

A CORRELATIONAL STUDY OF 5th STUDENTS' HANDWRITING LEGIBILITY AND
SCORES ON WRITING SAMPLES IN A NORTHWEST GEORGIA SCHOOL

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

This study explored the relationship between legibility in handwriting scores and compositional scores of students in grade five in one Northwest Georgia school. The ability to recall and write the letters automatically may impact the composing skills of students engaged in the writing process. Handwriting, often considered a motor skill in young children, may have a greater impact on literacy learning than is often considered. The strong connection to literacy learning along with the importance as a skill in communications both contribute to the importance of this study. Data was collected from one elementary school in Northwest Georgia. The school was chosen based on location and the school's use of a writing workshop model. As one school was chosen, all students are a part of the sampling for this study. A writing rubric for each piece of writing was scored and then compared to students' handwriting scores to determine if there is a statistically significant correlation. Sufficient evidence during this study to reject both null hypothesis was found. The results of this correlational study can add to the body of research investigating the amount of instructional time spent on handwriting.

Keywords: automaticity, handwriting instruction, penmanship, working memory, written composition

Dedication

I would like to dedicate this study to the memory of my father, Joe Pless. He inspired me through the life he lived, his 60-year marriage to my mother, and his love for his family. He was an encourager and a doer. Ironically, my father was left-handed and was “encouraged” in early years to use his right hand in school, which led to a life time of poor penmanship. Writing in any form was a struggle for him and he would often brush off his chicken-scratch handwriting with a laugh. This factor and watching other students struggle with penmanship in schools has led to my desire to explore issues related to handwriting and writing.

Acknowledgments

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I would also like to thank my husband, Robert. He has sacrificed countless hours, been a sounding board, and provided endless support. My mother has also been a great encouragement during the completion of this dissertation, including hanging up the phone on me and telling me to “get to work!”

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List of Abbreviations

Common Core Standards (CCS)

Georgia Standards of Excellence (GSE)

Learning Disability Association (LDA)

National Assessment of Educational Progress (NAEP)

Response to Intervention (RTI)

CHAPTER ONE: INTRODUCTION

Overview

This is a quantitative study designed to explore the possible relationship between handwriting and writing performance. A correlational study was chosen as the design for this study as the researcher was interested in the possibility of a relationship between the two scores. This chapter will provide the reader with background for this study, the problem that the study will address and the significance of this study as well as a statement of the research questions and hypotheses.

Background

The skill of penmanship or handwriting, a combination of literacy, art, and science, is quickly fading from modern culture with keyboarding moving to the front of the class as the preferred means of composing. Penmanship, a seemingly outdated term, may have lost its place in today's constantly evolving curriculum (Florey, 2009; Thornton, 1996). Standardized testing, which does not test handwriting, has become the measure of whether schools are meeting state standards. With an increased emphasis on teacher and school accountability, less focus is placed on untested skills. This often leads to educator pressure to "teach to the test." With little emphasis being placed on written expression on state tests, handwriting receives even less attention in the classroom. Educators, burdened with heavy curriculums, often completely drop instruction in handwriting for other, more formally tested skills.

Additionally, handwriting is becoming viewed as an old-fashioned form of communication in the digital age (Supon, 2009). The role that technology plays in today's classroom is front and center. Teachers are striving to integrate technology into their teaching,

which may be yet another reason that little time is devoted to the teaching of handwriting. Less time is available for instruction in handwriting when keyboarding is becoming a part of the curriculum in early grades. Keyboarding, which was once only taught at the secondary level, is now being taught as early as kindergarten. Handwriting is first introduced into the Common Core Standards at Grade 3 to produce text when writing (Common Core State Standards Initiative [CCS], 2016).

Furner (1985), in an overview of handwriting instruction, stated concerns about handwriting becoming obsolete as early as 1985, with the utilization of computers in schools. The idea that the handwritten form might be replaced by new technologies, however, predates the use of the personal computer. The advent of the printing press, along with the 1870 invention of the typewriter, were both thought to be replacements for the handwritten form (Florey, 2009; Thornton, 1996).

Dobbie and Askov (2001), in a study on handwriting research found that there was an increase in handwriting studies in the 1980s as compared to the 1960s. The 1980s were also a time of technological expansion in the United States. While there could be several explanations for this increase in studies, one explanation was greater interest in handwriting as a child's first literacy encounter (Dobbie & Askov, 2001). For most children entering elementary school, reading and writing letters go hand in hand. There is a body of research that supports writing as a mode of learning (Sapperstein Associates, 2012). Even though there is currently a debate concerning handwriting versus keyboarding, technologies are being used to assist in handwriting measures, instruction, and even the act of handwriting.

While the debate of keyboarding versus handwriting continues to grow, there is body of research that supports handwriting as a critical part of literacy development. The development

of early literacy skills is enhanced by the motor skill of handwriting. Students demonstrated better memorization of the letters of the alphabet when practicing writing them at the same time as learning to recognize the letters (Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 2006). This suggests that handwriting is still an important part of today's curriculum.

“Berninger states, ‘This myth that handwriting is just a motor skill is just plain wrong. We use motor parts of our brain, motor planning, motor control, but what’s very critical is a region of our brain where the visual and language come together, the fusiform gyrus, where visual stimuli actually become letters and written words. You have to see letters in “the mind’s eye” to produce them on the page.’” (Klauss, 2002, para. 9).

According to Taylor and Alston (1985), through the evaluation of a state curriculum, one can determine the importance placed on a subject area such as handwriting. The Common Core Initiative has defined new standards in English language instruction, but it is up to each individual state to determine whether to retain handwriting instruction in the adoption of Common Core Standards (CCS). Forty-five states have adopted the Common Core English Language Arts Standards, but only a few of those states have supplemented the CCS with a standard that addresses handwriting (CCS, 2016). Most include standards related to the use of technology to support writing or to publish writing, but do not address the compositional process, marginalizing the skill of handwriting. Some states, however, recognize the need for students to become proficient in both the skill of handwriting and keyboarding. An examination of these states’ curriculum includes a specific handwriting standard. North Carolina, at the current time, plans to continue with the practice of teaching students to write in both manuscript and cursive (Packer, 2011). In 2012, the state of Georgia included both manuscript and cursive handwriting as a part of their adoption of new Common Core Standards, recognizing the importance of

handwriting in today's curriculum. The state of Kansas curricular guidelines proposes a totally separate section in their curriculum addressing the need for handwriting instruction. "Children need handwriting instruction to succeed in their schools and later in the world of college and work" (Kansas State Department of Education, 2013, p. 5)

For students to become proficient at the skill of handwriting, some instruction should occur related to proper pencil grip and correct letter formation as well as letter placement, yet as little as 15 minutes or less per day may commonly occur in classrooms today (McCarroll & Fletcher, 2017). The skills of pencil grip, letter formation, and letter placement are directly related to a student's ability to complete documents in legible form (D'On Jones, 2015; Gillespie, Graham, 2011).

Despite living in an age of technology, however, a significant portion of the elementary student's day is spent on fine motor skills. A study of kindergarteners observed that students in kindergarten spend as much as 37% to 46% of the school day on fine motor skills (Marr, Cermak, Cohn, & Henderson, 2003). Not only is much of the school day spent on fine motor skills, poor motor skills have a negative impact on both a child's classroom performance and their self-esteem (Graham, Stuck, Santoro, Berninger, 2006). Students who have poor handwriting also struggle with self-efficacy and avoid tasks that require handwriting. This task avoidance could impact the student's success in today's classroom. With an increased emphasis on content writing across the curriculum and writing to show problem solving skills, student ability to show their learning may decline. For most students with handwriting difficulties, explicit instruction is necessary (Alston & Taylor, 1987). Scores on the ACT writing portion have shown a steady decline since its inception in 2005, while scores in math and science have remained constant (ACT, 2015).

Today, some consider handwriting as more of a creative endeavor, self-expression through the written word; however, that was not always the case (Thornton, 1996). Historically speaking, handwriting began in an entirely different role. Handwriting offered a means of transmitting a culture's knowledge and value systems, and very few people were trained in the skill of handwriting. Those who were trained were primarily men, as handwriting was considered a skilled trade. In colonial times, the writing master taught handwriting. Women learned penmanship for composing handwritten missives—handwriting was more of a leisure activity, and they were trained in a different “hand” (Thornton, 1996). Reading was taught and expected to be mastered prior to the endeavor of learning handwriting, which was taught in specialized schools. Those who plied their craft of teaching handwriting were considered masters. But while handwriting has played an important role in shaping communication, even in forming societal roles, it may not be enough to continue to keep instruction in handwriting in the public schools in an already overburdened curriculum. In the early years of American education, handwriting was practiced for the art of penmanship only. It was only years later that handwriting was taught in conjunction with reading and became a part of the early literacy skills that young children needed to demonstrate success in school (Trubeck, 2016; Florey, 2009). The idea that handwriting plays a vital role in the acquisition of reading may require that we take a second look at the importance of handwriting in today's curriculum.

With so many changes in curriculum, it seems that the teaching of handwriting has reached a crucial point of change in American history. Prior to making instructional decisions, educators have a responsibility to review what the research states about the importance of handwriting in a child's early years. Educators must review the role of handwriting in literacy learning and in learning to compose, and to what extent it impacts learning in other subject areas.

In 1962, Horn proposed several questions for research in handwriting that still merit exploration today:

1. What evidence should be obtained on modern and social school needs in handwriting?
2. What should be the controlling purpose in teaching handwriting?
3. Do deficiencies in handwriting handicap students in tasks that involve writing?
4. On the problem of quality, speed, and fatigue in prolonged writing, how adequate are present data on general posture; on the position of the arms and hand; on the way pens or pencils should be held; on movement, including rhythm; and the ways in which the various letters should be formed? Do we need more evidence on the length and the nature of practice periods and the distribution of practice?
5. When, if at all, should the change to cursive writing be made? What kinds of instruction best facilitate the transition? How much time should be spent on such instruction?

The current study will examine relationships between handwriting and written expression to assist current educators in making informed curricular decisions.

Problem Statement

For many years, handwriting has played a prominent role in the classroom. Students spent part of the school day practicing letter formation, and handwriting was graded as a separate subject on the student's report card. Teachers marked chalkboards with lines to model for students that were practicing their letters, and handwriting paper was considered as much of a necessity as the pencils used to write on it. Handwriting was as much a part of the curriculum as reading, writing, or math. Today, teachers face numerous challenges as they educate our

nations' youth. They vie for the attention of young people who have multiple forms of entertainment at their fingertips. They must make educational decisions and are held to high accountability standards (McRel, 2012). Teachers are tasked with basing instructional decisions on research. Educators must know that what they are spending classroom instructional time on is of value for their students and will impact their achievement.

Handwriting, which is inextricably linked to literacy, could therefore be argued as an essential skill that would impact a student's achievement over their school career. "Literacy—meaning the ability to construe a written, linguistic, alphabetic symbol system—is arguably the most important skill students acquire in preschool through 12th grade education because it makes all other forms of higher-order learning, critical thinking, and communication possible (Colorado Department of Education, 2015). Illiteracy continues to remain a problem in the United States. The following statistics from the National Assessment of Adult Literacy highlights some of the problems with literacy in the United States.

- Literacy is learned. Illiteracy is passed along by parents who cannot read or write.
- One child in four grows up not knowing how to read.
- 43% of adults at Level 1 literacy skills live in poverty compared to only 4% of those at Level 5
- 3 out of 4 food stamp recipients perform in the lowest 2 percent literacy level
- 90% of welfare recipients are high school dropouts
- 16- to 19-year old girls at the poverty level and below, with below average skills, are 6 times more likely to have out-of-wedlock children than their reading counterparts.

- Low literacy costs \$73 million per year in terms of direct health care costs. A recent study by Pfizer put the cost much higher (National Assessment of Adult Literacy, 2003).

Brain research links literacy learning to the formal act of handwriting. Students in early grades are also still learning to read by first learning letters and attaching letter sounds. Studies have linked the physical act of writing and forming letters to recalling and identifying those letters. Neuroscientists have been able to determine that when a student puts pen to paper, the parts of the brain that are activated differ from those activated when composing on the keyboard. The range of instruction in early grades for actual handwriting can be anywhere from none to 30 minutes per day. A conservative estimate might be around 10 or 15 minutes a day (Graham, 2007; Vander Hart, Fitzpatrick, & Cortesa, 2009).

When new learning takes place, unless it is attached or connected to previously learned material, the old learning is supplanted by the new learning or is forgotten. If students are introduced to the new skill of keyboarding prior to mastering handwriting, either in manuscript or cursive, students may learn these two things, but not very well. The best way to make sense of print is to participate in the composing process. When learning to read, writing supports the skills learned through reading instruction. Students learning to read reinforce the early literacy skills of reading by writing or forming letters over and over. Handwriting, a tool for composing, is therefore also an essential literacy skill (Spear-Swerling, 2006)

For educators to understand the importance of handwriting in today's curriculum, we must examine the link between handwriting as a motor skill and writing (i.e. composition). Schlagal (as cited in Graham, MacArthur, and Fitzgerald, 2007), in a review of best practices in writing instruction, notes that handwriting as a separate subject area no longer exists in today's

curriculum. The instruction of handwriting as a skill has diminished and may even be disappearing from the curriculum; yet handwritten work is still the primary form of students' work assignments in today's schools. Students in kindergarten through the fifth grade still practice writing their numbers and words in handwritten form, and turn in assignments that are completed on paper. Students are expected to "show their work," which requires a written explanation of solving problems in math. Constructed-response standardized tests are becoming popular in many states, and the SAT still requires a handwritten essay response. Homework is still assigned, and in many cases, students still complete these assignments by hand. With the additional cognitive demands of writing, students may not be receiving adequate instruction in a skill that is a requirement for students to demonstrate success. Lack of instruction in cursive handwriting and even manuscript in the earlier grades may impact students' later scores, even on standardized tests. The concern is that students who are unable to write fluently might be hindered in their ability to write ideas and to complete their writing in the allotted time on the writing test. Additionally, papers that are written in "sloppy" handwriting may receive lower scores (Graham, 2009). Handwriting speed has been found to impact the quantity and quality of a student's work. Steve Graham (2009), has conducted extensive research on the connection between reading and writing. He found that children think as they write, which means if they write slowly they risk losing ideas. And if a child must think about the letters they write, there are fewer cognitive resources available for them to think about (the) other aspects of what they're doing. (Graham, 2009, p. 2)

A current challenge exists in the lack of data on the connection between handwriting and achievement in composition; not enough is known about the effects of handwriting on written composition. The problem of focus in this study is that not enough research has been conducted

in this area to make informed decisions on whether to continue to focus on handwriting as an instructional tool for composing. School administrators need solid research to support curricular decisions, and today's educators need research to determine which classroom practices are most promising and supportive of student achievement.

Purpose Statement

Today's educators are responsible for teaching a wide array of learning objectives and skills. An already overburdened curriculum in which students must master a wide range of skills and concepts, it is understandable that much thought should be given to which skills and concepts deserve the most prominence. As handwriting is considered a skill, which is being rapidly replaced by keyboarding, the necessity of spending curricular time on handwriting is in question. This study, then, will add to the current research and assist curriculum directors and educators in determining whether to continue to spend limited curriculum time teaching handwriting by adding to the body of research on handwriting. A correlation between handwriting and writing achievement will be examined, with handwriting being the predictor variable in this study. The researcher will examine whether there is a relationship between handwriting and writing achievement through examining both handwriting samples and writing samples in a public-school setting in Northwest Georgia. Both samples will be collected from students in grades three through five and separately scored. The independent variable, handwriting, will be correlated to the dependent variable of writing achievement through Pearson product movement correlations coefficient study.

The purpose of this quantitative study is to investigate the relationship between handwriting and writing achievement in written composition. One school in Northwest Georgia was chosen to provide the subjects for this correlational study. Students in grades three, four,

and five were selected to participate in the study as they would have developed some skills in both handwriting and written composition.

Significance of the Study

The significance of this correlational study is to explore the relationship between handwriting and compositional skills, and how it would assist educators and curriculum directors in making informed decisions about which curricular aspects need focus. If the study indicates a high positive relationship between the two factors being studied, then further considerations may need to be given to handwriting instruction in the classroom. A correlational study would also help educators predict which students may need additional writing assistance in the Response to Intervention or hereafter referred to as the RTI process. This study could aid educators in current RTI practices for making decisions about Tier 1 instructional practice. Georgia's RTI Tier 1 process requires that all students receive core researched based instruction. The basic premise of RTI is that all students have quality instruction prior to being referred to Level II for support services.

Additionally, the ability to recall and write the letters automatically may impact the composing skills of students engaged in the writing process. Handwriting, often considered a motor skill in young children, may have a greater impact on literacy learning than is often considered (Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 2006; Graham, 2007). Handwriting can also mask poor literacy skills in some students (McCarney, Peters, Jackson, Thomas & Kirby, 2013). The strong connection to literacy learning along with the importance as a skill in communications both contribute to the importance of this study

While handwriting is seemingly a small skill in literacy learning, it impacts not only learning to write, but how to read. Students that struggle with handwriting, may also struggle in

other areas of literacy (Clark, 2010). Handwriting, however, is ignored in favor of reading or writing. In the state of Georgia, students cannot be referred for special education services if only struggling with dysgraphia. Handwriting is considered a secondary skill in learning to write and is not given the importance that learning to read has within the public-school setting. Changes in neural activity in the brain have been discovered by researchers at Indiana University when students practice printing letters by hand as opposed to looking at letters of the alphabet. MRI brain scans determined that the neural activity of the group of students writing as advanced in comparison with the alternate group of students (James, 2011). Students in kindergarten, just beginning to learn letter names and sounds can benefit from instruction in letter writing along with letter identification. Writing the letter along with learning to identify the letter activates portions of the brain that are not used when just saying the letter. Writing aids memory and James (2006), proposes retaining the skill of handwriting in schools. Students that are learning to write (compose), need to be able to recall the letter name, shape and then form the letter from memory (Medwell & Wray, 2012).

Student writers engaged in the writing process need “tools” to be effective writers. Whether it is through the skill of handwriting or keyboarding, the expectation is that they must compose well enough to meet state standards in written expression. Without appropriate tools, students may struggle to place their thoughts on the page. One such tool for written expression is handwriting. While some may feel that keyboarding should replace handwriting, the technology does not exist within the schools to support this notion. One past study supports the teaching of handwriting prior the skill of keyboarding (Stevenson & Just, 2012). This study should help educators decide whether students should receive instruction in handwriting or whether current

practices that exist are sufficient for student writers. This study should also aid educators in current RTI practices for making decisions about Tier 1 instructional practice.

This study should add to the body of research that may help to answer the questions of “What is the role of handwriting today and is handwriting important in literacy learning?” when making decisions about Common Core Standards. With the new role that CCS plays in today’s classroom, the focus is on college and career readiness. The need for handwriting instruction may be in question. This study should help to answer questions about whether handwriting instruction should be included in the curriculum.

Research Questions

The focus questions for this study are as follows:

RQ1: Is there a correlation between 5th grade students’ handwriting legibility scores as measured by a curriculum-based assessment rubric and *writing performance* as measured by Units of Study writing rubrics?

RQ2: Is there a correlation between 5th grade students’ handwriting legibility scores as measured by a curriculum-based assessment rubric and *organization in written composition* as measured by Units of Study writing rubrics?

Definitions

1. Handwriting, considered a complex skill is part linguistic, part motor skill and part cognitive (National Handwriting Association, 2016). It is the physical act of forming letters on a page with both legibility and speed or fluency.

2. Common Core Standards (CCS), are standards that are considered rigorous and of high quality to define what students in grades kindergarten through twelfth should know in both math and English Language Arts. These standards were developed in 2009 through the combined efforts of state school chiefs and governors that comprise CCSSO and the NGA Center (Common Core Standards Initiative, 2017).
3. Composing is the act of putting thoughts into written form. This includes the formulation of thoughts into written expression (Brown & Briggs, 1991).
4. Dysgraphia, a specific learning disability related to severe problems with all forms of written expression (SPELD Foundation, 2014; Berninger & Wolf, 2009; Graham, Struck, Santoro, & Berninger, 2006).
5. Graphonomics is defined as the study of handwriting as a psychomotor behavior (Kao, Galen, & Hoosain, 1986).
6. Orthographic refers to the writing system and the way that students use symbols to convey meaning (Berninger, 1994).
7. Pencil grip for this study is the way the student grasps the pencil to write. There are several traditional pencil grips including tripod and quadrapod that are considered ideal for legible handwriting (Olsen, 2017).
8. Response to Intervention (RTI) is a process for identifying and supporting struggling learners prior to the possibility of referral for Special Education testing (Bender & Shores, 2007).
9. Written composition is the complex process of transferring one's thoughts to paper. It includes both the transcription of thoughts to words and the use of

language conventions (Altemeier, Abbott, & Berninger, 2008; Brindle, Graham, Harris, & Hebert, 2016).

CHAPTER TWO: LITERATURE REVIEW

Overview

This review of the literature explores various implications of handwriting instruction as well as ways that handwriting is currently taught in the classroom. Additionally, the link between handwriting and written composition is reviewed. This review of studies in handwriting reveals several main categories of research, primarily studies of methodologies for teaching handwriting and studies on the effect of handwriting on other subject areas. Previous studies can also be divided by types of methodologies researchers used to study the subject of handwriting.

As educational emphasis is being diverted away from handwriting and more toward keyboarding or technology skills, fewer studies are being conducted on handwriting instruction. Prior to the 1980s, handwriting received some emphasis as a needed skill that was taught in the classroom. Jean Alston and Jane Taylor's (1987) seminal work on handwriting research, conducted primarily in the United Kingdom, reviewed theories of handwriting as well as current research and applications of handwriting instruction. While at the publication of their work in 1987, reading instruction was receiving considerable attention, however, less was known about the physical skill of handwriting. This work returned a focus onto handwriting research.

The role of handwriting in education is constantly evolving. Though once it was considered necessary to learn to read prior to learning to write, reading and writing are now taught simultaneously. Reading and writing, including handwriting, are intrinsically related; when the visual and motor processes are linked, students experience more success in learning to read, write, and spell (Berninger, Abbott, Jones, Wolf, Gould, Anderson-Youngstrom, Shimada, & Apel, 2006). For example, students with strong handwriting skills perform better than students without good handwriting on written composition assessments (HWT, 2017).

The need for handwriting instruction is not limited to the early grades. There is still a large variability in handwriting fluency (speed) in Grades 4 and 6, with handwriting speed increasing until Grade 9 (Graham, 2007). But educators cannot explore handwriting instruction without first exploring the purpose behind handwriting—writing and expression. Recent research has shown that “the development of higher-order thinking skills, including problem solving and analytic thinking, is related directly to the student’s ability to put thoughts on paper using learned language skills” (Gentry & Graham, 2010, p.6). Despite debates on the demise of handwriting, specifically cursive, handwriting is still considered vital for literacy learning.

To perform the literature review, I searched for physically and electronically published dissertations, peer-reviewed articles and texts, and scholarly journals. Key terms for this review included handwriting, penmanship, graphonomics, writing composition, writing achievement, written expression, working memory, writing fluency, and legibility. I reviewed literature on written composition regarding achievement and fluency, teaching methods for both written composition and handwriting, and studies comparing handwriting to keyboarding.

Conceptual or Theoretical Framework

Several theories and constructs contributed to this study. One is the paradigm of positivism research in developing a quantitative study; another is the theory of working memory. A quantitative research study is based on the idea of certain truths existing independently of the value of the researchers. Quantitative research tends to be “synonymous with positivist research” (Gall, Gall, & Borg, 2007). The focus of this study is on exploring a correlational relationship and as relationships between handwriting and composition exist. The review of an existing body of research determined that studies existed in exploring connections between working memory and handwriting (Berninger, Abbott, Swanson, Lee-Lovitt, Gould, Youngstrom, Shimada,

Amtmann, 2010) and also studies that determined a link between writing composition and handwriting (Graham, 2007). These studies have led the researcher to determine that an additional study to explore the possibility of a relationship between handwriting and writing achievement would further the existing body of knowledge.

Additionally, this study is grounded in the Cognitive Learning Theory and, within that theory, information processing. Learning has been described in different ways throughout history, but, with the invention of MRIs and CAT scans, much has been discovered about how the brain functions. The brain and nervous system are the central command center of the body and have been compared computer systems. Thus, information processing theories have described how information is processed, stored and retrieved. These theories support the importance of automaticity in handwriting when processing information during writing composition. Memory processes also are central to this approach of learning (Santrock, 2011). Higher memory capacity improves the processing of information; hence, automaticity in handwriting would improve the ability to compose.

A key theoretical concept in developing this study lies in the seminal work of Alan Baddeley and Graham Hitch on working memory. Their theory expanded the notion of short-term memory and developed this concept into the framework described as working memory. Working memory is the process through which information is processed, manipulated, and acted upon (Baddeley & Hitch, 1974). While long-term memory is considered unlimited, working memory is limited in storage capacity. Furthermore, distractions while working, attempts to process large amounts of new learning, or heavy demands on cognitive skills can all be restrictive to working memory. Two ways to create more efficiency in working memory are *chunking* and automatization of skills. To process more information, learners can manipulate

single units of information or can *chunk* information, which means to group information in such a way that the information may be more easily manipulated in working memory (Baddaley & Hitch, 1974). Additionally, processes that have been practiced to the point of automaticity can provide more efficiency for working memory (Baddaley & Hitch, 1974; Koopman-Holm, 2016).

This theory of working memory, which refers to the temporary storage of information while it is being manipulated or “worked on” by the learner, was developed in part by researchers to explain short-term memory in adults (Kemps, Rammelaere, & Desmet, 2000). This storage capacity can be described as “the cognitive function responsible for keeping information online, manipulating it, and using it in your thinking” (Santrock, 117, 2011). Working memory is what keeps people focused and performing tasks with efficiency (Pearson, 2016). The knowledge that there is limited working memory would promote to educators the importance of instruction and practice in handwriting. Students who have not internalized or developed automaticity in forming letter structures may be using the limited capacity of working memory to recall letter shapes instead of forming ideas for the writing process (Allen, Hitch, & Baddeley, 2009; Willingham, 2009).

Automaticity, another key concept for this study, is the ability to perform a task with little conscious thought or cognitive process (Samuels, 2006). It is the concept of building skills to the point that the learner can lift some of the cognitive demands on working memory when using those skills. A new skill typically needs much practice before it becomes automatic. The skill of handwriting, for example, must be practiced daily for some length of time for a student to form a letter with little thought.

Working memory, often described as the “mental process of maintaining and manipulating information online during the execution of ongoing tasks and activities” (Lazar, p.

197, 2017). Working memory can play a critical role in planning and executing writing tasks and while working memory plays an important role in building processes that are automatic for writing, the converse can be true as well. The more frequently and creatively students write, the more the working-memory capacity can be enhanced (Klein & Boals, 2001). Writing, which may be one of the more complex thinking tasks that students undertake in their school career, requires the integration of such motor skills as letter formation and recall of sound–symbol relationships. Writing involves not only word retrieval but also the production of letters and words. There are two parts of working memory that deal with spoken and written material: the phonological loop and articulatory control process. A lack of automaticity in letter formation may hinder word production in written comprehension (Ehri, 1998; Nelson, 1980). When learning letter recognition and letter formation, students use more working memory. Once letter recognition and letter formation are automatic, students can use working memory for the process of writing. Research has also found that instruction in handwriting may allow students to use the limited capacity of working memory for composing rather than forming letters (Allen, Hitch, & Baddeley, 2009; Willingham, 2009). Additionally, students who struggle with handwriting may also struggle to hold their ideas long enough in working memory to produce quality writing. The extra effort to perform a task that is not yet automatic for them (i.e., handwriting) may cause cognitive overload (Graham, 2007). In one study, groups of children were asked to identify letters either by stating the letters, tracing the letters by hand, or finding them on a keyboard. Brain activity was found to be greater in students who practiced writing letters by hand than in those who only verbally identified or typed the letters (James & Englehardt, 2012).

Role of Working Memory in Transcription

Working memory is not only necessary for storing thoughts while the learner is building new skills, it can also play a role in the learner's ability to transcribe thoughts. A distinction is provided between higher order executive functions, which involve the act of composing one's thoughts onto paper and the lower order executive functions which support transcription of thoughts, including handwriting skills and spelling (Berninger, Rjlaarsdam, & Fayol, 2012). These lower order executive functions also regulate working memory. For these functions to work more easily, some amount of automaticity is needed in both handwriting and spelling. Automaticity occurs when the process of handwriting is produced by the student with little effort. Executive functioning plays a role in both handwriting and composing. For students to apply the motor skill of handwriting, the shape of letters must be recalled. The lack of automaticity or an impaired working memory can impact a student's ability to compose text throughout the writing process (Berninger, Rijlaarsdam, & Fayol, 2012).

Related Literature

The following is a review of related literature for this study. Studies related to both handwriting and written composition are divided into relevant categories including the impact of handwriting on literacy learning, handwriting legibility, and writing achievement and the effect of handwriting instruction on the general population.

Historical Trends in Handwriting Research

As in any educational program, there is some flexibility to the views and importance lent to handwriting instruction in the classroom. The study of handwriting then is not unique in that it does not remain static, and its importance has varied from being a highly specialized field of study, mainly for a person's trade, to a need for literacy for the masses. From the 1930s to the 1960s, research in handwriting was stable and depicted interest in the educator's role in

handwriting and the proficient use of handwriting as a skill. The 1970s, however, saw a marked change in handwriting instruction, reflecting educational trends. The role of handwriting was changing, and research studies were being conducted to determine whether students could process thoughts faster by keyboarding or handwriting. Handwriting was beginning to lose importance as a needed skill in the classroom compared to the new need for technology skills.

Handwriting Instruction

A study of early works in handwriting instruction provided evidence of the importance not only of instruction but also of teaching correct pencil grip and attending to posture in handwriting (Addy & Wylie, 1973), which encompasses developmental stages of graphomotor skills, ways of assessing handwriting, and the impact of learning problems on handwriting. At one time, copying was the favored form of practice in handwriting skills (Petty, 1964), and instruction in handwriting included concepts of legibility, practice, and proper form for the writer. In 1961, the research recommended further studies in providing sequencing to the development of handwriting skills, in the possible need to teach spelling and handwriting together, and in teachers' perceptions of handwriting (Herrick, 1962). Herrick (1962) highlighted the importance of studying handwriting as a key literacy skill in young children, stating that "large amounts of time [were] being spent to teach every child attending an elementary school this first skill of literacy" (p. 9).

Earlier works on handwriting instruction were based on the idea that handwriting is a motor skill. Students must develop fine motor skills prior to writing. The most common pencil grasp is the dynamic tripod grasp, and children are considered developmentally able to form this grasp around 4 and a half years of age (Graham, 1999; Ziviani, 1987). This grasp purportedly gives the writer an advantage in manipulating the writing instrument. Thus, the importance of

instruction in proper posture, grip, and positioning cannot be ignored. Some, students, however, may demonstrate problems with posture, grip and paper positioning, which are characteristics of dysgraphia (Rosenblum, Goldstand, & Parush 2006). Additionally, research has supported spaced motor-skill practice for optimal learning (Graham & Miller, 1980). Spaced practice of handwriting would optimally include instruction followed by short practice periods for handwriting to become an automatic process.

While the ultimate purpose of handwriting is and should be communication, instruction in handwriting remains necessary for students to become proficient. Current trends may reveal more about this complex skill. For example, graphonomics is a relatively contemporary area of study that emerged in the 1980s. Graphonomics describes the behaviors and physical processes involved in the production of handwriting (Kao, Galen, & Hoosain, 1986). The exploration of the processes behind handwriting has shaped our current view of handwriting today. The idea that handwriting processes can be both observed and measured can inform the way handwriting is taught.

Not only does handwriting impact literacy learning, writing by hand engages the brain differently than keyboarding (e.g., Kiefer, 2015; Longcamp, 2011). Using CAT scans, researchers have found more brain activity in language-learning areas for students writing by hand than in students who only identified letters orally. In other studies, students who took notes by hand in class, rather than taking notes with a keyboard, retained the information far better than their keyboarding counterparts (James & Atwood, 2009; James & Englehardt, 2012; James & Gauthier, 2006; James, Wong, & Jobard, 2010; Longcamp et al., 2000).

Standards for Handwriting

Adopted state standards for handwriting are almost nonexistent. A review of the Common Core Standards adopted by many states highlights that fact. Most state standards related to handwriting have been reduced simply to “students will print with legible handwriting” (CCS, 2016). Current standards give little guidance for how handwriting should be addressed in the class or for the required level of proficiency (Collette, Anson, Halabi, Schilierman, & Suriner, 2017). Some states provide additional guidance for the instruction of writing composition (Georgia Standards of Excellence, 2016); however, few state standards address handwriting as a key skill for proficiency in writing composition. Standards for production and publication of writing focuses more on the use of technology and keyboarding in writing. Standards for production in writing include: “With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting” (CCS, 2016).

While schools in the United Kingdom have developed policies about instruction in handwriting, few, if any, exist in U.S. public schools. U.S. public schools have adopted Common Core Standards with some modifications related to the teaching of handwriting at the state level. The state of Georgia, for example, has removed standards related to students writing proficiently in manuscript and cursive but has produced a document related to teaching cursive in Grades 3 and 4 (Georgia Department of Education, 2016). While national standards do not explicitly state that students are provided instruction in handwriting, Georgia is one of the few states to retain standards for handwriting in their curriculum along with the adoption of the Common Core Standards in the early grades (Georgia Department of Education, 2015). Other states that have chosen to keep handwriting as part of the curriculum include Alabama,

Louisiana, Mississippi, South Carolina, Tennessee, and Texas as well as a few other (Learning without Tears, 2018). While many states that do not address handwriting instruction in their standards (Shanahan, 2014), the state of Utah is one state that has deliberately added standards for handwriting back to their curriculum. A committee directed by the Utah State Board of Education, reviewed the need for standards for handwriting and opted to include these in their state's curriculum (Jones & Hall, 2013).

The lack of handwriting standards could be attributed to the growing use of technology, a lack of emphasis being placed on handwriting, or even the flexibility of each state to adjust their own curricular standards.

In one study of its kind, teacher beliefs were explored pertaining to the impact of Common Core on instruction on handwriting. More than 50% of the study's respondents felt that the implementation of Common Core Standards had a negative impact on instruction related to handwriting (Collete, Anson, Halabi, Schelierman, & Suriner, 2017). Findings also support the work of Graham (2007), in that there is inconsistency across classrooms in implementation of handwriting instruction (Collete, et.al., 2017).

Impact of Handwriting on Literacy Learning

While handwriting may seem a small component of literacy learning, it impacts not only learning to write but also learning to read. Students who struggle with handwriting may also struggle in other areas of literacy. However, handwriting is considered a secondary skill in learning to write and is not given same the importance for learning to read within public schools. But researchers at Indiana University have discovered differences in brain activity when students practice printing letters by hand rather than looking at letters of the alphabet. MRI brain scans determined that the neural activity of the group of students writing advanced compared to that of

the alternate group of students (James, 2011). Students in kindergarten, who are just beginning to learn letter names and sounds, can benefit from instruction in letter writing along with letter identification. Writing the letter along with identifying the letter activates portions of the brain that are not used when only saying the letter. Also, there is more activity in regions of the brain related to language development when printing or writing letters than when typing letters (James & Engelhardt 2012). Moreover, the Indiana University researchers argued that physically writing aids memory (James, 2011). Students learning to write (compose) must be able to recall the letter name and shape and then to form the letter from memory. For this to occur, the student must practice forming the letter until it is stored in long-term memory. Recalling letters is a foundational skill that needs to be developed early because it impacts learning to compose; neglecting to develop it early could constrain critical thinking when composing. Additionally, learning to write helps develop eye–hand coordination skills and influences all language learning (Berninger, 2012; James, 2012; James & Gauthier, 2006; Saperstein Associates, 2012).

Implications of Handwriting Instruction with Students in the General Population

Studies have indicated that students benefit from some form of handwriting instruction (Berninger, 2007; Graham, 2009). Given that composing by hand impacts the brain in learning literacy (Berninger, 2012; James, 2012), early instruction in handwriting would benefit all students in literacy acquisition. Specifically, the link between letter acquisition and early foundational reading skills has been proven (Berninger, 2015). Therefore, early handwriting instruction should include handwriting strokes, correct pencil grip, and verbal cues for the formation of the strokes in handwriting (Amundson & Weil, 1996). While there are clear best practices for the teaching of handwriting (posture, pencil grip, writing from memory), stages of motor development may also dictate instructional practices in handwriting. Handwriting as a

motor skill is best learned through the application of daily spaced instruction. Students tasked with learning a letter form learn best when presented with a single letter. Students also benefit from direct and explicit instruction in handwriting. Research has found more benefits in using visual cues as opposed to tracing and copying letters (Graham, Berninger, Weintraub & Schafer, 2010; Graham, Struck, Santoro, Berninger, 2006). The recommended time spent on handwriting instruction weekly is thought to be 75 minutes, but a survey of common practices demonstrated that drastically less instruction occurs in classrooms (Santangelo, Graham, 2016). Instead, findings have indicated that instruction may vary from 20 minutes to as little as 10 minutes or even no time in elementary classrooms (Graham, 2007; Vander Hart, Fitzpatrick, & Cortes, 2009). In a survey of instructional practices, Donica and Larson (2012) reported that only about half of teachers surveyed used a handwriting curriculum. Lack of teacher preparation, of time, and of new technologies were reasons cited for little to no instruction of handwriting in the classroom (Donica & Larson, 2012).

In a typical classroom, students are taught to write in manuscript prior to being taught in cursive. Manuscript was traditionally chosen because it more closely resembled the font in which children learn to read, thus enhancing literacy learning for students in the early grades. Whether manuscript or cursive handwriting should be taught first and in which sequence has been thoroughly debated (Herrick, 2013). Some programs call for cursive over manuscript, stating that the transition from manuscript to cursive is confusing for students. The rationale for teaching manuscript prior to cursive is that students then learn to write in a script that they are simultaneously learning to read. There are also differences of opinion on when cursive should be taught. In Montessori schools, cursive is taught when students are beginning to learn the skill of

handwriting. In most public schools, students begin with manuscript and change to cursive somewhere around the third to fourth grade.

Legibility in Handwriting

Handwriting legibility, or the ability to produce a readable font when composing, is often judged by the ability to produce letters that are spaced appropriately, have appropriate line placements, and are formed accurately. Factors that can influence legibility in handwriting are speed, handedness, student age, and gender (Graham, Berninger, Weintraub, & Schafer, 2010; Lohman, 1993; Wood, Webster, Gullickson, & Walker, 1987). Legible handwriting influences the scorer's response on written work (Graham et al., 2010), on top of actual writing performance and the reader's ability to comprehend the written work. Overall, legibility can contribute to the clearer expression of ideas.

Studies have indicated that both speed and legibility increase from grade to grade. By Grade 5, legibility and speed begin to "level off," with female students indicating a higher level of legibility than do male students. It is unclear as to whether it is the actual age of the student and their physical growth that impacts legibility or the instruction and practice provided in classrooms that is the most determining factor. What is clear, is that the age of the student impacted more than other factors, the legibility of students (Stievano, Michetti, McClintock, Levi, & Scalisi, 2016).

Additionally, in a study of 46 fourth graders, students' legibility was greater on shorter copying tasks than on longer copying tasks (Dennis & Swinth, 2001). This result is not surprising as hand fatigue can also impact handwriting legibility. Comparing students using dynamic tripod grasps and those who used atypical grasps, this same study found that pencil grasps did not affect handwriting legibility. However, other studies have contradicted Dennis

and Swinth (2001) by reporting that alternative pencil grips resulted in tighter grips and therefore more hand fatigue (Graham, Struck, Santoro, & Berninger, 2006).

Another factor impacting legibility is gender (Wood, Webster, Gullickson, & Walker 1987). In males, handwriting tends to be less legible than that of their female counterpart. It was also found that there are differences in the way males and females perceive their writing. Male students perceived that they wrote faster than their female counterparts, although findings indicated that they wrote slower (Lahav, Maeir, & Weintraub, 2014). Development may account for some of these differences between young male and female students. Fine motor skills were slower to develop in male students than in females, although gaps between the two genders closes as the students age (Kokstejn, Jusalek, & Tufano, 2107).

Measures of Handwriting Legibility

The goal of most handwriting instruction is legibility and automaticity. Hackney (2008) stated there are four keys to handwriting legibility: size, shape, slant, and spacing. To be considered legible, the size of the letters produced should be consistent in size and fitted to the space. Shape of letters refers to the formation of the letters. Slant of the letters changes when students switch from print to cursive, presenting a challenge to legibility. Finally, the spacing of the letters is crucial when forming words. Spacing allows the eye to “see” the individual letters and to make the letters into words.

There are several commercial programs that include measures of evaluating handwriting and handwriting legibility. Such programs range from the Minnesota Handwriting Test, which provides measures of speed and quality of handwriting for students in Grades 1 and 2, to the Evaluation Tool of Children’s Handwriting (ETCH), which measures both legibility and speed of students’ handwriting in Grades 1 through 6. Some tests are diagnostic in nature, such as the

Diagnosis and Remediation of Handwriting Problems (DRHP). Others, such as the ETCH, are criterion-referenced. Handwriting assessments, such as the ETCH or Test of Handwriting Revised, can define norms for handwriting legibility and may be used to evaluate both manuscript and cursive handwriting. Such instruments are costly for schools to use on a regular basis, so they are typically brought in to assess the need for a student's placement with an occupational therapist.

A recent assessment to quickly and reliably identify legibility in students was developed by Barrett, Pruntz, and Rosenblum, (2017). This assessment indicated promising results to identify students with handwriting difficulties.

The focus of assessment tools is to determine a student's legibility and speed in handwriting tasks like those required of students in the classroom. ETCH tasks include “alphabet and numerical writing, near-point and far-point copying, dictation, and sentence generation” (ETCH,1995, para. 2). ETCH assesses legibility components, pencil grasp, hand preference, pencil pressure, manipulative skills with the writing tool, and classroom observations. The test administration lasts 15 to 25 minutes with scoring using standardized scoring guidelines and procedures in 15 to 20 minutes. Scoring targets legibility of individual tasks and total tasks and speed. An interrater reliability study has been completed for both ETCH-Manuscript and ETCH-Cursive, so the scoring standard has been established.

The use of digitizing tablets in studies can help researchers with measures of legibility. In a study of 118 elementary-aged children in Taiwan, Lee, Howe, Chen, and Wang (2016) used digitizing writing tablets to assess the biomechanics of handwriting. The results indicated variances among the age groups measured for predictive factors of handwriting legibility. The researchers then assessed legibility using a computerized program. The digitizing writing tablets

allowed the researchers to assess the children's visual-motor integration, visual processing, and eye-hand coordination, using the Beery-Buktenica Developmental Test of Visual-Motor Integration. The researchers determined that visual-motor integration predicted legibility for first-grade students, and both eye-hand coordination and stroke force predicted handwriting legibility for second-grade students.

Handwriting Speed and Fluency

Handwriting speed has been linked to age and gender with age being the number one factor for handwriting speed (Steivano, Michetti, McClintock, Levi, & Scalissi, 2016; Ferrier, Horne, & Singleton, 2013). Speed is typically linked to both automaticity and to handwriting fluency and impacts the writer's ability to generate text of an appropriate length to generate written text for a specific purpose. Typically, handwriting speed is measured as word per minute count, as seen below. Handwriting speed can indicate if the student is able to recall both letter formation and then accurately reproduces text. Another simple measure is a copying test. During this assessment, a student is given a copy of the text for them to reproduce (Santangelo & Graham, 2105). In this case, the ability to recall letter formation is not necessary for the student to complete the task, which would provide more of an analysis of the students' motor skills without the impact of working memory to recall letters.

Derived norms for handwriting speed developed by Penny Allcock in pilot studies conducted on students from ages 11 through 16 determined that a normally developing student writes approximately 13 words per minute at age 11 and leveled off at age 16 with approximately 17 words per minute (Allcock, 2001). Typical formulas for calculating handwriting speed are # of letters/words X 60 divided by the total # of seconds. This calculation will provide a score that can be compared to calculated norms for students of like ages. Studies involving handwriting

speed have specifically linked speed to the working memory functions. By calculating scores on handwriting speed, difficulties students might have related to handwriting speed and writing fluency can be identified.

Types of Script

There is a wide range of types of script. These various types of scripts used reflect the role of both the writer and the purpose of handwriting. The role of handwriting has changed throughout time as well as the predominate types of scripts that are used for instruction. Earlier forms of scripts were much more elaborate and were taught in isolation from written composition (Florey, 2008).

Spencerian script, one early form of handwriting, was developed by Platt Rogers Spencer. His goal in developing this script was to “rescue from its undeserved obscurity the practical Art of Writing” (Spencer, 1866, p. 9). In his script, Spencer included fanciful curls and loops imitating forms found in nature, which he said, “brought him closer to God” (Spencer, 1866, p. 9). This handwriting form was developed at a time that students attended penmanship schools strictly for learning the art and skill of penmanship (Florey, 2009).

In 1888, master penman Charles Zaner founded Zaner-Bloser at a time that penmanship was not just a skill for school but was a profession. Zaner began his company as a series of courses for penmanship and a seller of handwriting supplies. Today, it is one of the leading handwriting programs used widely in schools across the United States. The company’s original penmanship script evolved into a manuscript with ball and stick letters. One criticism of Zaner-Bloser, however, is that the ball and stick formation of letters in manuscript is more difficult for young children to form based on the number of pencil lifts and circular shapes (Cohen, 2012). Thus, its counterpart, D’Nealian script, was developed.

Donald Thurber developed D'Nealian script based on the Palmer method to ease the transition between manuscript (print) and cursive, which typically occurs between Grades 2 and 3 (Cohen, 2012). D'Nealian was considered an easier form of script because educators believed that picking up the pencil less would lead to easier letter formation (D'Nealian, 2016). There is little to support the claim, however, that slanted handwriting is easier to learn than the more vertical form of Zaner-Bloser (Graham, 2007). The debate for which script is better learned and better for learning has continued for years, but studies have shown that the font that most clearly mirrors the print that students learn early on when reading tends to best support literacy learning; currently, Zaner-Bloser's script is closest to the font students most often read.

A third popular handwriting program was developed in 1977 by Jan Olsen, an occupational therapist. This program incorporated manipulatives to support young students in developing handwriting skills. The font style is a simpler form of the ball and stick approach required by Zaner-Bloser. This program has gained in popularity due to the simpler instructional format, which is in a developmental sequence.

Types of script have been related to the ease at which students learn handwriting. They have also been linked to the ease of transitioning between manuscript and cursive. Studies conducted to determine the ease of transition between manuscript and the use of either Zaner-Bloser or D'Nealian handwriting programs found no difference between the two programs (Ourada, 1993; Trap-Porter, Cooper, Hill, Swisher, & Lanunziata, 1984). More recent studies related to this issue were not existing. The type of script used was also found to have little impact on students' writing production (Jones & Candler, 2011), indicating that the choice of handwriting script may matter little when making curricular decisions.

Handwriting Posture, Pencil Grip, and Script Placement

Other aspects of handwriting instruction include proper posture and pencil grip. Students receiving explicit instruction in these areas demonstrate greater proficiency in handwriting skills. Not only does proper posture alleviate stress on the student's spine, but it also allows for better handwriting. Pencil grip, the way the pencil is held by the writer, should demonstrate one of two occupational-therapist-recommend methods: the tripod grip and the quadropod grip. The most commonly used is the tripod grip in which the pencil is gripped between the thumb and the index finger and rested on the middle finger. In the quadropod grip, an extra finger is added for stability. The third aspect of instruction in handwriting is proper placement of the script in relation to the lines on the page. The placement of the letters on the page with appropriate spacing may be strongly linked to both visual perception and legibility in handwriting. This third aspect is closely related to the use of handwriting paper as a support for writing development.

Handwriting Paper

Handwriting paper was developed to assist students with letter placement which impacts legibility in handwriting. Originally, students learning the skill of penmanship practiced letters on slate boards with chalk. It was in the 1920s that companies such as Zaner-Bloser and Top-Flight mass produced both handwriting paper and the more traditional lined paper for school use (Trubeck, 2016). Handwriting paper is typically used in earlier grades as students are learning to write letters. As the more traditional lined paper is less costly, it is also used more widely.

There has been some debate about the impact of lined paper on both legibility and creativity in students. Some experts in the field of literacy, suggested that the use of lined paper constrained students' creativity (Calkins, 1994; Graves, 1983). Later studies determined that lined paper provides more support for legibility in writing for students above Grade 2 while students in earlier grades wrote more legibly on unlined paper (Feder & Majnemer, 2007; Olsen,

2016). Handwriting paper comes in different forms including paper that is tactile and allows students to physically “bump” the bottom line, orienting them to the lines on the paper.

Typically, the line widths vary according to students’ age level. Students in pre-kindergarten and kindergarten are encouraged to write on lines with a width of 2 inches between the top and bottom lines; their handwriting paper contains color variations to help direct students in the placement of letters on the line, with the bottom line typically being red and the top line blue, and a dashed or broken middle line. Research has shown that “students who struggle with start and placement on other styles of paper succeed on double lines” (Olsen, 2016). Handwriting Without Tears currently includes a double-lined paper with its program, with a base line and mid-line for guidance. As the placement of letters on the page can impact handwriting legibility, the use of specific lined paper can provide additional support for struggling writers (Olsen, 2016).

One study suggests that lined paper only impacts the size of the letter quality, not the legibility of the letters (Reidlinger, 2010). Results for students in first grade were examined using two different types of handwriting paper. While students were tested using Wilson’s four-line writing grid and a second group with double lined paper it was unclear as to whether students practiced with either type of paper prior to being tested. Use of either type of paper could have impacted study results. Another study found that the combined use of both lined paper with prompting increased participants ability to write their names (Smith, McLaughlin, Neyman, & Rinaldi, 2013). This later study only examined the effects of lined paper and prompts on two students, so a larger sample size might yield different results.

Few studies have been conducted concerning the impact of lined paper on handwriting quality, including legibility. It is also difficult to judge the use of handwriting paper, as various

templates are available for download online (First-School, 2018; Savetz Publishing, 2018). Little is known due to a lack of survey information directly related to actual classroom practice with handwriting paper, although a popular teacher resource, Teachers Pay Teachers search yielded over 5,000 resources with the search term “handwriting paper” (Teachers Pay Teachers, 2018).

Difficulties with Handwriting

Studies have estimated that 10% to 30% of students struggle with written expression (Graham, Struck, Santoro, & Berninger, 2006), while those numbers may be higher for those with handwriting difficulties. Overveld & Hulstijn, (2011) have found that those numbers are upwards to 37% in early elementary, then declining to 17% in later elementary grades. The most commonly reported handwriting problems are in grip, spacing, and uniformity of slant (Graham et al., 2006). However, Datchuk, 2105, identified handwriting problems in letter formation, alphabetic knowledge and speed. These students are typically referred for occupational therapy, yet basic instruction in handwriting may correct most difficulties. Studies have indicated that students with handwriting difficulties face later school problems including poorer self-esteem (Berninger, 2007; Graham et al., 2006).

A specific type of learning disorder, dysgraphia, can result in “illegible handwriting, inconsistent spacing, poor spatial planning on paper, poor spelling, and difficulty composing writing as well as thinking and writing at the same time” (LDA, 2002). Students exhibiting this disorder may have difficulty not only with the motor skills of handwriting but also in ordering the words on the page. Dysgraphia can present as difficulty holding the pencil, proper spacing of words, illegible handwriting, and the inability to form thoughts on paper with efficiency.

Implications for Response to Intervention

Response to Intervention (RTI), a process for identifying students with learning problems and giving structured interventions, requires research-based instruction with fidelity at what is known as Tier I (RTI Network, 2017). Tier I is the level at which all students receive instruction without additional supports. At this level, students should receive basic core curricular instruction that is based on research and best practices (Bender & Shores, 2007). If handwriting has implications for writing instruction, all students should receive quality, research-based handwriting instruction within the classroom. In other words, the focus at Tier I for all students is for classroom instruction to be based on best practices. Without research-based core instruction, many students may begin to fall behind and be identified as needing additional interventions on universal screeners.

While some consideration has been given to correct pencil grip, writing implementations, and the structure of writing, little research has focused on the aspect of teacher instruction. Teacher instruction would encompass correct letter formation, pencil grip, and correct posture when writing. A study of 72 first- and second-grade students in New York City examined the effectiveness of two approaches to improve poor handwriting (Howe, Roston, Sheu, & Hinojosa, 2013). In one approach, students received intensive handwriting instruction; in the other approach, students engaged in visual-perceptual-motor activities for a total of 12 weeks. The study's findings indicated that students receiving intensive handwriting intervention demonstrated significant improvements in handwriting legibility. These results indicated that handwriting instruction prior to referral for other intervention services is important for students who struggle with handwriting legibility. A second study providing interventions to kindergarten students in Israel also demonstrated that intensive interventions provided early did impact both handwriting speed and quality (Lifshitz & Har-zvi, 2015).

For students who receive instructional interventions for writing fluency at Tier 2 levels, unlike Tier I, very few recommendations address the need for handwriting. Interventions include the use of invented spelling, daily writing, and student self-monitoring techniques. Writing fluency is addressed solely as a function of composition rather than as the physical production of words on the page. The development of ideas is important in writing, but how much the lack of handwriting skills may be hindering that production has not yet been addressed.

Students in both third grade were provided interventions in handwriting to measure the impact on text quality, spelling and fluency. Handwriting training did not have a measurable impact on handwriting fluency over the groups receiving only spelling and reading (Lichtsteiner, Wicki & Falmann, 2018). These results were somewhat different when applied to first graders. First graders receiving a multi-modal handwriting intervention showed greater gains over students not receiving this intervention (Wolf, Abbott, & Berninger, 2016). While treatment in the two groups varied in that the younger students were provided an intervention that was multi-modal, there could also be differences due to the students' developmental stages. The multi-modal approach appeared to be effective, results for interventions impacting motor skills failed to show significant impact on handwriting speed and quality (Li, Coleman, Ransdell, Coleman, & Irwin, 2014).

Implications of Handwriting Instruction for Students with Learning Disabilities

In general, children identified with learning disabilities in reading, will struggle with tasks that involve writing or other higher order executive functions (Graham, Collins, Rigby-Wills, 2017). Students with learning disabilities are also at a greater risk for handwriting problems (Graham, 2007; Shaywitz, 2003) and may need additional instruction in handwriting for success. It has also been noted that students suffering from learning disabilities benefit from

instruction in cursive handwriting (Graham, 2007). Findings have indicated that cursive handwriting relies more on kinesthetic and motor memory and less on visual perception, making it helpful for instructing students with learning disabilities (Gordon, 2009).

For those students with dyslexia, handwriting can also be hampered by spelling. As the student focuses on how to spell a word, the ability to focus on handwriting is constrained. Summer, Connelly, & Barnett, 2014, attributed these findings to the link between working memory and the demands of writing. This would suggest a need to provide instruction in spelling along with explicit handwriting instruction.

A bigger impact on these students may be in the type and amount of instruction they receive. Students with a learning disability need specific instruction and additional time to practice any new skill, including the skill of handwriting. The amount of instruction and practice students currently receive may be inadequate. Students who are struggling learners need explicit handwriting instruction, which will later affect their ability to write fluently enough to meet state requirements (Berninger, 1994; Graham, 2000; MacArthur & Fitzgerald, 2007).

Writing Composition

Writing, or written composition, is one of the most complex skills students learn. Writing as a task in elementary school started with a focus on penmanship, but began to shift to a focus on the process of writing in the 1970's and 1980's (Langer & Applebee, 2007). Writing composition, also referred to as composing can be defined as the "complex cognitive processes of generating ideas, planning what to write and how to write it, translating the ideas and plans into written text, and reviewing and revising the text to make it better" (Berninger & Wolf, 2009). Writing is both a cognitive and social task ((Pritchard & Honeycutt, 2006) and should be scaffolded for young writers to effectively develop the skill of writing. Writing standards,

included in the Common Core Standards (2016), define what students need to know at each grade level. In 2006, Graham and MacArthur (2006) published a work defining best practices in writing instruction. Among those practices were a focus on the importance of writing instruction, a strong understanding of what proficient writing is, and the development of effective procedures for teaching writing. The authors took a process approach to writing instruction and used teaching conventions to support the teaching of story composition. One purpose of writing instruction is to provide skills that students can use to access the level of language required in the complex skill of composing. Being able to transcribe one's thoughts involves not only language process skills, and that there are clear basic concepts in the teaching of writing to support developing writers (Pritchard & Honeycutt, 2006).

Best practices for the teaching of composition involve explicit instruction in the use of strategies and the writing process. These practices also include developing common expectations for students as authors and authentic writing tasks (National Writing Project, 2006). Graham and Harris (2005) state the need for teaching self-regulating strategies approach. This approach, developed in 1982 by Harris, calls for the explicit teaching of the writing process.

Instruction in Written Composition

As the terms “writing” and “handwriting” are used synonymously, instruction in writing is often confused with handwriting instruction. Therefore, to clarify what is meant by writing instruction it will be defined as instruction in the craft and mechanics of writing. Gillespie and Graham (2011, para. 1) define writing as a “multifaceted task that involves the use and coordination of many cognitive processes. Due to its complexities, many students find writing challenging and many teachers struggle to find methods to effectively teach the skill.” Teachers can focus on teaching skills in grammar and mechanics or in the craft of writing, or on both.

Findings for how teachers provide instruction in writing were varied. Writing instruction was found to be inconsistent across states (Collette, Anson, Halabi, Schierman, & Suriner, 2017). Inconsistencies were found in the amount of time spent on writing instruction, the type of instruction given, and the amount of time students spent on writing practice. However, lessons in mechanics or skills were most frequently taught (Coker, Farley-ripple, Jackson, Wen, Macarthur, & Jennings, 2016). Explanations for the teaching of skills over the process may be due to teacher comfort levels. Handwriting was sometimes included in skills instruction, but more often spelling and usage skills (Coker, et. al. 2016). Those students provided daily lessons in the craft of writing, increased writing skills. Writing instruction is often linked to educator beliefs and educator efficacy (McCarthy & Kang, 2017).

As with handwriting, daily instructional time in written composition varies greatly. Kindergarten teachers reported times for instruction which varied from 20 minutes each week to 300 minutes each week (Malpique, Pino-Pasternak, & Valcan, 2017); while practices in first grade varied from 5.5 minutes to 74.25 minutes (Coker, Farley-Ripple, Jackson, Wen, MacArthur, & Jennings, 2015).

Standards for Written Composition

A shift to the adoption of Common Core Standards by 48 states in 2009 has provided a standardization of writing standards nationwide. The standards for written composition require students to write in three genres; narrative, opinion writing and information. The standards are written so that “students should demonstrate increasing sophistication in all aspects of language use, from vocabulary and syntax to the development and organization of ideas,” (2016). As student progress throughout their school career, what they are expected to write becomes more complex. Students should demonstrate growth in writing, based on yearly standards. For

example, students in kindergarten might demonstrate their proficiency in writing with pictures and written text. By third grade, students should be able to introduce a topic and support a topic across various genres (Common Core Standards, 2016).

While the standards are explicit in the expectations for what students should be taught, how the instruction is provided is left to school districts to determine. The state of Georgia has adopted Comprehensive Reading Solutions as both a core reading and writing program, although it is not a requirement for all districts to adopt (Georgia Department of Education, 2017). Within this program, the authors suggest a process approach to the teaching of writing and refer to the Common Core Standards in their approach (Comprehensive Reading Solutions, 2012). This process approach to teaching writing suggests that students again, develop their writing skills over time. The developers of Comprehensive Reading Solutions, McKenna and Walpole, also recognize the need for both handwriting instruction and spelling to develop writing skills. “With a strong understanding of the contributing forces responsible for writing development, teachers can design instruction in both domains to ensure continued growth.” (Mckenna & Walpole, p. 2, 2012). Along with a process approach to teaching writing, students continue to develop handwriting skills in conjunction with writing. Findings from a study conducted in 2008, stated that the automatization of handwriting did impact the quality of writing and that automatization continued to increase from 5th grade to 9th grade (Olive, Favart, Beauvasi, & Beauvasi, 2008).

Assessing Written Composition

Effective assessment differs from grading student work in that assessment is used to make informed instructional decisions (Brookhart, 2013; Hougen & Smartt, 2012). The most common way to assess writing is through rubrics (Brookhart, 2013; Hougen & Smartt, 2012). Rubrics present an advantage for this type of assessment by providing performance-specific data and

graduations for performances in each category. Rubrics can also provide a less subjective look at a student performance assessment, such as writing (Philippakos, MacArthur, & Coker, 2015). Educators primarily use two main types of rubrics to assess writing: holistic, which describes a “range of performance levels” (Hougen & Smartt, 2012, p. 210) and analytic, which looks at each component part. Each type of rubric provides advantages and disadvantages for the scoring of writing. Holistic rubrics are used to look at the writing as a whole, whereas in contrast, analytic rubrics provide specific analysis of each component part of the writing process (Brookhart, 2013). With the use of a holistic rubric, the grader can score the writing faster than with an analytic rubric. Achieving inter-rater reliability is also easier with a holistic rubric. The advantage of the use of an analytic rubric lies in the ability to look at the component parts or writing criteria. This provides specific feedback for the student as well (Brookhart, 2013). Writing as a process is additionally supported using rubrics developed with both input from the teacher and the student to assess writing (Pritchard & Honeycutt, 2006).

Composing by Hand and Composing by Keyboarding

Technological devices are quickly changing the face of communication and knowledge acquisition. Electronic tablets are becoming commonplace within schools, and students can access these devices and complete assignments using touch technology. Computer-assisted instruction (CAI) is a researched-based strategy for student interventions in the classroom (Bender & Shores, 2007). Keyboarding was once only taught at the secondary level but has become a part of the elementary curriculum. Many states now require handwriting fluency and legibility as well as the skill of keyboarding. There is little doubt that keyboarding can enhance the process of composing. Rogers and Case-Smith (2002) found some correlation of students’ handwriting speeds and legibility to their keyboarding speeds. Additionally, word processing

eases the revision and editing of student composition. Both handwriting and keyboarding skills take considerable practice to master, yet there is little time during the school day for students to adequately practice either. While some studies have pointed to composing on the keyboard as more productive than composing by hand, many elementary students have had little training in keyboarding skills. Furthermore, the technology for students to make full use of keyboarding to compose all the writing expected, including in math classes, is not available in many U.S. schools.

Though there is strong evidence for the use of keyboarding, some evidence has also suggested better composition when composing by hand. The evidence is unclear as to whether this is due to a lack of instruction in either keyboarding or in the writing process. However, findings have indicated a link between students who have good handwriting and compositional skills and students who are able to compose well on the keyboard (Rogers & Case-Smith, 2002). This suggests another link between these students that would explain their strengths in both areas—possibly a link to working memory. Students with a stronger working memory can hold their thoughts well as they compose either by hand or on the keyboard. In a study by Weintraub (2015), there was a moderate correlation between handwriting speeds and keyboarding speeds. Weintraub’s study and similar studies have suggested a causal link between fine motor skills with both handwriting and keyboarding when composing.

Fourth grade is considered a typical age at which students are developmentally ready to begin keyboarding skills (Klein, Erickson, James, Perrott, Williamson, & Zacharuk, 2008). This age is suggested due to the size and spacing of the keys on the keyboard and the size of the hand span of fourth-grade students. What is not known, however, is the impact of keyboarding on composing when keyboarding is introduced prior to handwriting. Factors such as instruction and

practice could impact the differences between keyboarding and handwriting instruction. A student first exposed to manuscript print and given instruction and practice in that area would need the same exposure to keyboarding prior to making comparisons. There can be little doubt that, once a person has had training using a word processing program, composition results should be better than in those that were handwritten. Being able to compose, correct, and use a dictionary and thesaurus with little interruption of the composing thought processes results in better compositions. In 2012, fourth grade students completed the National Educational Assessment Progress on the computer. Results were mixed indicating that while higher-performing students scoring “substantively” higher, but middle and lower performing students scoring lower (NAEP, 2017). Students composing on the keyboard during this assessment produced an average of 49 words than those students composing with paper/pencil (NAEP, 2017).

Additionally, in developing either keyboarding or handwriting as a skill, many of the same points and issues appear. Students must be developmentally ready for either the complex task of handwriting or of keyboarding. The biggest concern for composition is whether handwriting activates a part of the brain that is used for long-term storage and retrieval of information and whether keyboarding would activate these same parts of the brain. An argument could, therefore, be made for continuing to teach handwriting in early grades and then shifting the focus to keyboarding in either upper elementary or middle grades. Students can certainly benefit from both skills. Handwriting instruction would give students an early boost in the ability to compose, and keyboarding instruction would give students the ability to compose without being hindered by the revision and editing process. This sequence of instruction would

not result in an argument of keyboarding against handwriting but rather in a way to teach both in an already overburdened school curriculum.

Summary

A review of the literature suggests that handwriting supports literacy acquisition skills in both reading and writing (Santangelo, & Graham, 2016; Berninger, Abbott, Swanson, Lee-Lovitt, Gould, Youngstrom, Shimada, & Amtmann, 2010; Altemeier, Abbott, & Berninger, 2008; Tucha, Tucha, & Lange, 2008; Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 2006). Beginning literacy in children is impacted by the ability to write letters in ways that keyboarding letters does not. Students who wrote letters by hand, learned letters of the alphabet more easily than those just identifying the letters by sight or by touching on a keyboard (James, & Engelhardt, 2012). Handwriting also impacts students' ability to write. Students who are unable to write fluently and with legibility do not write as well as their peers and may need additional interventions (Graham, Struck, Santoro, & Berninger, 2006; Ourada, 1993).

The literature has shown that handwriting legibility strongly impacts scorer bias in relationship to students' writing scores (Graham, Berninger, Weintraub, & Schafer, 2010). Legibility instruments can be used for both to guide classroom instructional practices and to identify students in need of interventions in handwriting (Santangelo, & Graham, 2016; Howe, Roston, Sheu, & Hinojosa, 2013). One of the most often cited reason for a student to be referred for occupational therapy is because of poor or illegible handwriting (Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott, 2006). Because of the impact of handwriting on student acquisition of early literacy skill, writing performance and self-efficacy, there is still a need to provide instruction in handwriting skills.

While keyboarding may be an appropriate intervention for students with learning disabilities, it is not appropriate to begin teaching keyboarding skills until the fourth grade. Handwriting instruction impacts the both the quality and speed of handwriting in early grades, emphasizing the importance of instruction being provided (Dolin, 2016). Additionally, studies have indicated that handwriting may change the “wiring” in the brain related to literacy acquisition (Altemeier, Abbott, & Berninger, 2008; Graham, 2007).

Current literature has suggested that handwriting should be taught prior to keyboarding. A lack of handwriting instruction can hinder the composition process, but, for students with dysgraphia, keyboarding can support the craft of writing. While research has suggested that handwriting instruction should occur prior to keyboarding, there is a clear lack of research that has examined the potential impact of literacy learning if keyboarding were to replace handwriting instruction. Additionally, the literature has suggested that many handwriting difficulties could be resolved through appropriate handwriting instruction. Handwriting instruction should consider the developmental needs of the student, proper posture, pencil grips, and appropriate tools for handwriting.

This study will address some of the gaps in the literature, namely the possible link between writing achievement and handwriting legibility. While studies have shown that handwriting legibility can influence scorers’ ratings on writing, little is known about legibility’s impact on students’ ability to compose. This study will provide needed information related to the relationship between legibility and composition while also possibly providing predictors for when legibility might impact students’ composition

CHAPTER THREE: METHODS

Overview

The current study is of a correlational design to facilitate an exploration of the possible relationship between handwriting legibility and written composition achievement for students in Grades 3 through 5 in Northwest Georgia. This chapter will describe the design, research questions, hypotheses, population, sampling procedures, and instrumentation for this study.

Design

To address the research questions, a correlational study was chosen. Establishing correlations in research can uncover relationships between variables. One advantage of a correlational design is that the degree of relationships between variables can be determined with this type of study (Gall, Gall, & Borg, 2007). This will help determine not only the possibility of a relationship, but the strength and direction of that relationship. The use of correlational design to test the interrelationships between the two variables defined in this study can be used to “inform further writing research,” (Berninger, Rijlaarsdam, Fayol, 2012, p.33). The idea behind the use of initial correlational research is to provide direction for later randomized, controlled experiments to then test observations and relationships between variables, (Berninger, Rijlaarsdam, Fayol, 2012,). The two identified variables for this study were handwriting legibility and written composition achievement. Handwriting legibility is defined as the ability to read the written text composed by the student (Graham, Struck, Santoro, Berninger, 2006). Written composition is defined a process for transferring one’s thought onto paper to convey meaning (Kent, Wanzek, Petscher, Otaiba, Kim, 2013).

Research Questions

RQ1: Is there a correlation between 5th grade students' handwriting legibility scores as measured by a curriculum-based assessment rubric and *writing performance* as measured by Units of Study writing rubrics?

RQ2: Is there a correlation between 5th grade students' handwriting legibility scores as measured by a curriculum-based assessment rubric and *organization in written composition* as measured by Units of Study writing rubrics?

Hypotheses

H₀1: There is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum-based assessment rubric and *writing performance* as measured by Units of Study writing rubrics.

H₀2: There is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum-based assessment rubric and *organization in written composition* as measured by Units of Study writing rubrics.

Participants and Setting

The participants for the study were drawn using convenience sampling to include one elementary school's student population in Grade 5 located in northwest Georgia during the spring semester of the 2016-17 school year. The school is an accredited member of the Southern Association of Colleges and Schools (SACS), a National Blue-Ribbon School, a Georgia Platinum School, and a Georgia School of Excellence. This school is a Title 1 school, serving a population in which more than 50% qualify for free or reduced lunch.

There were a total 95 fifth graders at the chosen school site. Of this population, 45% are female and 55% are male. In terms of race and ethnicity, 83% of the students were White, 14% were Hispanic, less than 1% were Asian, and 1% identify as two or more races. The demographics at the school site were somewhat representative of the county. The county has approximately 83% of the population as identifying as White, 11% Black, and only 4% Hispanic, and the state's population was described as 41% Caucasian, 38% African-American, and 13% Hispanic. The state's population of students in Grade 5 were described as approximately 16% Hispanic, 3% Asian, 37% Black, 38% White, 4% two or more races, and less than 1% Pacific Islander and American Indian combined, according to the Georgia State Department of Education (2016).

Sample

For this study, 313 participants were considered for this study. Participants were determined based on the students' enrollment in the school and grade level at the school site. While random sampling would have been a more ideal way of sampling the population, and would provide results that are better able to be generalized to the population, a random sampling within the schools was not possible. The ability to gather data from a randomized sample was beyond the scope of this study. The sample population was only representative of the area chosen and therefore may only represent the general socio-economic area.

While three grade levels (3rd, 4th, and 5th) were considered for this study, the study was limited to just the fifth-grade students at the chosen school site. The rationale behind this decision was determined by the amount of writing the fifth-graders can produce, their ability to respond to a prompt, and the relative ease of writing in manuscript.

The population consisted of 95 fifth graders with an average age of 10 years old. A sample of size of 77 students was selected. The students in fifth-grade are reflective of the student population at the school site. This sample size exceeds the minimum sample size recommended for a correlational study. According to Gall, Gall, and Borg, (2007), a sample size for a correlational study with a power of .7, an alpha of .05, and a medium effect size should contain a minimum of 66 participants.

Instrumentation

The purpose of this study was to explore the possibility of a relationship between writing achievement and handwriting legibility. In this study, the variables that were examined included both writing achievement and handwriting legibility. One sample from each student was provided to measure both variables in the study for data analysis.

Curriculum Based Assessment Rubric

A commercially produced rubric to measure handwriting was chosen for use in this study. This rubric was developed to assess the manuscript handwriting of students in elementary grades and provides a curriculum-based measure. A curriculum-based assessment is designed to assess the performance of the student and reflects the content that is taught (Jones, 2008). The rubric contains the following criteria of letter formation, letter size, proportion & alignment, spacing, line quality, and letter slant. The rubric was slightly modified to consist of a four-point scale as opposed to a five-point scale. While the ideal scale for a Likert is generally set at 5 points, a decision was made to modify the rubric. An odd number of criteria allows the scorer to default to the middle rating. An even number of criteria will “force” the rater to choose between two scores on the rubric (Brookhart, 2013; Hougen & Smartt, 2012).

The curriculum based assessment rubric yielded raw scores that ranged from 18 to 72.

Scores between 18 and 36 indicated poor quality or legibility of handwriting, scores that ranged between 54 and 72 indicated legibility in handwriting. Scores falling between 37 and 53 indicated a minimal legibility in handwriting. Legibility was measured through spacing of both letters and words, slant and sizing of letters, and proportion of the letters.

Two certified teachers were trained in the use of the curriculum based assessment rubric. They acted as independent scorers for the handwriting samples and were paid for their time. Upon scoring each handwriting sample, participants' scores were measured against each other to determine if the instrument and the scoring system provides inter-rater reliability.

Units of Study Writing Rubrics

The second variable, achievement in written composition, was measured with a Writing Pathways, Performance Assessments and Learning Progressions, Grades K-8 (Calkins, 2015). The rubric is grade-specific, and can be used to assess on-demand writing (Heinemann, 2017). This rubric provided a way of assigning a quantitative score to written compositions, and each rubric contained weighted categories to provide a point score for each participant in the study. Point scores were assigned from 1 to 44 based on how the writing matches the rubric descriptors. Point scores can be translated into a scaled score of 0-4. A high point score ranged between 39 and 44 provided a student with a scaled score of 4, meaning that this student would exceed the grade level expectations when compared to the grade level standards. A score ranging between 28 and 38.5 would translate to a scaled score of 3.0 to 3.5. A student with scores in this range would demonstrate proficiency in writing to grade level standards. Student scoring between 17 and 27.5 are approaching grade level standards and students scoring at or below 16.5 are not writing at a level proficient to meet the standards. See figure 1 for table of points to scaled scores.

Figure 1. Writing Pathways to Scaled Score (Calkins, 2015).

Number of Points	Scaled Score
1-11	1
11.5-17.5	1.5
18-22	2
22.5-27.5	2.5
28-33	3
33.5-38.5	3.5
39-44	4

Note. Adapted from “Writing Pathways, Performance Assessments and Learning Progressions” by L. Calkins, K. Hohne, and A. Robb, Copyright 2015 by The Teachers College Reading and Writing Project. Reprinted with permission (Appendix C).

These rubrics are aligned to the Common Core English Language Arts standards. Georgia is one of 43 states that use the Common Core standards as their adopted English Language Arts curriculum. As the rubric is aligned to the standards taught at each grade level, this lends credence to the use of a rubric to evaluate writing achievement for this study.

Rubrics are a type of scoring tool commonly used to assess performance assignments. The use of a rubric for scoring writing allowed for the assessment of component parts of the work and descriptions of the levels of mastery when compared to a standard (Karkehabadi, 2008). Two types of rubrics for scoring writing are holistic and analytical. The holistic rubric

scores the writing as on a single scale, or as a whole. With an analytical type of rubric, each component is scored or analyzed separately. Both types of rubrics have their advantages and disadvantages, but an analytical rubric allowed the researcher to break down scores on the writing assessment. For the purpose of this study, an analytical type of rubric was used as described in the previous paragraph.

For purposes of validating and determining the reliability of the use of the rubric, both factors were examined. Two certified teachers were trained in the use of the writing rubric. They acted as independent scorers for the writing samples and were paid for their time. Upon scoring each writing sample, participants' scores were measured against each other to determine if the instrument and the scoring system provided inter-rater reliability. In the case of validity, the rubric should measure writing achievement. To decide if this rubric was measuring writing achievement, a determination of writing achievement was defined. Writing achievement for this study was defined as the ability for the student to write at grade-level proficiency based on Common Core standards. Students should be able to “demonstrate increasing sophistication in all aspects of language use, from vocabulary and syntax to the development and organization of ideas, and they should address increasingly demanding content and sources” (Common Core Initiative, 2017, para. #1).

Inter-reliability was measured between the two scorers on both the writing and handwriting rubric. A reliability of .728 was determined for the curriculum based assessment rubric measuring handwriting between the two scorers. A reliability of .689 was determined between the two scorers on the writing rubric. While an ideal measure would have been higher .80, .70 is an acceptable measure of reliability (Bruin, 2006).

Procedures

IRB approval through the institution was obtained prior to the collection of data for this study. IRB approval was obtained and then the researcher submitted a request to the local school board for research approval. Prior to any study being conducted at the local level, researchers must submit a letter to a designated board representative for research approval. This request contains the IRB approval form in addition to a brief description of the type of research study being requested within the district. After the district provided approval, written approval from the school principal was obtained. Permission for students to participate in the study was not needed as samples were collected as archival data from a writing assessment used in the school for portfolio data.

Written composition samples were collected on regular, wide-ruled notebook paper using lead pencils. Materials used during the writing assessments were provided by the school. No. 2 pencils were provided to students from a previous standardized testing session. Writing samples were assessed for both written composition and handwriting.

Once samples were collected and numbered, they were scored using the appropriate instrument. Prior to the scoring of the writing samples, all samples were typed by the researcher. The scorers were certified educators recruited from outside of the participating schools' district, and compensation was offered for the scoring of the data. Training were provided prior to scoring, and each sample was scored independently by each scorer.

To preserve the integrity of the data and to preserve the privacy of all participants, all samples were numbered and de-identified prior to scoring and kept in a locked filing cabinet in a locked office.

Data Analysis

To test the null hypotheses, a Pearson's product moment correlation analysis was used to examine how handwriting scores are related to scaled scores on the Units of Study rubrics. A scatterplot was used to look for data linearity and bivariate normal distribution. Each variable represented one data point on the scatterplot; data writing samples were plotted along the vertical axis, and handwriting along the horizontal axis. The scatterplot gave an overall idea of the direction of the relationship between the two variables (Lodiego, Spaulding, & Voegtle, 2010). A simple Pearson's product moment correlation analysis for the two research questions provided a determination the relationship between (handwriting legibility) and (written composition). Data was then analyzed using Pearson's product moment correlation. Pearson's product moment correlation, or Pearson's r , can be used to measure the strength of a linear relationship, if one exists. A correlation coefficient of .08 to 1.00 was considered as having high strength, .02 to .079 was considered as having medium strength and .00 to .019 was considered as having weak strength. The null hypothesis will be rejected at the 95% confidence interval for both research questions. A significance level of .05 was set to determine if any findings may have a high possibility of being true, however, in order to protect from a type one error, a Bonferroni correction was made and an alpha level of .025 was used.

CHAPTER FOUR: FINDINGS

Overview

Chapter 4 includes the presentation of data analysis associated with this study and a review of the research questions and hypotheses. The purpose of this study was to determine whether there were any statistically significant relationships between handwriting legibility and writing achievement as measured on a rubric developed by Units of Study (Calkins, 2013).

Research Questions

RQ1: Is there a correlation between 5th grade students' handwriting legibility scores as measured by a curriculum-based assessment rubric and *writing performance* as measured by Units of Study writing rubrics?

RQ2: Is there a correlation between 5th grade students' handwriting legibility scores as measured by a curriculum-based assessment rubric and *organization in written composition* as measured by Units of Study writing rubrics?

Null Hypothesis

H₀1: There is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum-based assessment rubric and *writing performance* as measured by Units of Study writing rubrics.

H₀2: There is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum-based assessment rubric and *organization in written composition* as measured by Units of Study writing rubrics.

Descriptive Statistics

Writing narratives were provided by the school site from an end of the year writing portfolio. All students were provided the same narrative prompt, "Write about your best school day." A total of 91 writing narratives were collected on the day of the assessment. All narratives were stripped of identifying information and copies were provided by the school after permission from the IRB was obtained to the researcher.

The total population for the chosen grade was 95 students. On the day of the writing assessment, 4 students were reported as absent. A total of 91 narrative writing pieces were collected. Those student narrative writing pieces were stripped of identifiable data and copies were made at the site for the researcher. For scoring the writing achievement, all narratives were typed and numbered prior to being scored. The numbering process for each narrative was Student # and gender. The writing narratives were copied and scored for handwriting data.

Of the 91 collected narratives, some were not scorable due to extreme spelling or legibility issues. A total of nine samples were discarded based on the lack of legibility in writing or spelling, a total of four samples did not write enough to score using the fifth-grade rubric. While this may have impacted data, the writing was too illegible to obtain a writing score. Seven samples were discarded based on the use of a combination of both manuscript writing and cursive. Only samples written in manuscript writing were scored for this study.

Both student writing scores and handwriting scores were averaged. The average fifth grade student had an overall writing composite score of 17.03 (SD = 5.04), and a handwriting score of 56.76 (SD = 8.06). The average writing length was 331 words. The number of words ranged from 36 to 731. A percent of spelling errors was also evaluated with a mean score of .04% of spelling errors per writing sample.

Handwriting legibility scores were evaluated using a curriculum-based rubric. This rubric was developed for classroom use in assessing student performance in handwriting. The scales were designed to measure letter formation, letter size, proportion, alignment, and spacing (Jones, 2008). Scores ranged between 35 and 69. The standard deviation for handwriting scores was 8.0 with the low score being 3 standard deviations below the mean and the high score being 2 standard deviations above the mean.

Writing achievement was also evaluated with the use of a rubric. Scores for writing ranged from 9.25 to 31.5 and a standard deviation of 5.04. Writing scores were then broken down further to look at organization. Organization scores in writing had a range of 1 to 4 with a mean of 1.86 and a standard deviation of .81.

Prior to data analysis, inter-rater reliability was calculated for the two sets of graded samples. It was necessary to determine the reliability of the scores prior to data analysis. Inter-rater reliability for the writing rubric was 80% high agreement and 75% minimal agreement (no more than 1 adjacent score away). Inter-rater reliability for the curriculum based assessment rubric was 75% high agreement and 75% minimal agreement. The acceptable level for inter rater reliability is 70% agreement. To evaluate the second hypothesis, organization in writing was also analyzed. to determine inter-rater reliability. Inter-rater reliability scores were 69.5. As scores at a 70% weighted Kappa is an acceptable, this score was minimally at the acceptable rate for inter-rater reliability.

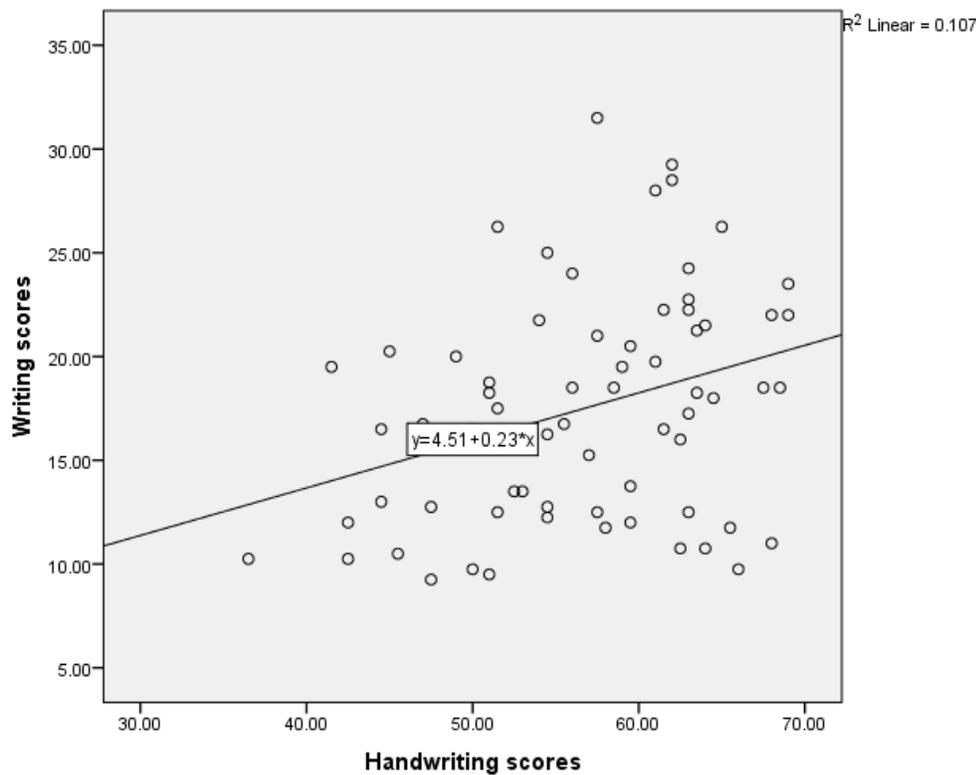
Results

Assumption Testing

Pearson product-moment correlation was then used to evaluate the null hypothesis for each research question. The following assumptions were tested for this study. One assumption

was that there was paired continuous data for both variables. Next, both linearity and bivariate normal distribution was tested using a scatter-plot.

Figure 2: Presentation of scatterplot data for handwriting legibility scores and writing achievement.



Null Hypothesis 1

Null Hypothesis 1 (H_{01}) stated that there would be no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *writing performance* as measured by Units of Study writing rubrics. Using the statistical

software program SPSS Statistics, a correlation analysis was performed to assess the relationship between handwriting legibility and writing achievement as measured with rubrics. The Pearson product-moment correlation coefficient was calculated between handwriting-legibility scores ($M = 56.76$, $SD = 8.03$) and writing-achievement scores ($M = 17.03$, $SD = 5.04$), revealing a correlation of medium strength, correlation, $r(80) = .326$, $p = .004$. A significance level of .05 was set to determine if any findings may have a high possibility of being true, however, in order to protect from a type one error, a Bonferroni correction was made and an alpha level of .025 was used. The null hypothesis was rejected at a 98% confidence level.

Null Hypothesis 2

Null Hypothesis 2 (H_{02}) stated there is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *organization in written composition* as measured by Units of Study writing rubrics. A Pearson product-moment correlation was conducted using SPSS on the two sets of data. The Pearson product-moment correlation coefficient was calculated between handwriting legibility scores ($M = 56.76$, $SD = 8.03$) and organization in writing scores ($M = 56.76$, $SD = 5.04$), revealing a moderate positive correlation, $r(80) = .273$, $p = .02$. A significance level of .05 was set to determine if any findings may have a high possibility of being true, however, in order to protect from a type one error, a Bonferroni correction was made and an alpha level of .025 was used. In conclusion, there was significant evidence to reject the null hypothesis at a 98% confidence level.

CHAPTER FIVE: CONCLUSIONS

Overview

Chapter 5 will provide a discussion of the analysis of the findings from Chapter as implications from this study. Limitations of this study will be provided as well as recommendations for future studies in this area.

Discussion

The present study was designed to investigate the correlation between legibility in handwriting and writing achievement. Two research questions were examined: (1) Is there a correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *writing performance* as measured by Units of Study writing rubrics? and (2) Is there a correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *organization in written composition* as measured by Units of Study writing rubrics? The results of the analysis will be discussed as well as implications, limitations, and recommendations for future research. The present study showed no statistically significant relationship between legibility in handwriting and writing achievement.

Null Hypothesis One stated that there would be no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *writing performance* as measured by Units of Study writing rubrics. The hypothesis was rejected based on findings and a new hypothesis formulated stating that there is a moderate correlation between elementary grade students' handwriting scores and *writing performance*.

A significant relationship was found in handwriting legibility and writing achievement. The results of the study also indicated that students demonstrated a low basic proficiency in both handwriting legibility and writing achievement. Scores were clustered around the mean both in writing and handwriting. The average fifth grader in this study wrote at the level of a second grader. This suggests there is a need to focus on both handwriting and writing instruction.

The concept of automaticity is defined as a skill becoming fluid so that little thought is required for the skill to take place (Ehri, 1998; Nelson, 1980). The key to more smoothly learning new tasks that require multiple skills at one time (composition—which requires cognition, spelling, and handwriting, of which the latter can be complicated in and of them) is for more of the processes to be stored in the brain and practiced until they are considered automatic (Willingham, 2010). A lack of automaticity in letter formation may hinder word production in written comprehension (Ehri, 1998; Nelson, 1980). Students, when learning letter recognition and letter formation, use more working memory on these processes. Once letter recognition and letter formation are automatic, students can use working memory for the process of writing. Research findings also support that instruction in handwriting may allow students to use the limited capacity of working memory for composing rather than forming letters (Allen, Hitch, & Baddeley, 2009; Willingham, 2009).

This study's focus was on legibility. The idea that legibility is also related to writing composition may suggest that students are lacking in handwriting fluency, which impacts their legibility. It might also suggest that the legibility or lack thereof may constrain the compositional process in that students are struggling to make meaning of the text they are composing.

Hypothesis two stated there is no correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *organization in written composition* as measured by Units of Study writing rubrics. This hypothesis was tested to determine if poor handwriting legibility might be a factor in organizational skills in writing. The null hypothesis was rejected at the 98% confidence level. A new hypothesis was formulated to state, there is a correlation between 5th grade students' handwriting scores in legibility as measured by a curriculum based rubric assessment and *organization in written composition* as measured by Units of Study writing rubrics. The moderate correlation suggests that the ability to write legibly is related to organizing thoughts on paper. Students were graded on the ability to write a story that contained a clear beginning, middle and end. The rubric also called for the ability to develop the story with transition words to show the passage of time. Students in this study demonstrated some ability to organize their thoughts, but were not proficient in organization in writing. Additionally, this study focused only on one organizational structure in written composition for narrative structure. Students should have had exposure to this type of organizational structure in early grades as fictional stories are an important teaching structure for this grade level.

Implications

As this study rejected both null hypotheses, finding that both legibility in handwriting is positively related to both writing achievement and organizing thoughts on paper, time spent teaching letter formation in the early grades is strongly recommended. Graham (2007), recommends spending a minimum of 10 minutes daily on handwriting instruction. Based on the results of this study, handwriting can either hinder or support students' ability to compose text

and therefore, providing daily instruction for the purpose of automatizing handwriting should be an instructional consideration.

Other implications of this study point to the need for more instruction in writing with a focus on organization and conventions in writing. The area that most students exhibited difficulty was in conventions with elaboration being the next area of most difficulty. Teachers can use data drawn from rubric analysis to determine areas for instruction. As most students scored around a second-grade level in writing achievement with all students being tested at the end of fifth grade, this demonstrates that students are not proficient in writing with not enough emphasis on instruction.

Limitations

There were several limitations to consider during this study. The sampling was a sample of convenience drawn from 95 fifth grade students. Accessing data from local elementary schools is often difficult due to concerns with researchers taking class time and allowing researchers to contact both students and parents. The school's population is not reflective of the state's population at large and results of this study may not generalize to other populations. Another limitation of this study was the way the handwriting sample was gathered and measured. Because of the limitations of being able to gather data within the schools, the same writing sample was used for handwriting. The possible use of separately gathering the writing assessment and handwriting sample may have impacted scores for the handwriting sample.

Handwriting was graded using a curriculum-based assessment rubric as opposed to a more formal handwriting assessment. A separate handwriting assessment might have yielded different results than scoring the handwriting with a rubric. It was not possible to score the

samples using a commercial handwriting assessment for this study as data was collected ex post facto.

Additionally, the sample population was fifth grade students. Fifth graders were used in this study because fifth graders have had ample practice time to become proficient in handwriting and can produce a sufficient volume of writing to score with a rubric (Graham, McKeown, Kiuahara, and Harris, 2012). Students' speed and legibility in composing tend to increase from grade to grade, although this increase was not linear. For grades 1-4, the increase was steady, but began to slow in grade 5 (Graham, Berninger, Weintraub, & Schafer, 2001). The sample for this was drawn from fifth grade, indicating that skills in handwriting would be stable and may not have the same impact on legibility as scores of a third-grade student.

As data samples for handwriting were drawn from the writing sample, a commercial rubric for handwriting was used. There were concerns about the use of this rubric as it was modified prior to the study to provide an even number of criteria. This was done to minimize the possibility of the raters' defaulting to the middle score on an odd number of evaluation criteria (Brookhart, 2103; Hougan & Smartt, 2012; Garland, 1991).

One limitation that greatly affected the study was the use of rubrics as the instrumentation for scoring both the handwriting and writing samples. While a commercially prepared rubric was considered for scoring the handwriting, this instrument required administering the assessment in the school by the researcher. As samples were collected ex post facto in the summer, there was not an opportunity to administer a handwriting assessment. Also, to gain permission to administer a standardized test within the school setting would require parental permission. This would pose additional problems for this study. Standardized testing has

become a concern for many parents (Pizmony-Levy & Saraisky, 2016) and gaining permission might have caused a concern for gaining an appropriate sample size.

The low consensus rate between rubric scores between scorers was another limitation for this study. Despite the use of common rubrics, calibration of rubrics and trainings on the instruments, inter-rater reliability scores were around 70%. While this was an acceptable level, inter-rater reliability on both the writing rubrics and handwriting rubrics were at the low end of acceptability. Low inter-rater reliability scores might have impacted results of the study. One scorer taught with struggling learners and tended to score higher than the other scorer who was in a regular education classroom. This impacted scorers' perceptions. Scoring with rubrics, should have limited scorer bias. However, this low consensus between scorers indicates that even with a rubric, scorers still grade according to subjective thoughts based on past experiences with the grade level.

Recommendations for Future Research

Based on findings from the current study, several areas for future research could be considered. In that the study was only conducted with fifth graders, replicating the study in grades below fifth would provide additional information to administrators, curriculum directors and classroom teachers about the need for handwriting instruction in lower elementary grades. These grades are still in the process of becoming proficient in handwriting and the relationship between the two might be stronger as students are still learning the skill of handwriting (MacArthur & Fitzgerald, 2007). Studies indicate that both speed and legibility increase from grade to grade. By grade 5, legibility and speed begin to "level off", with female students indicating a higher level of legibility than for male students.

A study using a commercial handwriting scoring instrument in grades 5 and below would provide comparable information to the study using a rubric to score the handwriting. A commercially scored handwriting assessment would provide scaled scores, norms and percentiles (Milone, 2007). This data would provide additional descriptive data that could be used by teachers to determine if students are performing at grade level in handwriting.

Another area for future research would be to explore the possible relationship between handwriting legibility and conventions in writing. The present study attempted to explore this relationship but could not obtain inter-rater reliability between the two sets of scores. Providing in depth training needed to ensure inter-rater reliability was beyond the scope of this study. Students in this study scored lowest in conventions overall.

The extensive work conducted by both Berninger and Graham emphasize the importance of automaticity in handwriting as related to the ability to compose fluently; however, less is known about the connection between automaticity and legibility. Further exploration of automaticity and legibility in handwriting as related to written composition could provide insight into which grade levels might benefit most from instruction in handwriting. Exploring the grade level during which students are most likely to demonstrate automaticity in handwriting might be another factor in which to introduce keyboarding. The current idea is that students would best benefit from keyboarding instruction in fourth grade (Klein, Erickson, James, Perrott, Williamson, & Zacharuk, 2008). Georgia students begin standardized testing in third grade which is completed online with the use of keyboarding skills.

A final area for future research is in keyboarding proficiency in relation to writing achievement. Past studies have indicated that there is a link between handwriting skills and

keyboarding speed (Weintraub, 2015). Exploring the possibility of a relationship between keyboarding and writing achievement could give direction for curricular decisions. Technology, an important tool in the classroom, is used for standardized testing. In the state of Georgia, Milestone testing has replaced the former Writing Assessment (Georgia Department of Education, 2017), to determine proficiency in writing.

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APPENDIX A**IRB Form****LIBERTY UNIVERSITY**
INSTITUTIONAL REVIEW BOARD

June 20, 2017

Julia Houston

IRB Exemption 2898.062017: A Correlational Study of Students' Handwriting and Scores on Writing Samples in a Northwest Georgia School

Dear Julia Houston,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under exemption category 46.101(b)(4), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued

exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,


Administrative Chair of Institutional Research
The Graduate School



Liberty University | Training Champions for Christ since 1971

Appendix B

Request to Conduct Research in [REDACTED] Schools

June 7, 2017

[REDACTED]
Curriculum Director
[REDACTED]
[REDACTED]

Dear [REDACTED]

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The title of my research project is A CORRELATIONAL STUDY OF STUDENTS' HANDWRITING AND SCORES ON WRITING SAMPLES IN A NORTHWEST GEORGIA SCHOOL and the purpose of my research is to explore the relationship between handwriting and composition.

I am writing to request your permission to access and utilize student writing samples. The data will be used to correlate handwriting to writing samples. The relationship between the two will be examined. No student names, teacher names will be used in this study, nor will the school site be identified in the study.

Thank you for considering my request. If you choose to grant permission, please provide a signed statement on approved letterhead indicating your approval.

Sincerely,

Julia Houston
Doctoral Candidate

Appendix C

Permission to Conduct Research within [REDACTED] Schools

Permission form not shown to protect the privacy of the school

Appendix D

Permission to use Units of Study Rubric

Amanda Densmore <amanda.densmore@readingandwritingproject.com>

|

Tue 5/2/2017, 10:09 AM

Houston, Julia Lynn

Thank you for requesting permission. For your dissertation research and work, you have our permission to use the rubrics in the Writing Units of Study. If your work goes forward to publication of a book or other more public document, you will need to reapply for permission for publication.

Best,

[Redacted Signature]

--

XXXXXXX, Staff Developer

The Reading and Writing Project

Teachers College, Columbia University

XXXXXXXX@readingandwritingproject.com

readingandwritingproject.com

Appendix F

Manuscript Handwriting Rubric

1	2	3	4
(less than 25%)	(26%-50%)	(51% to 79%)	(80%-100%)
Letter Formation			
Mostly inaccurate letters consisting of straight strokes, vertical & horizontal (ie. E, F, H, I L, T, i, l, t)	Frequently inaccurate letters consisting of straight strokes, vertical & horizontal (ie. E, F, H, I L, T, i, l, t)	Usually accurate letters consisting of straight strokes, vertical & horizontal (ie. E, F, H, I L, T, i, l, t)	Letters consisting of straight strokes (vertical & horizontal) consistently accurate (ie. E, F, H, I L, T, i, l, t)
Mostly inaccurate formation of letters consisting of circle strokes. (o, O)	Frequently inaccurate formation of letters consisting of circle strokes.	Usually accurate formation of letters consisting of circle strokes.	Consistently accurate formation of letters consisting of circle strokes.
Mostly inaccurate formation of letters consisting of a combination of straight lines and circles (ie. P, b, d, P, a).	Frequently inaccurate formation of letters consisting of a combination of straight lines and circles (ie. P, b, d, P, a).	Usually accurate formation of letters consisting of a combination of straight lines and circles (ie. P, b, d, P, a).	Letters consisting of a combination of straight lines and circles consistently accurate (ie. p, b, d P, a).
Mostly inaccurate formation of letters consisting of a combination of straight lines and curved lines (ie. f, h, u, g, j, m, n).	Frequently inaccurate formation of letters consisting of a combination of straight lines and curved lines (ie. f, h, u, g, j, m, n).	Usually accurate formation of letters consisting of a combination of straight lines and curved lines (ie. f, h, u, g, j, m, n).	Consistently accurate formation of letters consisting of a combination of straight lines and curved lines (ie. f, h, u, g, j, m, n).
Letter Size, Proportion, & Alignment			
Letters of the same size are mostly not the same height. (ie. sco)	Letters of the same size are frequently not the same height.	Letters of the same size are usually the same height.	Letters of the same size are consistently the same height.
Lower case letter size is mostly inconsistent from the midline to	Lower case letter size is frequently inconsistent from the	Lower case letter size is usually consistent from the midline to	Lower case letter size is mostly consistent from the midline to

the baseline (ie. c, e, x, w, m, n)	midline to the baseline (ie. c, e, x, w, m, n)	the baseline (ie. c, e, x, w, m, n)	the baseline (ie. c, e, x, w, m, n)
Lower case letters (ie. b, d, h, k, l) mostly do not extend to the top line	Lower case letters (ie. b, d, h, k, l) frequently do not extend to the top line	Lower case letters (ie. b, d, h, k, l) usually extend to the top line	Lower case letters (ie. b, d, h, k, l) consistently extend to the top line
Lower case letters (ie. g, j, p, q, y) sit on the line and do not extend below the base line.	Lower case letters (ie. g, j, p, q, y) sit on the line and frequently do not extend below the base line.	Lower case letters (ie. g, j, p, q, y) usually extend below the base line.	Lower case letters (ie. g, j, p, q, y) consistently extend below the base line.
Upper case letters do not touch both the top and bottom lines.	Upper case letters frequently do not touch both the top and bottom lines.	Upper case letters usually touch both the top and bottom lines.	Upper case letters consistently touch both the top and bottom lines.
Letters are not even along the baseline	Letters are frequently not even along the baseline	Letters are usually even along the baseline	Letters are consistently even along the baseline
Upper case letters are the same size as lower case letters.	Upper case letters are frequently the same size as lower case letters.	Usually upper case letters are taller than lower case letters.	Upper case letters are consistently taller than their lower case counterparts.
Size of writing is very large or very small for grade level.	Size of writing is somewhat large or very small for grade level.	Size of writing is mostly appropriate for grade level.	Size of writing is consistently appropriate for grade level.
Spacing			
Spacing is inconsistent between letters within words.	Spacing is somewhat inconsistent between letters within words.	Spacing is mostly consistent between letters within words.	Spacing is consistent between letters within words.
Spacing is inconsistent between words and sentences.	Spacing is somewhat inconsistent between words and sentences.	Spacing is mostly consistent between words and sentences.	Spacing is consistent between words and sentences.
Line Quality			
The thickness of lines is usually inconsistent.	The thickness of lines is somewhat inconsistent.	The thickness of lines is mostly consistent.	The thickness of lines is usually consistent.
Steadiness of lines is inconsistent, often wavy.	Steadiness of lines is inconsistent, sometimes wavy.	Steadiness of lines is consistent, mostly not wavy.	Steadiness of lines is consistent, not wavy.
Slant			
Mostly inconsistent uniformity of slant.	Some inconsistency of uniformity of slant.	Usually slant of letters is consistent.	Slant of letters is consistently uniform.
Letters are mostly	Letters are often	Letters are mostly	Letters are

inconsistently perpendicular to the baseline.	inconsistently perpendicular to the baseline.	consistently perpendicular to the baseline.	consistently perpendicular to the baseline.
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Appendix G
Units of Study Writing Rubric

Rubric for Narrative Writing—Fifth Grade

	1.0 pt.	1.5	2.0 pts.	2.5 pts.	3.0 pts.	3.5 pts.	4 pts.
Structure							
Overall	The writer told the story bit by bit		The writer wrote the important part of an even bit by bit and took out unimportant parts.		The writer wrote a story of an important moment. It read like a story, even though it might be a true account		The writer wrote a story that had tension, resolution, and realistic characters and conveyed an idea or lesson.
Lead	The writer wrote a beginning in which he helped reader know who the characters were and what the setting was in his story.		The writer wrote a beginning in which she showed what was happening and where, getting readers into the world of the story.		The writer wrote a beginning in which he not only showed what was happening and where, but also gave some clues to what would later become a problem for the main character.		The writer wrote a beginning in which she not only set the plot or story in motion, but also hinted at the larger meaning the story would convey.
Transitions	The writer told her story in order by using phrases such as a little later and after		The writer showed how much time when by with words and phrases that mark time such as <i>just then</i> and <i>suddenly</i> (to		The writer used transitional phrases to show passage of time in complicated ways,		The writer used transitional phrases to connect what happened to why it happened such as <i>if he</i>

	that.		show when things happened quickly) or <i>after a while</i> and a <i>little later</i> (to show when a little time passed).		perhaps by showing things happening at the same time (<i>meanwhile, at the same time</i>) or flashback and flash-forward (<i>early that morning, three hours later</i>)		<i>hadn't...he might not have...because of..., although..., and little did she know that...</i>
Endings	The writer chose the action, talk, or feeling that would make a good ending and worked to write it well.		The writer wrote an ending that connected to the beginning or the middle of the story. The writer used action dialogue, or feeling to bring her story to a close.		The writer wrote an ending that connected to the main part of the story. The character said, did, or realized something at the end that came from what happened in the story. The writer gave readers a sense of closure.		The writer wrote an ending that connected to what the story was really about. The writer gave readers a sense of closure by showing a new realization or insight or a change in a character or narrator.
Organization	The writer used paragraphs and skipped lines to separate what		The writer used paragraphs to separate the different parts or times of the story or to show when a new character		The writer used paragraphs to separate different parts or time of the story and to		The writer used paragraphs purposefully, perhaps to show time or setting changes, new

	happened first from what happened later (and finally) in her story.		was speaking.		show when a new character was speaking. Some parts of the story were longer and more developed than others.		parts of the story, or to create suspense for readers,. He created a sequence of events that was clear.
Development							
Elaboration	The writer worked to show what was happening to (and in) his characters.		The writer added more to the heart of her story, including not only actions and dialogue but also thoughts and feelings.		The writer developed characters, setting, and plot throughout his story, especially the heart of the story. To do this, he used a blend of description, action, dialogue, and thinking.		The writer developed realistic characters and developed the details, action, dialogue, and internal thinking that contributed to the deeper meaning of the story.
Craft	The writer not only told her story, but also wrote it in ways that got readers to picture what was happening and that brought her story to life.		The writer showed why characters did what they did by including their thinking. The writer made some parts of the story go quickly, some slowly. The writer		The writer showed why characters did what they did by including their thinking and their responses to what happened. The writer		The writer developed character traits and emotions through what characters said and did. He developed some characters to show why they acted and spoke as they did. He told the internal as

		<p>included precise and sometimes sensory details and used figurative language (simile, metaphor, personification) to bring his story to life.</p> <p>The writer used a storytelling voice and conveyed the emotion or tone of his story through description, phrases dialogue, and thoughts.</p>	<p>slowed down the heart of the story. She made less important parts shorter and less detailed and blended storytelling and summary as needed.</p> <p>The writer included precise details and used figurative language so that reader could picture the setting, characters, and events. She used some objects or actions as symbols to bring forth her meaning. The writer varied her sentences to create the pace and tone of her narrative.</p>	<p>well as the external story.</p> <p>The writer chose several key parts to stretch out and several to move through more quickly.</p> <p>The writer wove together precise descriptions, figurative language, and symbolism to help reader picture the setting and events and to bring forth meaning.</p> <p>The writer not only varied his sentences to create the pace and tone of his narrative and to engage his readers, but also used language that fit his story's meaning, for example, in parts that had dialogue, different characters used different kinds of language.</p>
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Language Conventions							
Spelling	<p>The writer used what he knew about spelling patterns to help him spell and edit before he wrote his final draft.</p> <p>The writer got help from others to check his spelling and punctuation before he wrote his final draft.</p>		<p>The writer used what she knew about word families and spelling rules to help her spell and edit. She used the word wall and dictionaries when needed.</p>		<p>The writer used what he knew about word families and spelling rules to help him spell and edit. He used the word wall and dictionaries when needed.</p>		<p>The writer used resources to be sure the words in her writing were spelled correctly.</p>
Punctuation	<p>The writer punctuated dialogue correctly with commas and quotation marks. While writing, the writer put punctuation at the end of every sentence. The writer wrote in ways that helped readers</p>		<p>When writing long, complex sentences, the writer used commas to make them clear and correct.</p>		<p>The writer used commas to set off introductory parts of sentences, such as <i>One day at the park, I went on the slide</i>; she also used commas to show when a character is talking directly to someone, such as “<i>Are you</i></p>		<p>The writer used punctuation to help set a mood, convey meaning, and/or build tension in his story.</p>

	read with expression, reading some parts quickly, some slowly, some parts in one sort of voice and others in another.				<i>mad, Mom?"</i>		
--	---	--	--	--	-------------------	--	--