210.000</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10

Summary Table for the ANCOVA Using LNF Growth as the Dependent Variable, Writing Fluency as the Covariate, and HWT Instruction Status as the Independent Variable

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Fluency</td>
<td>147.566</td>
<td>1</td>
<td>147.566</td>
<td>1.022</td>
<td>.314</td>
</tr>
<tr>
<td>HWT instruction status</td>
<td>.150</td>
<td>1</td>
<td>.150</td>
<td>.001</td>
<td>.974</td>
</tr>
<tr>
<td>Error</td>
<td>17624.694</td>
<td>152</td>
<td>115.952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>55901.000</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dependent variable, nonsense word fluency-correct letter sounds and nonsense word fluency-whole words read. The Box's test of equality of covariance matrices \((p=.356)\) indicated there was homogeneity of variance-covariance. The results of the Factorial MANCOVA indicated no statistically significant difference on the combined dependent variables of CLS and WWR between first grade students who received HWT instruction and first grade students who did not receive HWT instruction when controlling for writing fluency, \((F(2, 70) = 2.719, p = .072;\) Pillai’s Trace = .072; partial \(\eta^2 = .072; F(2, 70) = 2.719, p = .072;\) Wilks' \(\Lambda = .928;\) partial \(\eta^2 = .072; F(2, 70) = 2.719, p = .072;\) Hotelling’s Trace = .078; partial \(\eta^2 = .072; F(2, 70) = 2.719, p = .072;\) Roy’s Largest Root = .078; partial \(\eta^2 = .072.\))

Mean growth on CLS for first grade students who received HWT instruction \((M = 22.08, SD = 20.47)\) was not significantly different when compared to first grade students who did not receive HWT \((M = 17.24, SD = 18.48)\) when controlling for writing fluency. Mean growth on WWR for first grade students who received HWT instruction \((M = 8.30, SD = 7.44)\) was not significantly different when compared to first grade students who did not receive HWT instruction \((M = 3.081, SD = 8.28)\) when controlling for writing fluency. Despite the non-significant of the multivariate test the ANCOVA tables have been provided (Tables 11 & 12).

Table 11

Summary Table for the ANCOVA Using CLS Growth as the Dependent Variable, Writing Fluency as the Covariate, and HWT Instruction Status as the Independent Variable

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Fluency</td>
<td>282.065</td>
<td>1</td>
<td>282.065</td>
<td>.739</td>
<td>.393</td>
</tr>
<tr>
<td>HWT instruction status</td>
<td>616.052</td>
<td>1</td>
<td>616.052</td>
<td>1.615</td>
<td>.208</td>
</tr>
<tr>
<td>Error</td>
<td>27089.503</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56413.000</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 12

*Summary table for the ANCOVA using WWR growth as the Dependent Variable, Writing Fluency as the Covariate, and HWT instruction status as the Independent Variable*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Fluency</td>
<td>109.070</td>
<td>1</td>
<td>109.070</td>
<td>1.779</td>
<td>.187</td>
<td>.024</td>
</tr>
<tr>
<td>HWT instruction status</td>
<td>337.964</td>
<td>1</td>
<td>337.964</td>
<td>5.512</td>
<td>.022</td>
<td>.072</td>
</tr>
<tr>
<td>Error</td>
<td>4353.416</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56413.000</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .123 (Adjusted R Squared = .99)

**Research Question 4**

Is there a significant difference in improvement on the Screener of Handwriting Proficiency (SHP) scores of students who received HWT instruction between District A and District B?

A repeated measures Factorial ANOVA was run to determine if there was a significant difference in improvement on the SHP scores of students who received HWT instruction between District A and District B. The Screener of Handwriting Proficiency Score served as the pretest and posttest dependent variable. The independent variable was District A or District B. The descriptive statistics for the SHP data obtained from participants is presented in Table 13. The table contains the Means, Standard Deviation, and Frequencies for Handwriting Legibility as measured and reported in SHP scores by HWT instruction status and District.

Box's test of equality of covariance matrices (p=.066) indicated there was homogeneity of variance-covariance. The results of the multivariate test of effects between time and District on the SHP score tests indicated statistically significant interaction between HWT instruction and District, \( (F(1, 149) = 36.455, p < .001; \) Pillai’s Trace = .197; partial \( \eta^2 = .197; \) F(1, 149) = 36.455, p < .001; Wilks' \( \Lambda = .803; \) partial \( \eta^2 = .197; \) F(1, 149) = 36.455, p < .001; Hotelling’s Trace = .245;
Table 13

Means and Standard Deviations for SHP Score by District and Time for Students Who Received HWT Instruction

<table>
<thead>
<tr>
<th>SHP score</th>
<th>District A</th>
<th>District B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HWT</td>
<td>HWT</td>
<td>HWT</td>
</tr>
<tr>
<td>Time 1</td>
<td>M 71.80</td>
<td>M 83.09</td>
<td>M 77.41</td>
</tr>
<tr>
<td></td>
<td>SD 9.82</td>
<td>SD 9.68</td>
<td>SD 11.25</td>
</tr>
<tr>
<td></td>
<td>n*76</td>
<td>n*75</td>
<td>n*151</td>
</tr>
<tr>
<td>Time 2</td>
<td>M 86.05</td>
<td>M 90.12</td>
<td>M 88.07</td>
</tr>
<tr>
<td></td>
<td>SD 8.89</td>
<td>SD 7.26</td>
<td>SD 8.34</td>
</tr>
<tr>
<td></td>
<td>n*76</td>
<td>n*75</td>
<td>n*151</td>
</tr>
</tbody>
</table>

*Represents the participants from the random sample with complete data sets between districts.

partial \( \eta^2 = .197 \); \( F(1, 149) = 36.455, p < .001 \); Roy’s Largest Root = .245; partial \( \eta^2 = .197 \). District A had significantly higher mean growth than District B (MD = 7.68, \( p < .001 \)). There was a significant linear relationship between pre-test and post-test and District \( F(1, 149) = 36.455, p < .001 \), partial \( \eta^2 = .197 \) as presented in Table 14. There were statistically significant changes in SHP over time between Districts.

Table 14

Summary Table for the Repeated Measures Factorial ANOVA Using SHP as the Dependent Variable with District and Time as the Independent Variables

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>( p )</th>
<th>Partial ( \eta^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>4451.857</td>
<td>1</td>
<td>4451.857</td>
<td>33.205</td>
<td>.000</td>
<td>.182</td>
</tr>
<tr>
<td>Error</td>
<td>19976.997</td>
<td>149</td>
<td>134.074</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Question 5

Research Question 5: How do teacher perceptions influence handwriting instruction in the classroom?
The Survey of Teacher Perceptions containing five open-ended questions (Appendix D) was developed to answer research question 5. The survey was distributed to the teachers of the classrooms participating in the study. A total of 32 teachers received the survey, 16 kindergarten teachers and 16 first grade teachers. Twelve of the 32 teachers responded.

Qualitative data were reviewed, examined, and coded. Grounded theory, open coding, axial coding and thematic analysis were used for analysis of qualitative survey data. Emerging themes were identified and are presented below; discussion of responses will be presented in chapter 5.

Representative responses from thematic analysis revealed “a positive trend demonstrating a positive perception of the importance of handwriting instruction”, asserted beliefs that “handwriting instruction impacts student learning.” Teachers noted challenges with implementation stating, “There is not enough time available to teach handwriting.”

Survey Question 1

Do you believe handwriting instruction is important for students? Please explain why or why not.

Results of Question 1 revealed that 12 of 12 (100%) respondents reported that they believe that handwriting instruction in important. Two of the 12 (17%) respondents asserted that they believe handwriting instruction is “Very Important” with one of the 12 (8%) respondents asserting that handwriting instruction is “imperative.” Neatness and prevention of bad habits were mentioned in 9 of 12 (75%) responses. Demonstration of knowledge for communication of learning success was mentioned but presented in various forms throughout the individual responses.
Survey Question 2

Do you believe that you are adequately prepared to effectively teach handwriting in the classroom? Please explain why or why not.

Results of Question 2 with information about teacher preparation to effectively teach handwriting revealed that 12 of 12 (100%) of teachers feel adequately prepared. Seven of the 12 (58%) stated, despite being adequately prepared, they did not have time to provide handwriting instruction to their students. Comments such as “I have to bump out other guided reading or writing lessons to effectively teach it (Handwriting)…” were provided as reasons for not having enough time.

Survey Question 3

In what ways do you believe handwriting instruction impacts student learning? Please list as many as you can think of.

Question 3 inquired about the impact of handwriting instruction on student learning. Answers were provided by 12 of 12 respondents and used for analysis to address the research question. Analysis reveals that student academic success, student confidence and self-esteem, and students’ eye-hand coordination and fine-motor skills are the top 3 main areas impacted by handwriting instruction.

Survey Question 4

How do you currently teach handwriting to students in your classroom? Please describe the amount of time, curriculum used (if any), and instructional strategies used.

Question 4 investigated handwriting instructional practices currently used in the classroom. All responses from Question 4 were analyzed and reveal two
main themes, Lack of Time for teaching handwriting on a daily or ongoing basis and Varied Teaching Practices.

Comments were provided that expressed time and noted the lack of time available for delivering handwriting instruction on a daily or ongoing basis within the classroom setting. Six of 12 teachers (50%) stated that they “review” letters and letter formations at the beginning of the year. One of the six teachers wrote, “At the beginning of the year, the lessons are about 20 minutes long, every day. In the spring, other demands make instructions very sporadic.” Two teachers (17%) noted that handwriting lessons are completed daily. Two teachers (17%) commented that Handwriting lessons are completed two to three times per week in the classroom. One teacher (8%) commented that writing is done daily in the context of a writing program (Steve Dunn); however this did not address specific letter formation or handwriting instruction. Three of the 12 teachers did not provide information about frequency of instruction; one of those three noted that they wish there was more time in the day but asserted that there was not.

Eight of the 12 respondents provided comments with mention of a curriculum. Six teachers noted using the HWT Curriculum, two teachers described a combined approach with two or more elements from other curricula, two teachers (17%) named a writing curriculum (Steve Dunn and Superkids), however, did not specify a particular “handwriting” curriculum.

Minimal information was provided about specific teaching strategies or approaches. A breakdown of noted strategies is provided in Table/Figure. Responses from this question illustrate a variety of strategies and approaches with low levels of consistency in methodology, approach, or frequency.
Survey Question 5

*Survey Question 5:* Please write any additional thoughts you may have about handwriting instruction.

Question 5 provided an opportunity for respondents to provide any additional comments or thoughts regarding handwriting instruction. Two main themes emerged from teacher comments, Instructional Time and “When & Who” meaning at what instructional level or who should be responsible for teaching handwriting.

Time is mentioned in 5 of 10 (50%) responses. Time was directly stated as a limitation in three of the five comments. One teacher stressed “more and more demands on teacher and student time has made it very difficult to teach those foundational skills that are so important for a child’s continuing education” and another respondent commented “I wish it (handwriting) would become more of a focus. …I do not think that is happening because teachers are b– loaded with other responsibilities.” Two of the five comments were made without direct reference to time as a limitation however they noted that “I enjoy HWT and my students do too…have really helped my students” and “I have been very pleased with the Handwriting Without Tears program. My only wish is that I could have started sooner. I feel that starting this program during the first week of kindergarten would have made a huge impact in my students’ handwriting. Even still, my students have made a lot of progress and have had less reversal since doing the program.” These comments indicate that teachers have noticed improvement for their students as a result of making time for handwriting instruction.

When and Who were referenced in regard to instructional level or who should be teaching handwriting in 5 of 10 (50%) respondents who commented on this question. Three of the comments noted that handwriting instruction should
begin early and additional comments about who should be teaching handwriting is found in three comments. Two of the five comments contained both when and who in the same comment. As a general statement, this theme contains statements noting that handwriting instruction should begin early, at home and in Pre-school, and needs to be taught in early Kindergarten as well as first grade since not all students attend Pre-school. One comment read “it is undeniable that handwriting instruction must precede more complex writing tasks” and another indicated “First grade should teach formal handwriting and second grade should build on it” and a separate respondent declared “Handwriting instruction begins at home, at a very young age. Parents need to know how to teach their children to hold a pencil/Crayon marker, etc.” These comments reveal a mixed set of opinions about whose responsibility it is and at what time handwriting should be addressed in the curriculum.

Synthesis of Themes

The synthesis of responses to questions 1-5 revealed three overall themes: Time, Implementation and Responsibility.

The first recurrent theme presented in responses for questions 1-5 was Time. Teachers feel as though there is not enough time available for handwriting instruction within the educational day despite the asserted beliefs that handwriting instruction is important, and that it serves as a critical foundation for student learning, a student’s demonstration of knowledge, student’s communication abilities, and individual self-esteem. A comment by a respondent sums it up, “It is a valuable use of time but the pace of instruction has increased so much that it does not give ample time to develop.”

A second theme presented in responses for questions 1-5 was Implementation. Although 100% of respondents reveal that they are adequately
prepared to teach handwriting, a pattern of inconsistent instructional practices is revealed. Instructional practices were noted to involve assorted materials that varied by teacher, different instructional strategies, and varied frequencies. This theme is evidenced by a teacher comment noting their eclectic approach to handwriting instruction, “We have Superkids and I love the writing paper with the ice cream lines. I have been trained in Handwriting Without Tears that I use… along with my D’Nealian training.”

The third theme illuminated throughout the respondent remarks for questions 1-5 was Responsibility. Responsibility for handwriting instruction was woven into many comments with two categories emerging: “who” should teach handwriting and “when” handwriting should be taught to students.

Responses demonstrated controversy over when and who holds instructional accountability for handwriting. Perceptions about who should teach handwriting and when it should be taught are spread across a continuum. Some believe that handwriting should be taught before a child enters school and others commented that handwriting instruction has a place in the primary grades. Who is supposed to teach handwriting is presented as an individual opinion, with views of instructional duty falling on different people from parents to various levels of elementary educators.

Predominantly, respondents are unclear about who should teach handwriting, how it should be taught, and when it can be a priority to take up time in the educational day however all respondents agree that handwriting instruction is important. An illustrative comment from a respondent noted,

*More and more demands on teacher and student time has made it very difficult to teach those foundational skills that are so important for a child’s continuing education... Neglecting handwriting in favor of a six-year-old learning the difference between articles and demonstrated determiners and properly producing possessive nouns is a great disservice.*
Findings of the survey of teacher perceptions generally revealed a contradictory relationship between perceived importance and instructional practices.

**Summary**

Findings from this study are mixed between analyses that examined measures of handwriting and measures of student academic achievement.

**The Results Suggest**

**Research Question 1.** There was a significant difference between students who received HWT instruction and students who did not receive HWT instruction on measures of Written Literacy from Writing Prompt scores in the areas of Words Spelled Correctly (WSC) and Number of Ideas Expressed (NIE). There was no statistically significant difference in scores on the Written Literacy measure from Writing Prompt scores for Total Number of Words written (TNW) between students who received HWT instruction and students who did not receive HWT instruction.

**Research Question 2.** There was a significant difference in improvement of handwriting legibility between students who received HWT instruction and students who did not receive HWT instruction. Students who received HWT instruction demonstrated significantly greater improvement in legibility as measured by the Screener of Handwriting Proficiency (SHP) as compared to students who did not receive HWT instruction.

**Research Question 3.** There was not a significant difference between students who received HWT instruction and those who did not receive HWT instruction on growth of the four DIBELS measures (First Sound Fluency (FSF),
Letter Naming Fluency (LNF), Nonsense Word Fluency-Correct Letter Sounds (CLS), or Nonsense Word Fluency-Whole Word Reading (WWR) measures).

**Research Question 4.** The results of the repeated measures Factorial ANOVA demonstrated a significant improvement on the Screener of Handwriting Proficiency (SHP) Score of students who received HWT instruction between Districts. Students in District A demonstrated significantly greater improvement on SHP score than students in District B.

**Research Question 5.** The three major themes emerged regarding teacher perceptions of the importance of handwriting instruction for student learning. The three themes of Time, Implementation and Responsibility emerged. Respondents are clear that there is not enough time to prioritize handwriting instruction and vary in their perceptions of whose responsibility it is to teach handwriting to students that results in uncertainty about when handwriting instruction should begin for students to be successful.

This chapter presented an analysis of the data and relationships among the presented variables. The next chapter, chapter 5, presents a discussion of these findings, conclusions that have been drawn as related to the research questions, implications related to handwriting instruction and student achievement, implications for educators, policy, and instructional practices, in addition to suggestions for future research.
CHAPTER 5: DISCUSSION

Chapter 5 discusses conclusions that have been drawn from the findings related to the research questions presented in chapter 4. The findings are discussed in relationship to their implications related to handwriting instruction and student achievement. Additionally, suggestions for further research and limitations of the study are included.

Purpose of the Study

The primary purpose of this study was to examine effects of handwriting instruction on student learning. This study sought to investigate the effectiveness of the use of a formal handwriting instructional curriculum on handwriting skills, literacy, and written literacy skills of developing writers. Additional information was gathered on teacher perceptions of participating K-1 elementary school teachers in regard to handwriting instruction in today’s classroom to further inform the findings of this research.

Specifically, this study investigated the effects of using the Handwriting Without Tears Program (HWT; a multi-sensory handwriting curriculum), as instructional curriculum that was embedded in the teaching practices and routine of the educational school day, on handwriting skills (transcription skills, writing fluency, writing speed, legibility), elements of literacy (reading, phonics, written literacy, and spelling), and informed by perceptions of K-1 classroom teachers regarding handwriting instruction.

A secondary purpose of this study was to add to the body of research regarding educational instructional practices for the purpose of informing policy decisions, educational pedagogy, and classroom instruction for maximizing student achievement.
Review of Methodology

The study utilized a mixed methods design. The Screener of Handwriting Proficiency (SHP) provided pre-test/post-test measures of handwriting ability and Dynamic Indicators of Basic Early Literacy Skills (DIBELS) component measures of First Sound Fluency (FSF), Letter Naming Fluency (LNF), Nonsense Word Fluency- Correct Letter Sounds (CLS), and Nonsense Word Fluency-Whole Word Reading (WWR) scores provided pre-test / post-test measures of literacy and reading and were used for qualitative data. Additional quantitative data were collected using the Alphabet Task (AT) as the outcome measure of writing fluency and the Writing Prompt Activity as the outcome measure of written literacy with Total Number of Words Written (TNW), Words Spelled Correctly (WSC), and Number of Ideas Expressed (NIE). The Survey of Teacher Perceptions provided qualitative data that was utilized to inform findings and provide context for the study. The Variables in the study examined handwriting ability (SHP), literacy (DIBELS: FSF, LNF, CLS, WWR), writing fluency (AT), and written literacy (Writing Prompt- TNW, WSC, and NIE), time, and teacher perceptions.

Independent variables for this study included students receiving HWT instruction and students not receiving HWT instruction, and students attending District A or District B.

Students were randomly selected \(n=320\) for data analysis from the total population of students \(n=789\) due to the unequal group sizes between the control and intervention groups. Student data from the two school districts were collected for data analysis. Students were coded with a numerical value for selection with a random number generator. Student work samples for the SHP, AT, and Writing Prompt were scored by a single examiner trained in scoring the respective measures and entered into a data set of scores containing each student’s DIBELS
Scores for each measure were analyzed to address the four research questions. The actual sample size for each individual question varied from the random sample of 320 due to seven students having missing or incomplete data. Additionally, DIBELS measures were administered differently between grade levels and between districts and impacted the final sample size values used to answer research question four. Data from the electronic survey of teacher perceptions \((n=12)\) were analyzed and coded to produce emergent themes.

**Statement of the Problem**

There is an educational emphasis on improving student achievement in today's modern education systems with a concentrated focus on developing students who are “College and Career Ready” and who can demonstrate “21st century skills” (Dombek & Al Otaiba, 2016; Kent et al., 2014). The Common Core State Standards are placing a new level of importance on writing with emphasis on the generation of written production that demonstrates proficiency with multiple forms of writing including narrative, informative/explanatory, and critical analysis/argumentative styles (Common Core State Standards Initiative, 2010). Despite the increased focus on writing processes and outcomes, standards for the production of writing, specifically, handwriting standards are non-existent (Troia, & Olinghouse, 2013). The standards for writing letters and numbers are vague and lack detail regarding the foundational elements for teaching the process or act of handwriting (Jones & Hall, 2013). The lack of specific standards regarding handwriting leaves decision makers and educators uninformed about the importance of allocating instructional time for handwriting (Santangelo & Graham, 2016). As a result, handwriting is being left out of the curriculum and taught as an afterthought or as a minimal element combined with language arts
curricula (Asher, 2006; Denham, 2006; Graham et al., 2008; Jones & Hall, 2013; Lifshitz & Har-Zvi, 2015; Puranik et al., 2014).

Although technology has made an increasingly large footprint in classrooms and educational systems, handwriting remains a primary occupation for elementary school students (McMaster & Roberts, 2016). Handwriting is a complex activity requiring the integration of several neurological processes (Richards et al., 2009). Principles of neurology and psychology underpin the integration of motor development, motor learning, working memory, executive functioning, and cognitive load theory that must not be overlooked when providing consideration for instructional practices of teaching and learning. Researchers have demonstrated complexity of these neuropsychological underpinnings involved in the act of handwriting (Berninger & Amtmann, 2004; Burdin & Fayol, 2000; Medwell & Wray 2014; Medwell et al., 2009). Research has demonstrated that increased automaticity with the foundational processes of handwriting resulted in increased fluency with text production (Medwell & Wray, 2014). Increased fluency with handwriting has been demonstrated to decrease the cognitive load (McCutchlen, 2000) and increased working memory to be available for higher level thinking skills for composition and production of written knowledge (Berninger, 2000; Berninger & Amtmann, 2004; Gathercole et al., 2004; Tucha, Tucha, & Lange, 2008).

Handwriting is a foundational skill that is no longer being given appropriate instructional attention to support students in learning for maximal achievement. The limited availability of research on the impact of handwriting instruction and the link to student learning is slight and insufficient to inform educators regarding current instructional practices. There has been no substantial evidence in the literature to link handwriting, daily instructional routines, student achievement and
specific learning outcomes; the problem has not been well established in the existing educational literature (Pfeiffer et al., 2015).

This study served to inform educators about the instructional elements to be considered worthy of premium instructional time in the classroom to support literacy skills and build a strong foundation for future academic success.

**Discussion of Research Questions**

**Research Question 1**

Is there a significant difference on Writing Prompt Scores (TNW, WSC, NIE) between students receiving HWT curriculum instruction and those students not receiving HWT instruction?

The results of the MANOVA indicated that there was a significant difference on Written Literacy measures on the Writing Prompt Scores between students receiving handwriting instruction using the HWT curriculum and those students not receiving HWT curriculum instruction. Writing Prompt scores were significantly higher for students receiving HWT instruction in the areas of Words Spelled Correctly (WSC) and Number of Ideas Expressed (NIE) between students receiving HWT instruction and those students who were not receiving HWT instruction. Results approached significance for Total Number of Words written (TNW) with the students of the HWT instruction group demonstrating a higher mean score than the students who did not receive HWT instruction, however there was no statistically significant difference in Writing Prompt scores for TNW between students receiving HWT instruction and those students who were not receiving HWT instruction.

These results are consistent with theoretical propositions and existing research reviewed finding that handwriting and transcription skills are
foundational and make a significant contribution to writing development for emergent writers (Berninger et al., 1992; Graham et al., 1997; Graham & Harris, 2000; Puranik & Al Otaiba, 2012; Roessingh & Elgie, 2014; Tucha et al., 2008).

The results are unique in that this is the first study to examine the effect of classroom instructional practices on writing performance of young, emergent writers. Previous research has focused on handwriting instruction as an intervention for identified groups of struggling students and has revealed significant improvements in handwriting that has improved written expression for developing writers (Jones & Christensen, 1999; Pfeiffer et al., 2015). In this study, these findings suggest that classroom practices incorporating a multi-sensory handwriting curriculum on an ongoing basis can support the development of foundational skills for written expressions of ideas and spelling in emergent writers at the kindergarten and first grade level. The importance of these results highlight and contribute to the theory that handwriting is causal in learning to write for young developing writers (Berninger et al., 2002; Graham et al., 2000; Graham & Harris, 2016; Jones & Christensen, 1999; Medwell & Wray, 2014; Santangelo & Graham, 2016).

Research Question 2

Is there a significant difference in improvement between handwriting legibility scores of students who received HWT instruction and students who did not receive HWT instruction?

The results of the repeated measures ANOVA demonstrated a significant difference in improvement of handwriting legibility between students receiving HWT instruction and those students not receiving HWT instruction. Students who received HWT instruction demonstrated significantly greater improvement in
legibility as measured by the SHP as compared to students who did not receive HWT instruction.

Specifically these results hold relevance within the sample in that students who received HWT instruction demonstrated significantly improved legibility as compared to those students who did not receive HWT instruction. The measure of legibility (Screener of Handwriting Proficiency, SHP) encompassed aspects of letter memory, orientation, placement, and sentence writing skills. Each of these skills is important for written production. The findings of this study are consistent with previous investigations by Berninger et al. (1997) and Jones and Christensen (1999).

Explicit handwriting instruction focused on accuracy and legibility for efficiency with production. Fluency of letter writing increases the probability of becoming a skilled writer and is a predictive variable for future writing success as well as preventing writing difficulties for early writers (Graham et al., 2000; Medwell & Wray, 2014; Tucha et al., 2008). The findings of this study align with findings in previous studies and provide rationale for educators to consider classroom instructional practices regarding handwriting instruction (Pfeiffer et al., 2015). Handwriting instruction delivered as a focused curriculum with specific emphasis on letter formation can promote writing development and prevent writing difficulties for developing writers (Berninger et al., 1997; McCutchen, 1996).

**Research Question 3**

Is there a significant difference in learning outcomes as measured by DIBELS scores between students who received HWT instruction and students who did not receive HWT instruction when controlling for writing fluency?
The results of the MANCOVA indicated no statistically significant difference on the combined dependent variables of First Sound Fluency (FSF) and Letter Naming Fluency (LNF) between those kindergarten students who received HWT instruction and students did not receive HWT instruction when controlling for the covariate of the writing fluency on the combined dependent variables First Sound Fluency (FSF) and Letter Naming Fluency (LNF). Additionally, results of the MANCOVA indicated no statistically significant difference on the combined dependent variables of Nonsense Word Fluency-Correct Letter Sequence (NWF-CLS) and Nonsense Word Fluency-Whole Words read (WWR) between those first grade students who received HWT instruction and first grade students who did not receive HWT instruction when controlling for the covariate of the writing fluency on the combined dependent variables, Correct letter sounds (CLS) and Whole Word Reading (WWR).

Previous research found phonological awareness and vocabulary accounted for no variance the writing performance of young children (Puranik & Al Otaiba, 2012). The findings of this study support and contribute to the body of literature that emphasizes handwriting as driven by a separate neurological pathway (Berninger et al., 2002) and supports the assertion that handwriting is worthy of separate instructional attention (without placing or combining into a phonics or reading curriculum) in effort to support the development of transcription skills to develop young emergent writers. These findings further support the need for a separate, handwriting instruction lesson. The combination of handwriting as an element of a phonological awareness or reading curriculum is cautioned against (Armitage & Ratzlaff, 1985; Berninger et al., 2002; Berninger et al., 2006; Graham et al., 1997; Graham et al., 2000; Hammerschmidt & Susawad, 2004).
In this case, the Alphabet task was used as the measure of writing fluency. Research asserts that handwriting becomes automatic, organized, and readily available as a tool between the ages of 8 years to 9 years of age; participants for this study were younger and within age range of 5 years to 7 years of age. The lack of established automaticity as a result of developmental levels of the study population may have had an impact on findings.

The findings of this study support the need for continued research to investigate the relationships between writing and reading systems. Research by Berninger et al. (2002) revealed significant relationships in predicting transcription from word recognition with significance presented with handwriting and spelling as the covariate, predicting success with word recognition. The asymmetrical relationship of handwriting and word recognition is asserted with significance demonstrated in the direct path from handwriting to word recognition for second grade students.

Writing fluency was not found to constrain measures of Literacy in this study. The current findings do not support the findings of Berninger et al., (2002) where the covariance for handwriting and spelling with word recognition was significant and bidirectional. Berninger et al. (2002) findings suggest that an asymmetrical relationship exists between word recognition and handwriting with that is significant for students in the second grade. The implications of findings here, though not significant, suggest that more research needs to be done in this area, specifically with practical application of handwriting instruction in the classroom.
Research Question 4

Is there a significant difference in improvement on the Screener of Handwriting Proficiency (SHP) scores of students who received HWT between District A and District B?

The results of the repeated measures factorial ANOVA demonstrated a significant in improvement on the Screener of Handwriting Proficiency (SHP) score of students who received HWT instruction between Districts. Students in District A demonstrated significantly greater improvement in SHP than students in District B.

The results of this exploratory research question reveal differences in handwriting legibility of students receiving HWT intervention between the two districts and aligns with existing research findings by Fitzpatrick et al. (2013) revealing that the amount of handwriting improvement in kindergarten students was dependent upon instructional practices.

While teachers did not log or track the time spent on HWT instruction, District A implemented the curriculum school wide, across all 3 kindergarten and 3 first grade classrooms. The teachers collectively met, as a combined group and as a grade level group to discuss the implementation process. District A utilized a methodological approach to implementation aligned with deployment during the English language Arts (ELA) block where students are grouped based on ELA proficiency. The administration of the school site in District A was aware and in support of HWT implementation in addition to the principal attending the HWT training.

District B was organizationally different in that the two schools were each a complete grade level. Teachers of District B schools voluntarily participated to implement HWT instruction therefore not all teachers of a single site were
implementing HWT. There were a small number of teachers choosing to implement HWT instruction at each of the District B schools; 2 of 10 teachers at school 1 and 3 of 10 teachers at school 2. Collaboration and instructional alignment between teachers was not reported in relation to HWT. Teachers did not report meeting as a group for those who chose to implement the HWT curriculum. Administrative personnel were not present for the training and the level of involvement or support for HWT implementation is unknown.

Both Districts were provided with training, all curriculum materials, and a sequenced curriculum map so implementation could be completed equally. It is possible that the differences between districts were due to the differences in implementation and professional learning community with strategic implementation that was supported by actively engaged administration. These exploratory findings substantiate the need to analyze implementation and teaching practices to further understand the underpinnings of effective handwriting instruction using the HWT curriculum.

Research Question 5

Research Question 5: How do teacher perceptions influence handwriting instruction in the classroom?

Qualitative analysis of the data received from the Survey of Teacher Perceptions revealed three major themes regarding teacher perceptions of the importance of handwriting instruction for student learning. The three themes that emerged were: Time, Implementation, and Responsibility.

Teacher respondents were united in their belief that handwriting is important, however their individual reasons underlying importance varied. Despite the unanimous belief that handwriting is important, respondents indicated that there was not enough time to prioritize handwriting instruction. The identified
theme of “Time” underpins the other two themes of Implementation and Responsibility. Teacher perceptions regarding the lack of “Time” as a limitation is woven into and included as part of perceptions regarding whose responsibility it is to teach handwriting to students and contributes to the ambiguity about when handwriting instruction should begin so that students can be successful. If teachers believe that there is not enough time to address handwriting and they believe it is an important skill, students need to come prepared with handwriting skills already established. As a result, students would then learn handwriting earlier (Prior to kindergarten or first grade) and receive the instruction from someone other than the kindergarten or first grade teacher.

From the common assertion that handwriting is important and has an impact on student success “Time” was mentioned and used as a rationale to explain “why” there is an inability to provide handwriting instruction within the classroom. This finding begs the question, “If handwriting is important and a valuable use of time, why is handwriting left to the periphery?” Practically speaking, if something was important, we typically find or make time to address it.

Implementation emerged as a theme and perceptions demonstrated varied methods and approaches to handwriting instruction. There are countless demands placed on teachers to meet the multitude educational standards set by Common Core State Standards to prepare students to be “College and Career ready with 21st Century Skills.” These standards do not include specific handwriting standards. As stated by one respondent “Out of the myriad of Common Core standards there is only one small mention of handwriting. L.1.1a: "Print all upper- and lowercase letters." This is part of a standard that lists 10 subheadings, of which the former is only one.” The need for clear, focused, and quality instructional practices has been established in the literature (Armitage & Ratzlaff,
Specific standards delineating important elements of handwriting standards are critical to allow teachers to justify use of precious classroom time to teach and develop foundational handwriting skills required for student success and academic achievement. This has implications for policy and practice to delineate expectations at each grade level.

Policy guides practice and serves to align standards with expectations for students and teachers. Responsibility emerged as an overarching theme from the Survey of Teacher Perceptions. Some respondents noted that it is the responsibility of parents prior to entering school, “Handwriting instruction begins at home, at a very young age. Parents need to know how to teach their children … Many of our students don't attend preschool, and therefore handwriting falls onto the Kinder teachers.” Another respondent asserted, “I wish it (handwriting) would become more of a focus. I feel a child's muscles are more prepared to write correctly in first grade. First grade should teach formal handwriting and second grade should build on it.” Clarity of responsibility and understanding the developmental abilities is essential for teachers to best meet student needs and effectively teach for student success. Teacher education programs must include objectives for teaching teachers about neurobiology of learning in addition to development as a foundation for learning. It is not reasonable to expect students to demonstrate knowledge if they have not been provided with the tools needed to demonstrate that knowledge. Handwriting is a skill that has must be taught (Olsen & Knapton, 2013a, 2013b).

Policies and standards have not provided specific standards for guiding instruction at specific grade levels. Existing literature has suggested that national and state organizations and agencies, such as the National Association for the
Education of Young Children (NAEYC) and state departments of education, assume a position with details regarding the need, standards and expectations for handwriting, skill development, and performance standards (Bliwise, 2013; Case-Smith et al., 2012; Graham et al., 2008). Active, ongoing support from administration is critical for policy and practice to evolve (Hall & Hord, 2006). Policy changes are needed. Being informed by research about the critical link between student achievement and handwriting is required to bridge the discrepancy between instructional practice and perceived importance as revealed by the findings of the Survey of Teacher Perceptions that informed this study.

**Recommendations for Educational Practice**

The results of this study provide evidence of the value of a specific, formal handwriting instructional curriculum implementation in kindergarten and first grade classrooms within the Central Valley of California. The findings of this study can serve as a basis for further discussion and research regarding handwriting and the role of handwriting instruction in the development of written literacy and written production for demonstrating knowledge and maximizing student achievement. The significant findings in this study suggest that handwriting plays a role in a student’s ability to demonstrate thoughts, knowledge and ideas early in their educational career, as early as kindergarten. These findings give rise to posing a question to educators and policy makers: Does handwriting matter?

The significant difference found in students handwriting ability and legibility in conjunction with significantly higher scores on written composition in the areas of Words Spelled Correctly (WSC) and Number of Ideas Expressed (NIE) suggest that implementing an effective handwriting instructional curriculum
is worthy of consideration as an adopted instructional practice that warrants a designated place in the instructional day.

Based upon the discussion of findings and conclusions, recommendations can be made regarding instructional practices in the classroom for developing handwriting skills. It is recommended that administrators and curriculum directors dialogue about and adopt practices based on these findings. The generation of specific handwriting standards in addition to the adoption of a specific handwriting curriculum that effectively teach the skill of handwriting is recommended; avoid the temptation to combine handwriting as an afterthought in conjunction with phonics programs that are not correlated with development of handwriting fluency, automaticity, and legibility.

Policy and educational standards must be considered. Additional discussion must be occur with Local Education Agencies and state legislative officials to consider the revision of education standards. Administrators and teachers look to the educational standards for guiding instructional practice, it is recommended that there be dialogue and discussion regarding the need for specific handwriting standards that provide detail to properly guide instructional practices.

To meet student needs and support academic achievement, Teacher education programs need to include competences for understanding the neurological, biological and developmental underpinnings of learning. It is imperative that educators be aware of the expectations that are being placed upon students and be mindful of human development to ensure students are equipped with the tools and foundational skill set required for moving along the continuum of learning. Placing demands that are misaligned with student abilities and developmental levels can impact student self-esteem and confidence thus leading students to feel like a failure and contribute to school truancy and dropout rates.
The practice implications of teaching handwriting as a direct means of supporting reading development is important for instructional pedagogy and classroom practice. In this case, the students in this study were younger than second grade year therefore a continuation of this study into the second grade year may be of value. Although no significance was present in the findings presented in this study results approached significance for Whole Word Reading (WWR) when Writing Fluency served as the covariate. Future research analyzing instructional implications of the relationship between handwriting and word recognition is warranted.

**Limitations**

There are many issues related to curriculum and instructional practices to consider as limitations for this study.

The timing of the study and duration of HWT instruction was not in alignment with the academic school year. In this study, the teachers were provided with training however, due to timing of various aspects of research, processes, and procedures, the training occurred after the start of the school year. A teacher participant commented,

“I have been very pleased with the Handwriting Without Tears program. My only wish is that I could have started sooner. I feel that starting this program during the first week of Kindergarten would have made a huge impact in my students' handwriting. Even still, my students have made a lot of progress and have had less reversals since doing the program.”

The implementation began after the beginning of the school year and ended in early spring, therefore the findings were based on duration less than the span of a full school year.

Implementation was a limitation. Each teacher was provided with a standard training and provided with all materials necessary to implement HWT
curriculum instruction with fidelity however time constraints and individual teacher characteristics limited frequency and fidelity of implementation. Although teachers reported consistent use with implementation, the same teachers also revealed challenges with carving out designated time within the instructional day. Controlling implementation of any curriculum within individual classrooms was not possible.

Administrative support proved to be a unique limitation. Differences existed between districts with regard to level of interest, implementation, and administrative support. One district principal commented that “handwriting is not a focus and is not something that we teach here, we focus on writing with our language arts curriculum” in a personal communication at the initiation of the study. Administrative support or lack thereof may have had an impact on findings.

The DIBELS measures of literacy that were used for this study offered an additional limitation. Each teacher administers the DIBELS assessments; inter-rater reliability, external validity, and fidelity of administration were unknown to this researcher. Additionally, the testing windows and item administration between districts and school sites was inconsistent and had a possible impact on research findings.

The Central Valley is home to a large population of minority groups with low socioeconomic levels, high Free and Reduced Lunch program recipients, and to students for whom English is a second language. The characteristics of the study population may have been a limitation and may restrict the generalizability of findings.
Future Research

The recommended next steps provide possibilities for continued research and focus on specific aspects of handwriting in addition to longitudinal studies to more fully understand the long-term benefits of handwriting instruction as related to student achievement.

First, this study should be replicated and expanded to include students from additional schools and school districts in the Central Valley, California, or the nation. The addition of specific measures aligned with district benchmark assessments should be considered in conjunction with completion of a study that spans the duration of a complete school year.

Future research that includes an analysis of handwriting instruction and student achievement over the course of an entire school year in addition to longitudinal studies is an area for future research. A longitudinal research design would allow the researcher(s) to capture changes as student developmental and neurobiological processes evolve over time and within the context of learning. Expanding the population to include Preschool and the Transitional Kindergarten populations provides additional opportunities for research in combination with longitudinal investigations.

Research that specifically addresses the impact of handwriting instruction and student achievement with specific populations including demographics, race, gender, socioeconomic status, and English as a primary language (EL) status. Research is needed that provides information for populations that are deemed to be at risk for academic difficulties.

It is recommended that future research investigate classroom instructional practices regarding handwriting instruction with emphasis on implementation and fidelity processes. Information about classroom implementation and instructional
practices will inform educational leaders, administrators, and teacher educators on supporting and educating teachers for effective teaching methodology.

**Concluding Remarks**

Does handwriting matter? This research suggests that it does. As responsible educators and advocates for our students, we must consider the foundations of what we teach and investigate our expectations to ensure our pedagogy, practice, and policy align with the neurobiology of learning for the benefit of our students. We must critically analyze the structures currently in place to determine if systems and processes are aligned to achieve the desired results of student achievement. We must be mindful of what we do and how we do it when we educate our students in order to support their development, success, and prepare them for college and career so to be equipped with a fully integrated set of skills for the 21st century. Make time for formal handwriting instruction and refine standards to support this as a priority in our elementary school curricula.

A quote from Ghandi:

“I saw that bad handwriting should be regarded as a sign of an imperfect education, I tried to improve mine, but it was too late. I could never repair the neglect of my youth. Let every young man and woman be warned by my example, and understand that good handwriting is a necessary part of education.”

Mahatma Gandhi, (1948, p. 13)

I believe that handwriting and handwriting instruction matters. The findings of this study add cause to support this belief.
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psread1.pdf


APPENDIX A: SCREENER OF HANDWRITING PROFICIENCY

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HOW TO ADMINISTER

Get Started - Read the directions to the class. Continue the directions, following the pattern for the next letters or numbers. Do not give students additional verbal cues or visual models.

Say: I will ask you to write some letters and numbers. Do not write anything until I ask you to. At the top, write your name beside the smiley face. [Wait until after the screening to fill in the date.]

Capital Letters
Say: Point to the turtle on the top line. [Check students]
Do you see capital letter T under the turtle?
I want you to write a capital letter under every picture.
I will say the picture and the letter. Wait for me to say the letter.
Do you see the owl? Write the capital O on the line below.

Continue: Fish - F Wagon - W Banana - B Snail - S Key - K Nose - N Rake - R

Numbers
Say: Find the line with the boxes.
Point to number 1 under the first box. [Check students]
I want you to write a number under every set of boxes.
I will say the number. Wait for me to say the number.
Do you see the two boxes? Write 2 on the line below.

Continue: 3 4 5 6 7 8 9

Lowercase Letters
Say: Point to the line with the rabbit. [Check students]
Do you see the lowercase e under the rabbit?
I want you to write a lowercase letter under every picture.
I will say the picture and the letter. Wait for me to say the letter.
Do you see the eagle? Write a lowercase e on the line below.

Continue: nail - n ant - a dog - d hat - h goat - g yarn - y plane - p

Sentence - Sentence writing is not an entry level expectation. Wait until mid-year to assess.

Say: I want you to write a sentence on the bottom line next to the smiley face. There are three words. Wait for me to spell the words. [Do not give capital, spacing, or punctuation clues.]

The 1st word is he Write he, h - e
The 2nd word is can Write can, c - a - n
The last word is hop Write hop, h - a - p
This is the end of the sentence.

When finished, say: Now, turn over your paper.

Collect papers; mark the Student Sheet to indicate screening date.

Tips for Screening:

☐ Administer in a room with no letter displays or turn desks away from letter displays.
☐ Use privacy folders to prevent copying.
☐ Guide students as needed by pointing.
☐ Keep students on track: wait for responses to "Do you see..." questions.
☐ Use pencils only.
☐ If time allows, administer in smaller groups.

Kindergarten Student Sheet

Kindergarten Answer Key

What's next?

☐ Download the Scoring Packet from hwtears.com/screener.
# PRINTING CONCERNS CHECKLIST

Place a check mark for each concern noted. Refer to the key below or scoring packets for identifying information and guidance.

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<th>Last Name</th>
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<th>Formation</th>
<th>Size</th>
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**Formation** - Starts at the bottom or writes out of order  
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**Pencil Grip** - Has awkward grip  
**Helper Hand** - Does not use hand to hold paper  
**Other** - Exhibits cognitive, physical, language, or attention issues

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www.hwtears.com/screener | Kindergarten 4
Screener of Handwriting Proficiency

Administration Packet - 1st

The Screener of Handwriting Proficiency is designed for educators and specialists to help them assess critical and measurable skills that students need for success. The Screener is quick and easy to administer, and you can use it for individuals and whole groups to get valuable performance outcomes and to plan for intervention.

- Identify children who need intervention early in the year.
- Inform and focus handwriting instruction.
- Generate reports that show what students need.
- Remediate and close the achievement gap.

The Screener works with all handwriting curricula and with any type of instruction. Use independently or as part of a Response to Intervention (RTI) model. For best results, administer the Screener three times a year to monitor progress.

Let’s get started:
- Review this Administration Packet.
- Copy the Student Sheet.
- Prepare the Concerns Checklist.
- Administer the Screener.
HOW TO ADMINISTER

Get Started • Read the directions to the class. Continue the directions, following the pattern for the next letters or numbers. Do not give students additional verbal cues or visual models.

Say: I will ask you to write some letters and numbers. Do not write anything until I ask you to. At the top, write your name beside the smiley face. (Wait until after the screening to fill in the date.)

CapitalLetters
Say: Point to the turtle on the top line. (Check students) Do you see capital letter T under the turtle? I want you to write a capital letter under every picture. I will say the picture and the letter. Wait for me to say the letter. Do you see the owl? Write the capital O on the line below.
Continue: Fish · F Wagon · W Banana · B Snail · S Key · K Nose · N Rake · R

Numbers
Say: Find the line with the boxes. Point to number 1 under the first box. (Check students) I want you to write a number under every set of boxes. I will say the number. Wait for me to say the number. Do you see the two boxes? Write 2 on the line below.
Continue: 3 4 5 6 7 8 9

Lowercase Letters
Say: Point to the line with the rabbit. (Check students) Do you see the lowercase r under the rabbit? I want you to write a lowercase letter under every picture. I will say the picture and the letter. Wait for me to say the letter. Do you see the eagle? Write a lowercase e on the line below.
Continue: nail · n ant · a dog · d hat · h goat · g yarn · y plane · p

Sentence
Say: I want you to write a sentence on the bottom line next to the smiley face. There are four words. Wait for me to spell the words. (Do not give capital, spacing, or punctuation clues.)
The 1st word is dogs Write dogs, d · a · g · s
The 2nd word is have White have, h · a · v · e
The 3rd word is four Write four, f · o · u · r
The last word is legs Write legs, l · e · g · s
This is the end of the sentence.

When finished, say: Now, turn over your paper. Collect papers; mark the Student Sheet to indicate screening date.

Tips for Screening:
☐ Administer in a room with no letter displays or turn desks away from letter displays.
☐ Use privacy folders to prevent copying.
☐ Guide students as needed by pointing.
☐ Keep students on track; wait for responses to “Do you see...?” questions.
☐ Use pencils only.

1st Grade Student Sheet

1st Grade Answer Key

What's next?
☐ Download the Scoring Packet from hwtears.com/screener.
# PRINTING CONCERNS CHECKLIST

Place a check mark for each concern noted. Refer to the key below or the scoring packets for identifying information and guidance.

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<th>Formation</th>
<th>Size</th>
<th>Neatness</th>
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APPENDIX B: WRITING PROMPT

Writing Prompt: Written Expression

Writing Prompt:

The task will be introduced and the students will be oriented to task expectations through a brief group discussion.

- Kindergarten prompt: “You have been in kindergarten for almost a whole year. Today we are going to write about kindergarten. Let’s think about what you enjoyed about being in kindergarten. What did you learn in school? Did anything special happen to you in kindergarten?”

- First Grade: “You have been in first grade for almost a whole year. Today we are going to write about first grade. Let’s think about what you enjoyed about being a first grader. What did you learn in school? Did anything special happen to you in First Grade?”

Students will be provided with paper and instructed to keep writing until told to stop. The following script will be used:

“If you get to a word you do not know how to spell, sound it out and do your best. I’m not going to help you with spelling today. If you make a mistake, cross out the word and keep writing. Don’t erase your mistake. Keep writing until I say stop.”

Students will have 15 minutes to complete the task. If students stop writing before the end and they will not be forced to continue.

All of the writing samples will be read to ensure that they can be understood. In case of doubt, either due to illegible writing or incorrectly spelled words, the students will be asked to read their samples. The administrator will write the word below the word to clarify each word the student intended for incorrect spelling or illegible word(s) written by the student.

The variables (widely used by researchers when measuring productivity in written language and measured with CBM-W) will be calculated from children’s writing samples:

(a) Total number of words written (TNW)

(b) Words spelled correctly (WSC)

(c) Number of ideas expressed (NIE)


Permission obtained via email
APPENDIX C: ALPHABET TASK

Alphabet Task: Handwriting fluency

Directions: "We’re going to play a game that will show me how well and quickly you can write your abc’s. First, you will write the lowercase of small abc’s as fast and carefully as you can. Don’t try to erase any of your mistakes, just cross them out and go on’’.

The examiner demonstrates writing lower case letters a, b, c. They also demonstrate making a mistake by writing "A” and crossing a line through it on the board. They ensure that everyone follows the instructions by asking the students if they have any questions. Then continue with the remaining directions…

“When I say ready begin, you will write the letters. Keep writing until I say stop. Ready, begin.”

Wait for exactly 60 seconds then state the following directions:

“Stop and put down your pencils.”

The following scoring system was used for this study as was used in the study by Puranik and Al Otaiba, (2012). The scoring system did account for the age and developmental level of the participants in the study. Children’s responses were scored as 0 if a letter was missing, incorrect, or not recognizable; scored as .5 if the letter was recognizable but poorly formed or reversed; scored as 1.0 if the letter was well formed and recognizable. Students’ scores on the individual letters they wrote were aggregated to form a single handwriting fluency score.


Permission obtained via email
**Teacher Perception Survey-R**

**1. Introduction & Informed Consent:**

Dear Teachers,

I am pursuing my Doctorate of Education with emphasis in Educational Leadership at California State University, Fresno. I am currently in the process of completing my dissertation project. My study is investigating handwriting and student learning outcomes. One aspect of my study is designed to investigate teacher perceptions and beliefs regarding handwriting instructional practices and student handwriting in the public school system. I aim to gather data from elementary education teachers utilizing the attached survey. The survey should take approximately 10 minutes to complete.

You have been selected due to your teaching role at your school site. Your individual responses will be anonymous and no individual or school will be singled out in this study. Participation in this survey is voluntary. Your name and identifying information will not be associated with your answers. If you have any questions or concerns regarding this questionnaire or the study itself, please feel free to contact me at (925) 570-1339 or by email at edolin@csufresno.edu.

Thank you in advance for completing this brief survey. Thank you for your time and participation in this study!

Sincerely,

*Erin T. Dolin*

Doctoral Student
Educational Leadership Program
California State University, Fresno
Email: edolin@csufresno.edu
Phone: 925-570-1339

*Click "Next" to begin the survey...*
Teacher Perception Survey-R

2. Survey Questions: Handwriting Instruction and Abilities

This brief survey is important to learn about teachers' perceptions of handwriting instruction and children's abilities to use handwriting. Please write as much as you can for each response. Please provide candid and detailed responses.

1. Do you believe handwriting instruction is important for students? Please explain why or why not.

2. Do you believe that you are adequately prepared to effectively teach handwriting in the classroom? Please explain why or why not.
3. In what ways do you believe handwriting instruction impacts student learning? Please list as many as you can think of.

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4. How do you currently teach handwriting to students in your classroom? Please describe the amount of time, curriculum used (if any), and instructional strategies used.
5. Please write any additional thoughts you may have about handwriting instruction.

Click "DONE" to submit your responses.
Thank you for your time and participation!
If you have any questions or are interested in the findings of this project...
Please contact me at: edolin@csufresno.edu
### Kindergarten:

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<td>1 per teacher</td>
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<td>LNM –</td>
<td>1 per student</td>
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<td>WP –</td>
<td>7 Boxes per class</td>
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<tr>
<td>Capital letter cards –</td>
<td>1 per class</td>
</tr>
<tr>
<td>Mat for WP –</td>
<td>7 per class</td>
</tr>
<tr>
<td>Slate –</td>
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</tr>
<tr>
<td>Double line Bb –</td>
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<tr>
<td>Wide double line notebook paper</td>
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<tr>
<td>Draw &amp; Write Notebook</td>
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<td>Color print &amp; number wall cards –</td>
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<tr>
<td>Print alphabet desk strips –</td>
<td>6 sheets per class</td>
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<td>Rock, Rap, Tap &amp; Learn CD –</td>
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<tr>
<td>Pencils for little hands –</td>
<td>1 box per class</td>
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<tr>
<td>Magic C Bunny</td>
<td>1 per class</td>
</tr>
<tr>
<td>Chalk bits</td>
<td>1 box per class</td>
</tr>
<tr>
<td>Sponge cubes</td>
<td>1 pkg per class</td>
</tr>
<tr>
<td>Digital Teaching Tools</td>
<td>1 per teacher/class</td>
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### First Grade:

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<tr>
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<tr>
<td>MPB –</td>
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<tr>
<td>WP –</td>
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<td>Capital letter cards –</td>
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<td>Mat for WP –</td>
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</tr>
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APPENDIX F: PRINT WORKSHOP OBJECTIVES

School Based K-1 Workshop:

**Workshop Objectives**

To provide the knowledge, skills, and materials to effectively teach printing:

1. Understand the handwriting process
   - Active teaching
   - Stages of learning

2. Incorporate foundation skills prior to paper and pencil
   - Readiness, directionality, and positional concepts
   - Demonstration and strategies for correct grip

3. Combine developmental and multisensory teaching strategies
   - Hands-on letter activities
   - Prevent and correct reversals
   - Order of instruction
   - Spacing and sentence skills

4. Identify handwriting assessments
   - Screener of Handwriting Proficiency

5. Apply simple, yet effective, remediation strategies
   - Tools and techniques
   - Additional resources

6. Share the knowledge of how research supports handwriting instruction
   - Common Core State Standards
   - Handwriting and technology

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APPENDIX G: HWT KINDERGARTEN LESSON PLAN

Example – Kindergarten

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Example – First Grade

**Objective:** To write lowercase a with correct formation.

**Lesson Plan**
Let's find the lowercase a. Help children find p. 22. Discuss what's on the page.

1. **Demonstrate**
   - Demonstrate a on the blackboard with double lines, whiteboard, or fly sheet.
   - Use voices for a (melodious activity, p. 77).
   - Children trace the large lowercase a in their workbooks.

2. **Copy**
   - Prepare for writing with good posture, pencil grip, and use all the helper hand.
   - Demonstrate a again, saying the step-by-step directions together with voices.
   - Children write a, then copy a.

3. **Check & Evaluate**
   - Help children:\r\n   - Their letter for correct Start, Slant, and Slump.
   - Evaluate the correct formation for lowercase a.

**Read, Color & Draw**
Read the sentence together: Point off the beginning of capital A and the lowercase a in alligator. Encourage free coloring and drawing. Add rocks, grass, water, etc.

**More to Learn**
- Explain that some lowercase letters look like their capitals but others don't. Look at the D, E, d, g.

**Support/ILL**
- For a tall animal, stretch the dot and trace on the line before coloring. Together with large movements and the voice (p. 49).

**Connections**
- Science link: Discuss alligators and other types of reptiles. How are they different from mammals?
  - Make a list of reptiles and mammals.

**Objective:** To use letter a in words; to build fluency by practicing previously learned letters.

**Lesson Plan**
Help children turn to p. 33. Read the words together. Look for lowercase a in each word. Demonstrate A and a for children to copy at the top.

1. **Demonstrate**
   - This first word on double lines for children to copy.
   - Prepare double lines.
   - Demonstrate a, letter a. Children write, then copy a.

2. **Copy**
   - Demonstrate the other words for children to copy.
   - Prepare double lines.
   - Demonstrate self, use, trees, and was.
   - Children copy all words.

3. **Check & Evaluate**
   - Help children:\r\n   - Their word for correct Size, Placement, and Closure.
   - Evaluate children as they copy the words, and help them as needed.

**Read & Discuss**
Read the words together:
- Point to or color the picture of the toys. Discuss different types of toys and their ingredients.

**More to Learn**
- Look around the room to find things that rhyme with the short a sound, e.g., cat, hat. Think about the short a sound.
- Use the hand activity (p. 45) to help children prepare for writing words.

**Connections**
- Language Arts link: See if children can identify the two words on the page that make a short a sound (e.g., cat, hat). Discuss the sounds of letter a.

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APPENDIX I: EXAMPLE OF TEACHING GUIDELINES-K

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# APPENDIX J: EXAMPLE OF TEACHING GUIDELINES – 1st GRADE

## First Grade Teaching Guidelines

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<td>hwttears.com/screener</td>
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APPENDIX K: HOME LINK EXAMPLE

How to Teach Capitals

Dear Families,

We are learning our capitals at school. Capitals are big, bold, and easy to learn. Students have fewer chances to make mistakes when they write capital letters. Capitals all start at the top and are all the same size. At school we use four shapes when writing our capitals: Big Lines, Little Lines, Big Curves, and Little Curves.

Below is a capital formation chart. Use it at home with your child while practicing proper letter formation. This builds consistency and makes learning capitals easy and fun.

Handwriting Without Tears®

A B C D E F G H I
Big Line Little Line Big Curve Big Line Little Line Big Line Little Line Big Curve Little Line Big Line

J K L M N O P Q R
Big Line Little Line Big Line Little Line Big Line Little Line Big Line Big Line Big Curve Go around Big Line Little Curve Big Curve Go around Big Curve Little Curve

S T U V W X Y Z
Little Curve Big Line Little Curve Big Line Big Line Big Line Big Line Big Line Big Line Little Line Big Line Big Line Big Line Little Line
APPENDIX L: SCREENER OF HANDWRITING PROFICIENCY

Scoring Packet

The Screener of Handwriting Proficiency helps you identify students who need additional support and guides your classroom instruction throughout the year. Assess your students three times a year, score results, and generate reports that help you track the development of critical handwriting skills.

Get ready to score:
The Screener can be administered up to 3 times/ year, to help you track student handwriting skills throughout the school year.

- Enter scores at screener.hwtears.com
- You will first need to select the month that your school year starts.
- After that, you can enter scores during the Beginning, Mid-Year, and End-of-Year testing periods. Each period runs for four months.
SCORING INFORMATION

Scoring is quick and easy. Here are the printing skills you will score and how to score them. Use the Kindergarten Answer Key and scoring examples for reference. The answer key includes multiple acceptable letter-number styles.

MEMORY: The ability to remember and write dictated letters and numbers.
1. Writing the letter/number is a memory error.
2. Writing an unrecognizable letter/number (like a crayon) is a memory error.
3. Writing the wrong letter/number (overface r for capital R or vice versa) is a memory error.

No memory error for:
1. A letter or number that is reversed/forwarded
2. A letter that uses wrong size - Oo, Ww, Ss
3. A letter in the wrong place - Pp, Tt

ORIENTATION: The ability to write letters and numbers facing the correct direction.

No orientation error for:
1. Rearranged, or backwritten letters are orientation errors.
8. Symmetrical letters/numbers. They cannot be reversed and are not scored.

PLACEMENT: The ability to place letters and numbers correctly on a baseline.
9. A letter/number (or part) that should be on the baseline but is outside the gray area (more than 1/8" above or below the line) is a placement error.
10. Letters/numbers that should be on the line but are above the gray area
11. Letters/numbers that should be on the line but are below the gray area

Note: Measure questionable placement. Line up the Kindergarten Placement Tool with the writing line (not the letter)

SENTENCES: The ability to use sentence conventions: a beginning capital, distinct lowercase letters (letters close), spaces between words, and ending punctuation.
12. Not using a capital to begin a sentence error.
13. Mixing capital and lowercase letters is a sentence error.
14. Putting too much space between letters in a word (w / a / s) is a sentence error.
15. Putting words too close is a sentence error.
16. Forgetting to put punctuation is a sentence error.
### Concerns: Other skills affect handwriting success

**Check concerns from the Assessment or classroom work.**

**Formation** - Group screening data bases left- or middle formation; regular handwriting formation, but you should notice formation generally. Poor habits affect pruning skills. Messy or slow writers don't move letters of the alphabet.

**Size** - Writing too large causes problems with school papers, speed, and spacing. Review classroom samples for problems. Check concerns if child writes too large for grade.

**Neatness** - Administer screening at an even pace, with time for children to do their best. Check concerns if a child's writing is not neat on the screen or in classroom work. Classrooms sample provide the best information about neatness in everyday writing.

**Speed** - Administer screening so that all students finish together. Watch for students who don't complete classroom work in a timely manner. Take note of those who are slow but don't overload the fast ones who are also messy. Check concerns if a child's writing speed is a problem in the classroom.

**Posture, Pencil Grip, and Helper Hand** - The physical aspect of handwriting is important. Observe your students for physical problems that can lead to handwriting difficulty. Check concerns if a child sits slumped, uses an awkward grip, or does not use hand to hold paper.

**Other** - Note any cognitive, physical, language, attention, or other skills that affect a child's written work.
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