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Pencil pointers: an evidence-based, online, handwriting resource for elementary educators

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Doctoral Project

PENCIL POINTERS:

AN EVIDENCE-BASED, ONLINE, HANDWRITING

RESOURCE FOR ELEMENTARY EDUCATORS

by

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DEDICATION

I would like to dedicate this work to the amazing educators at Corvian Community School who inspire me with their breadth of knowledge, creativity in teaching, and passion for always doing what is right for children.

I would also like to dedicate this work to my spouse, Steve, and my children, Ryn, Stephanie, and Colton who have supported and encouraged me throughout this process.

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ABSTRACT

Advances in the use of technology in the classroom have not changed the fact that handwriting remains a primary occupation of students throughout their educational careers. A recent study stated that "up to 27% of children in elementary school are reported to have handwriting problems" (Steinhart et al., 2021, p.2). Despite this fact, explicit handwriting instruction receives inadequate classroom time. For handwriting to become a functional skill, it needs to become automatic. Automaticity is developed through explicit instruction and sufficient practice (Montgomery & Zwicker, 2020). When faced with handwriting challenges, elementary school educators report not feeling equipped to help students with pencil grasp and handwriting deficits (Nye & Sood, 2018). Students who experience handwriting challenges often avoid writing by complaining about hand pain and discomfort or generating short, simplified written responses. These factors interfere with work completion and overall academic success. Pencil Pointers is an online, interactive, evidence-based, handwriting troubleshooting resource for general education elementary educators based on Experiential Learning Theory and Social Learning Theory. The intent is to provide quick and accurate, evidence-based, classroom-friendly activities and strategies for deficit-specific handwriting troubleshooting.

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LIST OF ABBREVIATIONS

CET .... Cultural Evolution Theory

ELA ....English Language Arts

ELT ....Experiential Learning Theory

IDEA ....Individuals with Disabilities Act

IEP ....Individualized Education Program

ISTE ....International Society for Technology in Education

MTSS ....Multi-tiered System of Supports

NCDPI...North Carolina Department of Public Instruction

OTP ....Occupational Therapy Practitioner

RRCNA...Reading Recovery Council of North America

SDI ....Specially Designed Instruction

CHAPTER ONE – Introduction

Advances in the use of technology in the classroom have not changed the fact that handwriting remains a primary occupation of students throughout their educational careers for the acquisition and expression of knowledge and creativity. Handwriting challenges are the number one reason for referral to school-based occupational therapy intervention (Brown & Link, 2016; Caramia et al, 2020; Steinhart et al., 2021). A recent study stated that "up to 27% of children in elementary school are reported to have handwriting problems" (Steinhart et al., 2021, p.2). However, in most states, occupational therapy is considered a related service that is recommended by a team of professionals who design Individualized Education Programs (IEPs) to assist eligible students in accessing their education with the support of specially designed instruction (SDI) (Chandler, 2013). According to the Individuals with Disabilities Education Act (IDEA):

> The term "related services" means transportation, and such developmental, corrective, and other supportive services (including speech-language pathology and audiology services, interpreting services, psychological services, physical and occupational therapy, recreation, including therapeutic recreation, social work services, school nurse services designed to enable a child with a disability to receive a free appropriate public education as described in the individualized education program of the child, counseling services, including rehabilitation counseling, orientation and mobility services, and medical services, except that such medical services shall be for diagnostic and evaluation purposes only) as

> may be required to assist a child with a disability to benefit from special
>
> education, and includes the early identification and assessment of disabling
>
> conditions in children (IDEA, 2004, Section 1401.26.A).

As a result, in most states, only students who qualify for SDI, as outlined in an IEP, are

eligible to receive occupational therapy intervention in school. According to recent

statistics, only 14.4% of students aged 3-21 are enrolled in special education (Riser-

Kositsky, 2019) and a fraction of those receive occupational therapy as a related service.

The remainder of the students with handwriting challenges who do not qualify for SDI

continue to grapple with hand pain/fatigue, decreased speed, and poor legibility in

general education classrooms with the support of their teachers.

Elementary school educators are tasked with initial, explicit handwriting

instruction for all students. Unfortunately, research reveals that explicit handwriting

instruction receives inadequate classroom time due to a lack of teacher confidence and

administrators' resistance to providing standardized, evidenced-based curricula (Nye &

Sood, 2018; Puranik et al., 2013). When students demonstrate handwriting challenges,

teachers report knowing that something is wrong and wanting to help but state that they

don't know how (Nye & Sood, 2018). They also consistently report inadequate training

related to explicit handwriting instruction in their undergraduate education programs and

limited time to attend professional development related to handwriting instruction (Nye

& Sood, 2018).

The Common Core State Standards (2021) outline the learning expectations for

students in the United States in grades kindergarten through twelfth grade. Though these

standards emphasize writing, for K-5 students, there are no standards that delineate handwriting legibility and fluency expectations. The writing process and various types of composition comprise grade-level goals, but letter formation, alignment, spacing, and speed skills are not among the required standards (Common Core State Standards Initiative, 2021). As a result, less time is spent in the classroom on handwriting and some schools no longer require explicit instruction in handwriting (McCarroll & Fletcher, 2017).   For handwriting to become a functional skill, it needs to become automatic and the critical period for developing this automaticity is from kindergarten through second grade (Chang & Yu, 2013; Puranik et al., 2013). Automaticity is developed through explicit instruction and daily practice (Du et al., 2022; Puranik et al, 2013).

When faced with handwriting challenges, elementary school educators report that they do not feel equipped to help students who have pencil grasp and handwriting deficits (Nye & Sood, 2018). Teachers report benefiting from collaborating with an occupational therapy practitioner but acknowledge that school-based occupational therapy practitioners' time is limited (Nye & Sood, 2018). This is especially true for addressing concerns about students who do not qualify for an IEP. Standardized assessments of reading competence and math skills are consistently administered in the elementary general education population to assess academic performance. According to these assessments alone, many elementary students with handwriting challenges are functioning, academically, as expected for their current grade. Although handwriting has been identified as a key factor in predicting academic success (McCarroll & Fletcher, 2017), it is not regularly assessed using standardized measures in general education.

Thus, illegible handwriting in the elementary school grades is not formally identified as a skill that hinders a student's ability to access their education.

The negative effect of slow and illegible handwriting on academic performance in upper grades is well documented (Brown & Link, 2016). In later years, deficits in pencil grasp, handwriting speed, and handwriting legibility often persist and begin to interfere with the student's ability to produce grade-level work (Lin et al., 2017). In addition, research indicates that teachers score written assignments with equal quality of content differently based on legibility giving lower scores to disorderly papers (Graham, 2018; Wallen et al., 2013). Struggling with handwriting challenges can lead to low self-esteem and academic failure (Brown & Link, 2016; Steinhart et al., 2021). Falling below grade level expectations in middle or high school, just as in elementary school, may result in a recommendation for SDI which may include a request for an occupational therapy consultation or evaluation to address handwriting as part of the evaluation process for putting an IEP in place. The understanding of automaticity and its role in complex skill acquisition teaches us that it is very important to catch maladaptive and pervasive immature motor patterns early. The more a motor pattern is repeated, the more automatic it becomes and the harder it is to change; whether it is an adaptive or a maladaptive pattern (Du et al., 2022). In other words, as stated by Sarah Kay in her poem "Postcards," "Practice does not make perfect. Practice makes permanent. Repeat the same mistakes over and over, and you don't get any closer to Carnegie Hall" (Kay, 2014, p. 76). Correcting maladaptive grasp patterns and handwriting habits in middle or high school after years of repetition is quite challenging. Therefore, it is imperative that we

help students develop and strengthen functional motor patterns with explicit handwriting instruction, correction of maladaptive motor patterns, and consistent practice early in their educational careers (Puranik et al., 2013).

Based on the knowledge that handwriting remains a primary occupation of students, the research that reveals the sizeable percentage of students struggling with handwriting challenges who do not qualify for school-based occupational therapy intervention, and the reports of educators who do not feel equipped to address these challenges, this author intends to design Pencil Pointers, an evidence-based, online handwriting resource for elementary, general-education teachers. Searching online for help with handwriting strategies is overwhelming. There are professional development courses that provide generalized information on handwriting instruction and troubleshooting; however, the strategies are not student- or deficit-specific and may not apply to an individual they are concerned about in their classroom. When sifting through websites, teachers find massive amounts of generalized activities for "fine motor development" or "improving pencil grasp." However, it is difficult to know which activities or strategies would be most effective for their student.

Pencil Pointers will begin by providing information about developmentally appropriate handwriting skills by grade level and functional pencil grasp patterns. If the teacher ascertains that the student of concern is demonstrating a deficit and not a developmentally appropriate pattern, the teacher will be guided through a series of questions and pictures requiring responses that relate to the student of concern. Based on the teacher's responses to these questions, this new resource will recommend activities

and strategies that are deficit-specific, evidence-based, and easy to implement within the teacher's scope of practice while waiting for an occupational therapy consultation to occur.   Teachers will be provided with video modeling and printable versions of the activity or strategy instructions as well as data collection sheets for progress monitoring.

CHAPTER TWO – Project Theoretical and Evidence Base

As discussed in Chapter 1, handwriting remains a primary occupation of students for the acquisition of knowledge, presentation of knowledge, and expression of creativity. It is also a key factor in indicating future academic success (McCarroll & Fletcher, 2017). Current teachers and administrators endorse the evidence-based value of explicit handwriting instruction in elementary education (Collette et al., 2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016). Unfortunately, as noted in Appendix A, teachers report that they do not know how and do not have time to explicitly teach handwriting (Collette et al., 2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016). As explained by Cultural Evolution Theory (CET), the focus, priorities, and methods within the education system of the United States have changed over time (Brahm & Poblete, 2022; Mesoudi, 2015). Throughout its course, the culture of education has adopted new characteristics and lost others in a process akin to Darwin's natural selection. These facets of evolution in the education culture have occurred in response to many events and innovations. Three factors implicated in the current lack of explicit handwriting instruction are the knowledge explosion of the industrial revolutions, the adoption of whole language theory which favored process writing instead of phonics instruction and explicit handwriting instruction, and the rush to incorporate the use of technology in the classroom to ensure digital literacy.

The knowledge explosion of the industrial revolutions has resulted in more topics to cover in all subject areas. R. Buckminster Fuller was a futurist and inventor who conceived the "Knowledge Doubling Curve" in 1982 (Carroll, 2022). Fuller surmised

that in 1900 the knowledge base of humanity doubled every one hundred years. He

estimated that by the end of 1945, the rate had quickened to doubling every twenty-five

years, and by 1982 every thirteen years. It is now estimated that the knowledge base of

humanity is doubling every twelve hours (Carroll, 2022). This is reflected in the high

expectations outlined in both the Common Core State Standards and the North Carolina

Standard Course of Study in all subject areas. The importance of explicit handwriting

instruction has been largely crowded out and ignored. The Common Core State

Standards include no standards related to handwriting legibility (Collette, 2017) and the

North Carolina Standard Course of Study includes only one handwriting standard out of

40-42 English Language Arts (ELA) Standards per grade level for grades K-2 (NCDPI,

2021). In a study by Collette and colleagues in 2017, over 50% of the teachers surveyed

felt that "Common Core increased instruction requirements in other areas, resulting in

insufficient or no time for handwriting instruction" (p. 5). The daily academic schedule

is full. Districts, schools, and teachers have to prioritize what is covered in the finite

hours of the academic day. Unfortunately, the foundational skill of handwriting is often

de-prioritized to the detriment of many students' academic success.

Whole-language theory was widely adopted in the United States in the 1980s.

The adoption of this teaching method negatively impacted explicit handwriting

instruction (Donica, 2010; Farris, 1991). Whole-language theory asserted that students

would naturally learn to write legibly during the use of process writing techniques (Farris,

1991). This is commonly known as the "caught vs. taught" strategy. Explicit

handwriting instruction was only to be provided to individual students who demonstrated

deficits in handwriting (Farris, 1991). This practice was time-consuming and inefficient for teachers and has been largely contradicted by recent research that supports explicit handwriting instruction with frequent periods of practice for all elementary-age students (Montgomery & Zwicker, 2020). Providing explicit handwriting instruction allows for the development of automatic handwriting skills which are integral to effective process writing activities.

A recent increase in the emphasis on the use of technology in the classroom and digital literacy starting in the early elementary grades is connected to the knowledge explosion and current cultural evolution toward the increased use of technology throughout society. Children are interacting with technology earlier and earlier. It is now expected that technology is incorporated into the classroom by both the teacher as part of the curriculum to enhance learning and by the students as a method of research, project completion, and self-expression. Many current jobs require, at minimum, basic digital literacy. However, children are not developmentally ready to begin learning how to type on a keyboard until third grade (Farris, 1991). As a result, handwriting remains the primary mode of written language through elementary school (Donica, 2010; Robert Joan, et al., 2012; McCarroll & Fletcher, 2017; Montgomery & Zwicker, 2020). Research has shown that children who struggle with handwriting struggle academically (McCarroll & Fletcher, 2017). Regardless of the use of technology, legible handwriting remains a critical and necessary skill.

The need to adapt education curricula in response to the knowledge explosion, the adoption of whole-language theory for literacy, and the increased emphasis on digital

literacy starting in the early elementary grades can be explained by the Cultural Evolution

Theory (CET). CET utilizes a Darwinian model to explain how "beliefs, preferences,

values, skills, knowledge, ideas, attitudes, and other socially transmittable 'traits'" (p. 4)

held at both the individual and group level, are subject to transmission, selection, and

variation, thus evolving over time (Brahm & Poblete, 2022; Mesoudi, 2015). These

occurrences have resulted in less time for explicit handwriting instruction during the

academic day (Collette et al., 2017; Nye & Sood, 2018). As a result of these cultural

shifts in the focus of elementary education, explicit handwriting instruction and evidence-

based handwriting curricula are inconsistently included as topics in undergraduate degree

program requirements (Collette et al., 2017; Donica et al., 2012; Sharp & Titus, 2016),

leaving teachers feeling under-prepared to provide explicit handwriting instruction in the

classroom regardless of the fact that teachers agree that explicit handwriting instruction is

important for academic success (Collette et al., 2017; Donica et al., 2012; Nye & Sood,

2018; Sharp & Titus, 2016). As stated in Chapter 1, it was recently reported that up to

27% of students in the elementary school student population have "handwriting

problems" (Steinhart et al., 2021). Though some of these students will qualify for direct

occupational therapy services, elementary educators benefit from support to provide

adequate handwriting instruction and to assist students with handwriting challenges in the

general education classroom (Collette et al., 2017; Donica et al., 2012; Nye & Sood,

2018, 2020) (see Figure 2.1).

Figure 2.1

Explanatory Model of the Problem Being Addressed
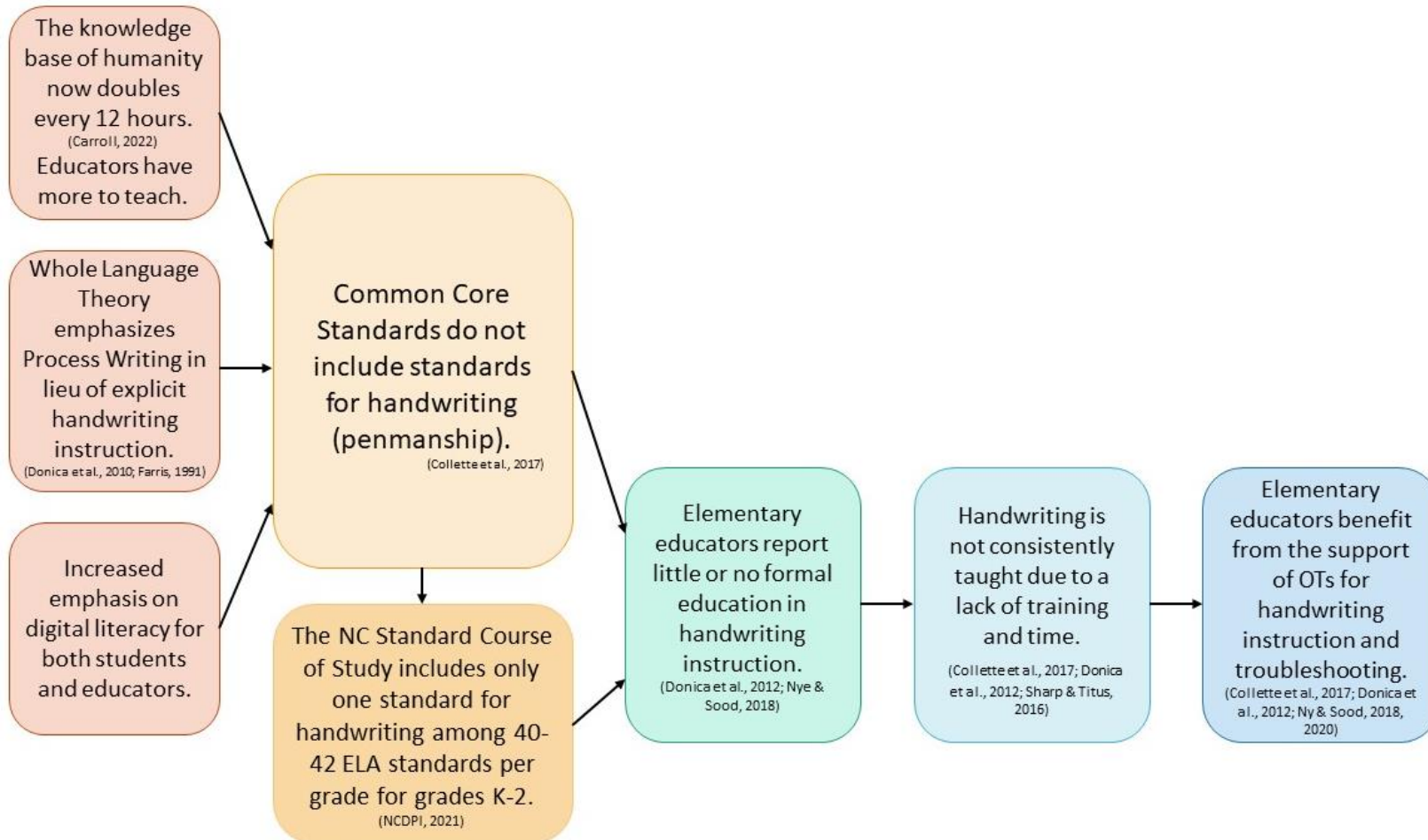
CHAPTER THREE – Overview of Current Approaches and Methods

It has been established that handwriting remains a primary occupation of elementary school students and that teachers endorse the value of explicit instruction in handwriting in the early elementary grades. However, teachers report that they are not consistently provided with undergraduate instruction in evidence-based handwriting curricula or methods for explicit handwriting instruction. So how do teachers currently acquire this knowledge? Professional development courses about handwriting are abundant, but also require teachers to take time away from the classroom and can be costly. In addition, professional development courses provide generalized information about handwriting instruction and troubleshooting which may or may not apply to the student or students a teacher is concerned about in their classroom.

A Google search using the keywords, "handwriting," "intervention," "teacher," and "resource" generated a flurry of grey literature. Websites, blogs, and videos with extensive, generalized lists of activities to "improve handwriting" or "fix pencil grasp" were plentiful, but confusing. Which activities were evidence-based? Which activities would help with specific handwriting deficits or maladaptive pencil grasp patterns observed in a particular student? Which strategies were appropriate for use with a second-grade student? Which activity should be first and is there a correct sequence for addressing the issue? Resources with more guided information were much less common. The most relevant resources located in this search included a website with blog posts, printable resources, and a related Facebook page; three YouTube channels; and a website with an integrated literacy curriculum.

The OT Toolbox (https://www.theottoolbox.com) is an information-dense, evidence-based website with blog posts on a wide variety of subjects; regular informational emails to subscribers; social media connections on Facebook, Instagram, Pinterest, and X; free printable resources; and printable resources for purchase. It is marketed to therapists, teachers, and parents. There is a specific section of the website dedicated to handwriting with evidence-based information and generalized activity suggestions for handwriting instruction and remediation. The YouTube channels most relevant to handwriting instruction and remediation included The OT Guide (https://www.youtube.com/@TheOTGuide), The Purple Alphabet (https://www.youtube.com/@ThePurpleAlphabet), and The Prince Edward Island Department of Education and Lifelong Learning School Therapy OT Program (https://www.youtube.com/watch?v=8NTUi6iJkFA&list=PLKGqXZKNtdG5I3i3A_KSt XpoSP-3xeTfq). All three of these YouTube channels offered a variety of videos on handwriting topics ranging from posture to pencil grasp to letter formation and remediation of various handwriting deficits. Finally, Learning Without Tears® (https://www.lwtears.com/) is an integrated, evidence-based continuum of literacy instruction that includes Handwriting Without Tears®, an evidence-based handwriting curriculum. The Learning Without Tears® website includes professional development options on a variety of topics including explicit handwriting instruction with limited strategies for handwriting remediation. Portions of this program are free while others require the user to pay a fee or purchase a product.

A search of current research found no studies related to handwriting resources for general education elementary teachers. Research is needed to discern if and how general education teachers are finding the resources they need to support general education students with handwriting deficits. Of the resources identified above, some were evidence-based, but none of the options allowed for the discovery of deficit-specific, student-centered information. They all presented general topics related to foundational skills for handwriting, the development of proper pencil grasp, and general activities for a variety of other handwriting topics. General education teachers will benefit from an easily accessible, online, student-specific, evidence-based resource for handwriting troubleshooting. It is recommended that a high-quality, user-friendly digital resource that provides specific, evidence-based, and equitable strategies for common handwriting challenges be designed to support educators in the general education population. Pencil Pointers will provide teachers with the needed support due to their self-reported lack of handwriting instruction training, limited access to handwriting curricula, and limited access to in-person occupational therapy practitioner support.

CHAPTER FOUR – Description of the Proposed Program

Theoretical Base

When considering providing an online resource for general education elementary

educators, it is important to consider the most effective method of delivery. Dernova

(2015) states that theories of adult learning, in general, assume that adults are motivated,

autonomous, and self-directed learners. There is an understanding that professional, real-

world problems are the primary focus of adult learners and their prior knowledge level

must be considered. Learning outcomes should be immediately applicable to the

learner's professional environment or another real-world scenario. The instructor should

be viewed as a guide, facilitator, or partner rather than someone who imparts knowledge.

Arghode et al. (2017) endorsed the same qualities of adult learning but also added that

self-paced learning is recommended with minimum direct instruction and maximum

autonomy. Specifically, Experiential Learning Theory (ELT) shifts the focus from

teaching or knowledge transfer to learning through cumulative experiences and is

"designed to engage students in direct experiences tied to real-world problems and

situations" (Dernova, 2015, p. 52).

Research regarding the effectiveness of specific online adult education methods

was challenging to locate. Copper and Semich (2014) studied the use of YouTube videos

as training tools for professional development. The results revealed four main themes:

convenience, consistency, quality, and appeal to visual and auditory learners. The

participants appreciated that the YouTube videos were accessible from anywhere and

they were free. In addition, the ability to rewind and rewatch the videos or use the same

videos for refreshing and retraining skills supported the consistency of this teaching

method. Participants highlighted the benefit of watching videos for both auditory and

visual learners but did endorse that the videos must be high quality to support adequate

learning. Daniels and Billingsley (2014) performed a study that gathered both qualitative

and quantitative data in the form of surveys and questionnaires with both closed and

open-ended questions regarding the use of a closed group Facebook page as a social

media method to support critical reflection among adult learners. Throughout the study,

the Facebook page reportedly became a cooperative conversation and space for

collaboration as well as further investigation. This phenomenon is supported by Deaton's

(2015) literature review on the application of social learning theory to the use of social

media in education. Deaton (2015) states that social media increases attention, memory,

and motivation. When interacting with social media, attention and engagement are

interwoven. Students who write posts, read posts, and respond are actively engaging and

utilizing sustained attention which facilitates sharing knowledge. At the end of Daniels

& Billingsley's (2014) study, one hundred percent of the participants either "agreed" or

"strongly agreed" that the Facebook page was "a helpful tool to communicate ideas,

thoughts, and reflections about current events" (p. 34). Finally, Jiménez et al. (2021)

performed a study in Latin America and the Canary Islands using a pre-test/post-test

design to compare pre-service and in-service teacher responses to a web-based course

related to attitudes and knowledge of teaching writing skills. Both pre-service and in-

service teachers demonstrated statistically significant knowledge growth in all areas

addressed. In-service teachers utilized the extra videos and discussion forum options

more than pre-service teachers. This correlates with the concept that in-service teachers

may be more likely to have shifted from an instructor-led knowledge transfer model to an

experiential, self-guided learner model that benefits from social learning and sharing of

knowledge and experience with other in-service teachers.

Collectively, these studies indicate that there are many benefits to the use of

online educational resources for adults. Research indicates that best practices for online

adult education involve the use of multi-media options such as videos as well as

interactive discussion platforms such as Facebook. Online resources were reported to be

convenient and consistent both in the ability to access them from anywhere around the

world with internet access as well as the opportunities for reviewing content as needed

(Copper & Semich, 2014; Jiménez et al., 2021). Both the YouTube videos (Copper &

Semich, 2014) and the online learning platform (Jiménez et al., 2021), allowed for

auditory and visual content delivery which improves access for students with different

learning needs. Discussion posts on Facebook (Daniels & Billingsley, 2014) and as an

option in the web-based course (Jiménez et al., 2021) provided a platform for cooperative

conversation and collaboration. Participants shared knowledge and investigated topics in

greater detail in the discussion posts which supports the concept that the use of social

media in adult education increases attention, memory, and motivation (Deaton, 2015). In

addition, engagement in discussion posts shifts the focus from teaching or knowledge

transfer to learning through cumulative experiences and is "designed to engage students

in direct experiences tied to real-world problems and situations" (Dernova, 2015, p. 52)

as supported by experiential learning theory. Finally, the opportunity for self-paced

learning was emphasized as a key ingredient for effective adult learning in two out of three studies (Copper & Semich, 2014; Jiménez et al., 2021).

Ultimately, none of these studies independently or collectively answered the question of "current best practices for the use of online delivery methods in adult learning" because only one assessed whether the participants gained knowledge of the content of the training while the other two studies focused on the participants' qualitative experiences using the online platforms. It is strongly recommended that more research be conducted on the effectiveness of various online education platforms. In the meantime, when designing an online resource for elementary educators, it will be essential to establish a strong foundation in adult learning theory to support the rationale for the design. Specifically, Experiential Learning Theory and Social Learning Theory have been identified as theories of adult learning that correlate well with online education (Deaton, 2015; Dernova, 2015; Arghode, 2017).

Basis of Proposed Program

Pencil Pointers is an evidence-based, online, interactive, handwriting troubleshooting resource for general education elementary educators. The design was informed by a mixed method survey conducted by this author with twenty-three general education elementary teachers (see Appendix A). Educators will answer questions about a student's grade level and handwriting challenges. They will also select a picture that most closely matches the student's pencil grasp (see Figure 4.3). Based on the answers provided and the pictures selected, the website will present the teacher with 5-7 evidence-based, handwriting activities and strategies appropriate for addressing the specific

student's needs. Online or printable data collection methods will be offered for progress

monitoring. Educators will be encouraged to return to the website for data entry and

follow-up. After the recommended implementation period, educators will have the

option to request new activities for maintaining student engagement and progress. If a

student is not progressing as expected, the educator will be directed to answer additional

questions for clarification of the student's handwriting challenges. This will result in the

recommendation of a new set of activities and strategies.

Problem Being Addressed

The advent of the whole language theory of education had a strong, negative

impact on explicit handwriting instruction (Donica, 2010; Farris, 1991). The thought was

that students would "naturally" learn how to form letters correctly while watching the

teacher and writing their own words and sentences in text-response assignments. In the

years following, research has largely debunked that theory, but the influence was

widespread. Common Core Standards don't include any requirements for handwriting

legibility (Collette, 2017). As a result, undergraduate education programs often do not

cover the subject, school districts do not purchase handwriting curriculums (as they do

for reading and math), time is not allotted for explicit handwriting instruction in many

schools, and teachers are left to troubleshoot handwriting challenges with little guidance

(Nye & Sood, 2018). In addition, teachers have limited time in the school day. The

expectations set forth by Common Core Standards and the North Carolina State

Standards are very high in the content areas. Teachers who choose to explicitly teach

handwriting due to their knowledge of evidence-based practice, often have to find

materials on their own or develop their own "curriculum."

In the school system, occupational therapy practitioners are often viewed as "handwriting specialists." When faced with students who have handwriting deficits, a teacher may request an occupational therapy screening or consultation, but many school-based occupational therapy practitioners are over-scheduled with students who require specially designed instruction (SDI). Thus, the referred student may have to wait for weeks before that screening or consultation occurs. Even then, options for support are variable for general education students who do not require an individualized education program (IEP). Occupational therapy is considered a related service in many states and only students who require an IEP have access to direct occupational therapy intervention. In some districts, schools may have an occupational therapy practitioner involved in the Multi-Tiered System of Support (MTSS), but this is inconsistent across districts and across the country.

Program Explanation

When faced with handwriting challenges, elementary school educators report that they do not feel equipped to help students who have pencil grasp and handwriting deficits (Nye & Sood, 2018). Pencil Pointers, based on ELT and social learning theory, will allow teachers to visit the website, click on related pictures, and provide answers to questions as they relate to a specific student in their classroom who is experiencing handwriting challenges (see Figure 4.1). Rather than attending a professional development course on handwriting that requires a half or full day away from the classroom and may or may not answer their specific questions, this web application will

Figure 4.1

Logic Model for Pencil Pointers

Pencil Pointers: An Evidence-Based, Online, Handwriting Resource for Elementary Educators

Program Clients

Elementary educators in general education classrooms.

Program Resources

Staffing
- Website designer
- Website content manager (self)

Funding
- Website building
- Website maintenance
- Marketing

Nature of the Problem
- Elementary educators are not taught how to teach handwriting
- Schools/districts often do not provide handwriting curricula or resources
- Educators do not have time to troubleshoot evidence-based, classroom-friendly activities for handwriting deficits with existing resources

Program Theories
- Experiential Learning Theory
- Social Learning Theory

Interventions and Activities
- Educator selects pictures and answers questions pertaining to student's handwriting deficit.
- Website analyzes responses and provides an explanation/lesson
- 5-7 activities/exercises are recommended to address the deficit (with printable pdf and video guidance)
- Data collection methods are provided (online and/or printable)
- Educators are encouraged to return to website with results and for additional information

Program Outputs
- Number of hits on the website
- Number of clicks on videos and downloads of pdfs
- Number of users who return to website
- Data collection outcomes

Short-Term Outcomes

At 1 month,
- Data collection demonstrates improvement in students' specific handwriting deficits
- Educators return to website to address handwriting deficits of other students.

Intermediate Outcomes

At 3 months post
- website traffic will double
- improved handwriting outcomes for 80% of students utilizing website-suggested strategies

Long-Term Outcomes

At 1 year post
– educators are successfully supporting students with handwriting deficits using the website
- improved test scores and overall academic success for students

be deficit-specific and provide immediate suggestions for activities and strategies to

assist the specific student of concern. Those suggestions will be evidence-based and

utilize materials that are generally readily available in a school setting. Teachers will be

encouraged to return to the website for data collection and progress monitoring. This

resource will address two of the main challenges general education teachers report facing

in regard to handwriting instruction and troubleshooting: 1) Teachers are not taught how

to teach handwriting or troubleshoot handwriting challenges in their undergraduate

programs and 2) Teachers report having limited time to learn these skills or adequately

serve their students regarding handwriting (McCarroll & Fletcher, 2017; Nye & Sood,

2018).

Stakeholders

The most important stakeholders at the micro level are elementary general-

education educators (see Figure 4.1) and, indirectly, their students. With access to a

quick and accurate, evidence-based, classroom-friendly resource to help with handwriting

troubleshooting, teachers will have the necessary guidance and gain confidence in

helping struggling students. Evidence-based activities along with data collection and

progress monitoring for effectiveness will benefit both the teachers and their students.

This will ultimately have a positive impact on student academic outcomes which will

impact both the district-level and the state-level academic scores.

At the meso level, administrators at various levels of the school system and

investors who fund the development of resources for teachers will be interested in Pencil

Pointers. How easily teachers locate the website, ease of use, and effectiveness of the

suggested activities and adaptations gathered from the website will interest administrators, investors, and teacher resource groups that may endorse and support the development and ongoing maintenance of this program.

Program Practice Scenario

Ms. Walker is a second-grade teacher in rural North Carolina. Though her administrators endorse the value of explicit handwriting instruction, her school does not provide a handwriting curriculum. In her county, one occupational therapist serves seven schools so her access to occupational therapy support is significantly limited. It is the beginning of a new school year and one of her students, Dylan, already demonstrates significant deficits in handwriting. He holds his pencil in an awkward manner and complains of pain when he writes. As a result, he writes as little as possible. He is reading on grade level according to the first reading check and his math skills seem to be on grade level as well, though the way he writes his numbers can be difficult to read. Ms. Walker turns to the internet for support, but the information she finds includes lengthy lists of non-specific, fine motor activities to "improve pencil grasp," a wide variety of molded pencil grips, and random recommendations for types of adapted paper. There is a wealth of suggestions, but it is more confusing than helpful. Which activities would help Dylan? Ms. Walker doesn't have time to incorporate all of the activities in the lists into Dylan's class time. How should she pick the right ones? Are there activities that are evidence-based instead of just "fun" or "cute?" Do pencil grips help students who are 7 or 8 years old or do they cause more problems/frustration and get in the way? Which pencil grip would be the right one for Dylan based on the way he holds his pencil now?

Would a pencil grip cause him more pain when he writes if it is the wrong one?

Pencil Pointers will eliminate and answer all those questions. Ms. Walker will go into the web application and create a teacher profile. She will then add an individual student folder for Dylan. Upon creating that folder, Ms. Walker will answer a series of demographic questions as well as handwriting-related questions pertaining to Dylan. She could then pick the category "Pencil Grasp" as her primary area of concern (see Figure 4.2).

Figure 4.2

Educator Selects Primary Area of Concern
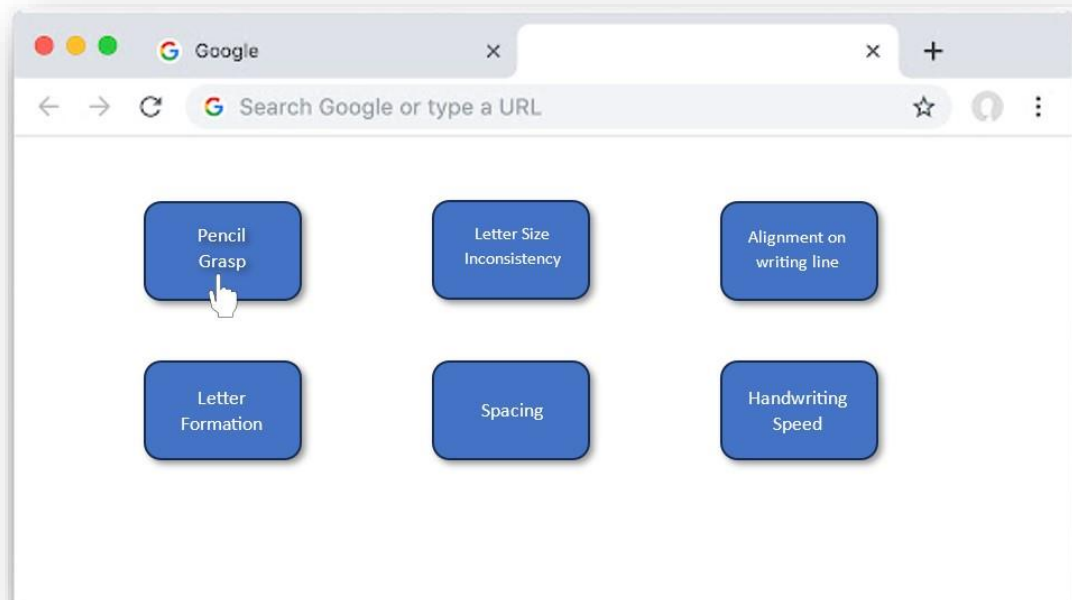
Following this selection, pictures of a variety of different pencil grasp patterns will emerge on the screen (see Figure 4.3). There will be a brief description of research by Schwellnus et al. (2012) that revealed four functional and efficient pencil grasp patterns. Pictures of those will be presented along with images of non-functional and

inefficient pencil grasps. Ms. Walker will click on the picture that best matches what

Dylan is most consistently doing in the classroom.

Figure 4.3

Educator Selects Pencil Grasp Image that Matches Student's Grasp
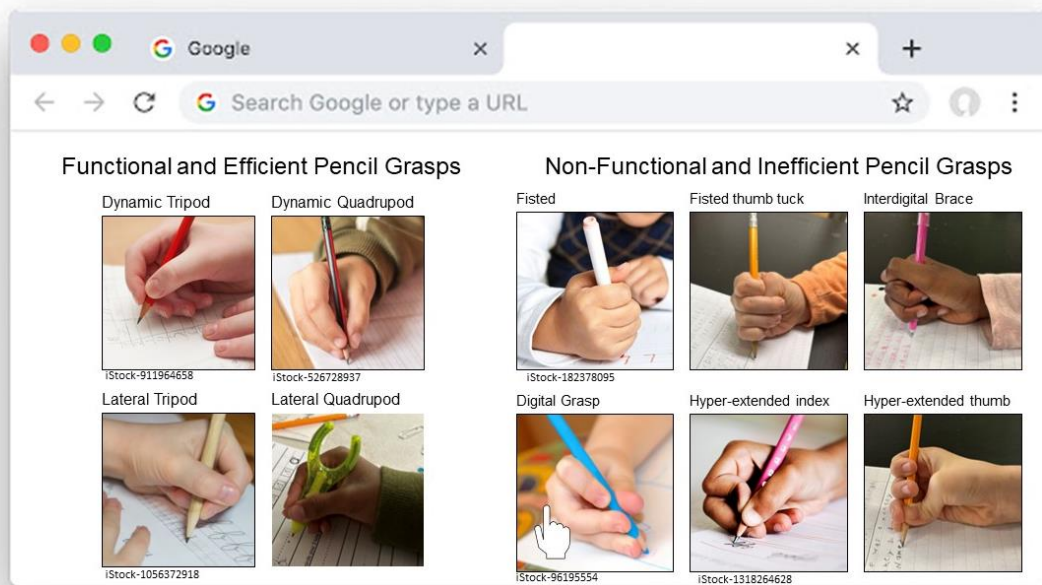
After clicking on the pencil grasp picture, a brief explanation of that grasp will

pop up (see Figure 4.4). It will give the most often utilized name for that grasp pattern,

whether the grasp is considered functional or non-functional, and a brief explanation of

why it is present (i.e. weakness in certain muscles or muscle groups, hyper-extension of

various joints due to joint laxity and poor joint stability, etc.). This will be provided

because in the experience of this author as well as according to adult learning theory,

adults like to understand the "why" behind what they are asked to do to address a

student's challenges.

Figure 4.4

Brief Explanation of Why the Specific Grasp Pattern Occurs
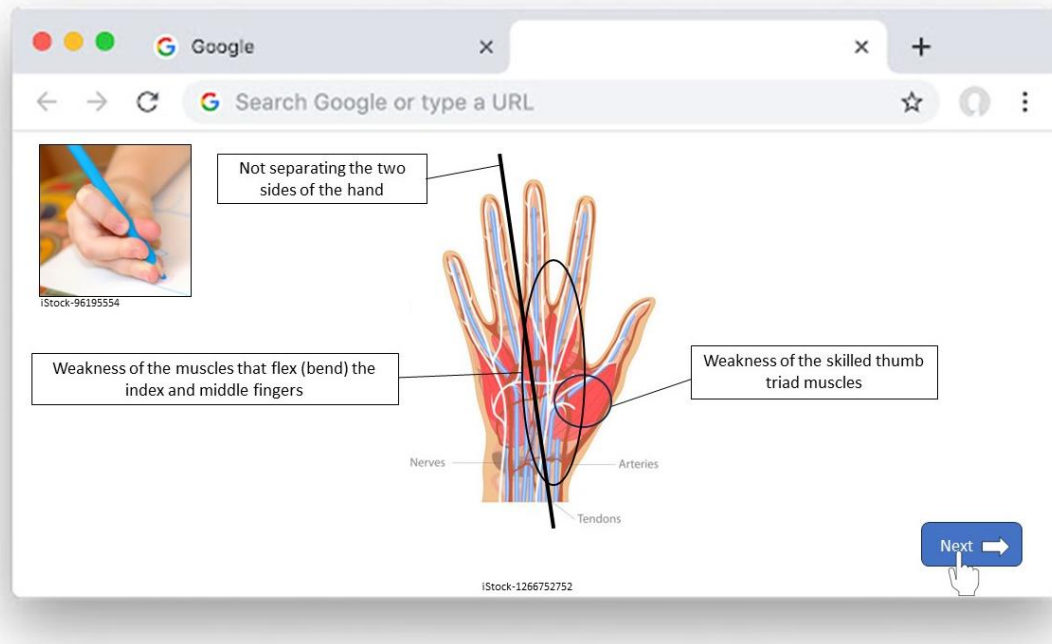
After the brief anatomy lesson, the teacher will be provided with 5-6 evidence-based, classroom-friendly activities or suggestions that are deficit-specific (see Figure 4.5). Instructional videos will be available for each activity as appropriate along with printable instructions for quick reference in the classroom.

Figure 4.5

Five to Seven Deficit-Specific Activities and Strategies
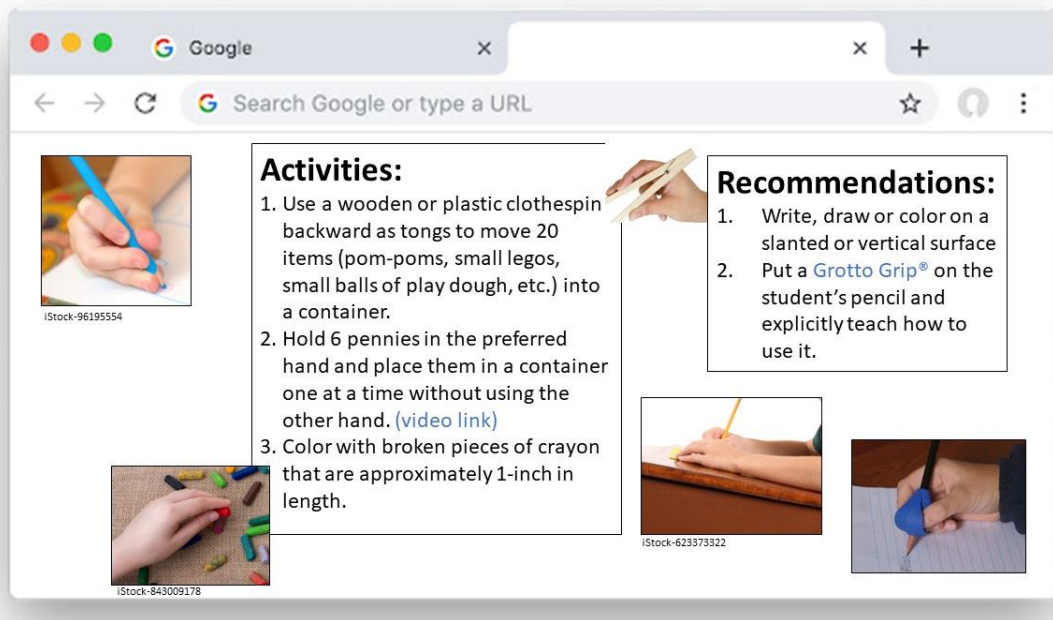
Data collection methods will be offered in printable form or online. Teachers will be encouraged to perform the given set of activities for a minimum of 2 weeks at the frequency recommended for each activity. They will then be encouraged to return to the website to follow up with effectiveness data. If the student demonstrates improvement, additional, progressive activities and strategies will be provided. If the student is not improving or is improving slowly and is tired of the first set of activities, a new set of activities will be provided with adjustments based on any additional teacher observations.

Intent in Offering the Proposed Program

The author intends to support general education elementary teachers by providing an evidence-based, classroom-friendly, deficit-specific, concise handwriting resource to help them support students in their classroom who demonstrate deficits in handwriting,

but do not yet receive or do not qualify for school-based occupational therapy intervention. The above example addresses deficits in pencil grasp because that is the primary request for consultation experienced by this author, but expansion is envisioned into various areas of handwriting including deficits in legibility markers such as letter formation, alignment, spacing, letter size consistency, fluency, and speed. The initial offering is intended to target elementary general education teachers, but eventually, a parent/caregiver portal will be added as well so that teachers and parents/caregivers can have access to the same resources for a shared student profile or a parent/caregiver can open a profile for a student who is educated at home. Long-term additions to the website would include an area for early childhood educators as well as options for middle and high school educators. This author would also like to add a social media component so that educators can share and discuss their successful adaptations to various activities and how they integrated an activity into a content area. This will also provide a platform for asking questions that are not addressed in the website content. This social media portion of the website will be based on Social Learning Theory and monitored by this author to ensure adherence to evidence-based practice.

Program Participants and Resources

In order to design Pencil Pointers, this author will need to partner with an individual, company, or university department that specializes in web application design. The cost of coding and website maintenance/marketing will be the largest initial and ongoing cost. This author intends to manage the content and questions independently until the website gains popularity, increased traffic, and profitability.

Instead of "re-inventing the wheel," this author envisions the possibility of partnering with other occupational therapy practitioners who already have an online presence and offer online resources. This author's website could link teachers and parents to their online resources for specific, evidence-based activities that fit the specific student's needs for whom they are visiting this author's website. This partnership would increase traffic on the partnering occupational therapy practitioners' websites as well.

Once the website is ready to launch, this author would offer a free pilot program with limited schools to gain feedback about the usefulness, efficiency, and effectiveness of the website design and recommendations. After making the necessary changes in response to feedback, the intention is to present at local, state, and national education conferences with teachers and administrators being the target audiences. As stated above, the direct program participants are elementary educators, however, membership fees at various levels would charged, thus administrators from the individual school level to the state level are important stakeholders as well.

In addition to presenting at conferences, email marketing will be sent to schools initially across the southeast with information about Pencil Pointers, the results of the pilot program, and the cost of membership.

Anticipated Barriers and Challenges

This author anticipates requiring guidance regarding web application design and coding. The cost of designing and maintaining a website of this caliber is the biggest unknown. Finding an affordable method to get this idea out of this author's head and onto the computer screen is the first challenge.

The second challenge will be marketing and investor/administrator (payor) buy-in. Disseminating information in a way that results in administrators paying for membership and teachers logging into the website and using it will be crucial.

CHAPTER FIVE – Program Evaluation Research Plan

Program Stakeholders

Pencil Pointers is an online, interactive, evidence-based, handwriting troubleshooting resource for general education elementary educators. The intent is to provide quick and accurate, evidence-based, classroom-friendly resources for deficit-specific handwriting troubleshooting. Pencil Pointers will allow teachers to visit the website, click on related pictures, and provide answers to questions as they relate to a specific student in their classroom who is experiencing handwriting challenges. The activity and strategy suggestions will be evidence-based and utilize materials that are generally readily available in a school setting.

The purpose of the program evaluation will be two-fold. First, to determine if the website is easy to locate and navigate. Second, to assess whether the recommended activities and strategies are effective (see Figure 5.1). Financial investors would be most interested in the quantitative data gathered from the website itself including the number of visits per day/week, number of return visitors, time spent on the website, and number of downloads of pdf instructions or clicks on instructional videos. These numbers would drive advertisement potential and/or willingness of investors to support the website.

Educators at all levels will be most interested in the effectiveness of the recommended activities and strategies. State, county, local, and individual educators will be more likely to invest in a group or individual membership to a website that generates positive results in student performance data. Educators in academia will be more likely to recommend a resource that has been proven effective in assisting teachers and students

in achieving daily classroom success.

Both sets of stakeholders, investors and educators, will be interested in the qualitative data gathered from teachers who participate in the pilot and ongoing use of the website. Teachers will be given an opportunity to comment on the ease of navigation of the website, appropriateness of the recommended activities, clarity of the activity instructions via both video and PDF, ease of use of the data collection platform, and effectiveness of the recommended activities in achieving the teacher/student goals.

Vision

Ideally, this program evaluation will reveal that Pencil Pointers is easy to navigate and highly effective for saving teachers time, increasing their knowledge of handwriting instruction and troubleshooting, and increasing academic success for students with handwriting challenges. Initially, these results would be used in a formative manner to improve the navigability and effectiveness of the website. Ultimately, however, summative tracking data pertaining to individual activity/strategy effectiveness regarding specific handwriting challenges will add to the occupational therapy body of knowledge of handwriting remediation.

Engagement of Stakeholders

As shown in Figures 4.1 and 5.1, the key stakeholders for Pencil Pointers are elementary, general education teachers. However, another important group to consider is administrators at all levels. Teachers may choose to pay for individual memberships to the website, but administrators who understand the value of this resource may choose to fund membership for their elementary educators within a school, district, or state.

Teachers and administrators of two schools will be essential to launch a pilot study of Pencil Pointers. This author would be the primary user of the initial program evaluation findings. Changes to the website would be made in response to the quantitative website data and focus group themes and suggestions. This feedback would also be used in marketing materials which would be distributed to teachers and administrators at all levels via email, social media, and in person at state and national education conferences. Ongoing program evaluation findings would be used to source funding through non-profit organizations that support teacher education such as the McCarthy Dressman Education Foundation and The Ford Foundation.

The teachers and administrators at two schools are already interested in participating in the pilot study. Administrators at both schools agreed to allow the teachers at these two schools to engage in a survey of their lived experiences providing handwriting instruction in the classroom. The results of this survey have informed the design of Pencil Pointers (see Appendix A). All involved understand the importance of explicit handwriting instruction and handwriting proficiency for students. They also comprehend that some schools have limited access to occupational therapy practitioners and that many teachers receive limited education pertaining to handwriting instruction and troubleshooting. If, for some reason, one or both schools were unable to participate in the pilot study, the network of school-based occupational therapists in North Carolina and the North Carolina Department of Public Instruction would be valuable resources for engaging alternative schools for this study.

Figure 5.1

Simplified Logic Model for Use with Stakeholders

Clients Resources	•Elementary Educators in general education classrooms •Computer, research, ideas for website design and content
Interventions Activities	•Educator survey involving picture identification and answers to questions •Analysis of the above answers generates a possible explanation for the described deficits •5-7 evidence-based, classroom-friendly, deficit-specific exercises/activities are recommended •Online or paper-based data collection methods are provided
Program Outputs	•Number of hits on the website •Number of clicks on videos and downloads of pdfs •Number of users who return to the website for support of additional students
Short-Term Outcomes	At one month post: •Data collection indicates improvement in students' specific handwriting deficits •50% of educators return to the website to address the handwriting deficits of additional students
Intermediate Outcomes	At three months post: •Website traffic will double •Improved handwriting outcomes for 80% of students utilizing website-suggested activities/strategies
Long-Term Outcomes	At one year post: •Educators across the country are successfully supporting students with handwriting deficits utilizing the website •Improved test scores and overall academic success for students

Preliminary Exploration and Confirmatory Process

The initial soft launch of this website will be a pilot run with two local elementary schools. Teachers and administrators will be given a short presentation and demonstration of the website prior to launch. During the pilot timeframe, all teachers will have free and unlimited access to all aspects of Pencil Pointers. Teachers will be asked to utilize the website content for a minimum of three students in the first three months. Following three months of website use, eight teachers in each grade level will be randomly selected to participate in grade-level focus groups to provide feedback and suggestions for improvement. Teachers who did not use the website for a student would

be excluded. Prior to participation in focus groups, the eight randomly selected teachers from each grade level will be asked to sign consent forms confirming their willingness to participate in the study and provide constructive feedback.

Program Evaluation Research Questions by Stakeholder Group

Stakeholders will be most interested to know if teachers find this website easy to use and effective. It will also be important to know if teachers are finding the website, using the website, and returning to the website. Ongoing evaluation of effectiveness will occur as content is added. See Table 5.1 below for specific research questions to be used when analyzing the data from the website and in grade-level teacher focus groups.

Table 5.1

Quantitative and Qualitative Research Questions

Website Analysis Questions	Focus Group Questions
How many people are visiting the website each month?	What did you like best about the website?
How long, on average, does a person remain active on the website?	What did you like least about the website?
How many pdfs does each person view/download on average?	Did you find the website easy to use?
How many videos does each person watch/download on average?	Were the directions for the suggested activities and strategies easy to follow?
How many people have returned to the website for more information?	Were the suggested activities and strategies easy to implement (i.e. finding supplies, fitting into classroom routine)?
	Were the suggested activities and strategies effective?

What are three suggestions you would make for improvement?

What is the best way to reach the largest audience of fellow teachers?

How much would you pay for an annual membership to this website?

Research Design

This program evaluation is non-experimental in design. Initially, both qualitative and quantitative methods will be utilized.

Methods Section

Qualitative Methods

Following the soft launch of the website, grade-level teacher focus groups will be conducted using open-ended questions (see Table 5.1) to gather formative data for website improvements. Information will also be gathered related to dissemination suggestions and membership value. Focus groups will be conducted via Zoom or Google Meets depending on the teachers' access to either platform. Ideally, all five grade-level meetings will occur after three months of website use and within a week of each other.

Quantitative Methods

Once the website is launched, data will be gathered regarding website usage (see Table 5.1). This information will be utilized to maintain or improve dissemination techniques. The use of embedded, quantitative survey questions will continue to provide data regarding ease of use and areas of interest for additional content following the full launch. Summative data collection will be built into the website in the form of digital

data collection methods utilized by the teachers to track activity and strategy effectiveness. Ideally, as shown in Figures 4.1 and 5.1, in addition to usage data, membership would double within three months of the full launch of the website.

Data Analysis

Qualitative Data Management and Analysis

Focus group sessions will be recorded on Zoom or Google Meets. These recordings will be transcribed into a Word or Google document. Three trained coders will be utilized to identify themes and manually code the transcripts using NVivo. These codes will be combined to identify the consistent, recurring themes.

Quantitative Data Management and Analysis

The quantitative data for this program evaluation will come directly from the website data itself and will not require advanced statistical analysis as this author will simply be comparing monthly averages and percentages using an Excel spreadsheet.

Anticipated Strengths and Limitations

This author is challenged to connect any of the threats to internal validity to the website data collection portion of this program evaluation except seasonality. Website usage will inevitably increase during the "school year" which is generally from mid to late August through early June. Website activity will inevitably drop during June and July because, with the exception of "year-round" schools, teachers will not have students in their classrooms.

Regarding the focus group portion of this evaluation, internal validity may be impacted by attrition if a member of the focus group leaves before the session has ended

and is not able to give feedback on all questions or is unable to attend the scheduled focus group session time at all. It is also possible the teachers would credit the Hawthorne effect or maturation with improvements in handwriting rather than the suggested activities, exercises, and strategies. Finally, though focus groups can generate positive discussion and comparison of experiences, a convincing member of the group may alter other members' initial thoughts or dissuade them from speaking their true opinions if they are counter to the assumed majority.

Potential Sources of Bias

This author is familiar with many of the teachers at the schools where the soft launch will occur. It will be imperative that a focus group facilitator other than this author be utilized to collect honest and open feedback and suggestions. In addition, a minimum of three coders will be utilized to identify themes and code the transcripts from the focus groups.

CHAPTER SIX – Dissemination Plan

Pencil Pointers is an online, interactive, handwriting troubleshooting resource for general education elementary educators. After creating a private teacher account and individual student profile, educators will answer questions about the student's grade level and handwriting challenges. They will also select a picture that most closely matches the student's pencil grasp. Based on various logarithms utilizing the answers provided and the selected picture, the website will present the teacher with a mini anatomy and physiology lesson to explain why the student's specific handwriting deficits may occur, followed by 5–7 evidence-based activities and strategies appropriate for addressing the student's specific needs. Additionally, users will be able to submit questions, make suggestions, and upload images of their student's pencil grasp, following caregiver-signed consent, that may not match those provided. This function will enable the author to provide customized solutions to the teacher and consider suggestions for future web application design modifications.

Dissemination goals

The goal of disseminating information about the Pencil Pointers website is to reach as many elementary educators and administrators as possible. Overwhelmingly, in person and according to research, teachers express a need for support regarding explicit handwriting instruction and troubleshooting handwriting challenges of students in their classrooms (Puranik et al., 2013; Nye & Sood, 2018). If every elementary educator around the globe could access Pencil Pointers for student-specific, evidence-based,

classroom-friendly solutions to handwriting challenges, teachers and students would ultimately benefit.

Table 6.1

Pencil Pointers Long and Short-Term Goals

Long Term Goal
Pencil Pointers will provide global support to teachers and families of students with handwriting challenges to reduce inequities in education that prevent access to explicit handwriting curriculums and occupational therapy intervention.
Short Term Goals
Pencil Pointers will be implemented locally in a pilot program involving two schools in suburban North Carolina.
Pencil Pointers will gain membership throughout the United States as a result of social media marketing, email marketing, and in-person marketing at educational conferences.
Pencil Pointers web application design will continue to update and expand content and accessibility standards to serve a global population.

Target audiences

The primary target audience for Pencil Pointers dissemination is elementary general education educators. Though administrators (secondary audience) may become the primary payors, the classroom educators are the individuals who agree with the need for and the value of this resource. They will also be the users of the web application. Administrators who do not experience the struggles of students with handwriting challenges first-hand and who do not provide evidence-based, explicit handwriting curricula may initially dismiss marketing materials for this program without advocacy from the educators who work for them.

Key messages

Educators:

1. Handwriting Legibility is one of three key factors indicating future academic success (McCarroll & Fletcher, 2017). It is important to identify and address deficits in handwriting legibility early.

2. Students' handwriting challenges often persist into upper grades and interfere with their abilities to produce grade-level work (Lin et al., 2017).

3. Pencil Pointers will provide student-specific, evidence-based strategies and activities to support students with handwriting challenges.

Administrators:

1. Handwriting Legibility is one of three key factors indicating future academic success (McCarroll & Fletcher, 2017). It is important to identify and address deficits in handwriting legibility early.

2. Students' handwriting challenges often persist into upper grades and interfere with their abilities to produce grade-level work (Lin et al., 2017).

3. When faced with handwriting challenges, elementary school educators report that they do not feel equipped to help students who have pencil grasp and handwriting deficits (Nye & Sood, 2018). Pencil Pointers will provide them with the student-specific,

evidence-based strategies and activities necessary to support students with handwriting challenges.

Sources/messengers

The Reading Recovery Council of North America (RRCNA) and the International Society for Technology in Education (ISTE) are respected by both elementary educators and administrators. Pencil Pointers would benefit from association with both organizations. Each organization hosts a comprehensive website as well as a large, annual, national/international conference.

The Reading Recovery Council of North America is an organization dedicated to supporting Reading Recovery and early literacy professionals and includes advocates and other professionals interested in literacy (RRCNA, 2024). This organization hosts an annual conference called LitCon which highlights professional development for literacy teachers in kindergarten through eighth grade. They also publish a journal entitled *The Journal of Reading Recovery* for Council members which accepts advertisements and manuscripts for consideration.

The International Society for Technology in Education (ISTE) is an organization that helps educators use technology to "revolutionize learning" both for their students and themselves (ISTE, 2024). In addition to the use of educational technology in the classroom, one of their key initiatives is "Teacher Preparation" (ISTE, 2024). ISTE hosts the annual ISTELive conference which welcomes sponsors, advertisers, and exhibitors.

They also reference resources and professional development for educators on their comprehensive website.

Locally, the North Carolina Department of Public Instruction (NCDPI) hosts events throughout the year for educators and administrators. Their annual AIM Conference strives to "Accelerate, Invigorate, and Motivate" district and school teams (NCDPI, 2024). The AIM Conference welcomes presenters and sponsors. Affiliation with NCDPI would accelerate the dissemination of information about Pencil Pointers within North Carolina and allow an opportunity for local educators to experience the web application in person at the many NCDPI events throughout the year.

Dissemination activities, tools/techniques, timing, and responsibilities

Following the initial pilot, marketing would begin with an email push to NCDPI literacy leaders and statewide school districts. This will include a digital brochure describing Pencil Pointers and a QR code for a free trial. In addition, Pencil Pointers will be active on social media including Instagram and Facebook groups specific to literacy education. Advertisements on social media that target these groups will also increase visibility. For a limited time, the QR code for a free trial will be accessible on these platforms as well.

In addition to email and social media marketing, this author will register as an exhibitor and submit proposals to present at NCDPI and LitCon in year one. These conferences will be attended again in year two depending on marketing value and the ISTE conference will be added in year 2 due to the increased expense of that conference.

All dates are to be determined as they are released. As an exhibitor, an attractive booth, useful giveaways, and extra computers for educators to experience Pencil Pointers will be necessary. Additional staff will be required to maintain the booth throughout the conference hours, especially if this author presents a poster or workshop.

Budget

The primary expense involved in disseminating information about Pencil Pointers will be the expenses incurred in traveling to and participating as an exhibitor at state and national conferences. These expenses include booth design, giveaways for booth visitors, extra computers for website trials, booth registration, additional staff necessary to work in the booth, and travel expenses. See Table 7.1 for details. Attendance at these conferences along with digital outreach will extend to both educators and administrators simultaneously.

Table 6.2

Dissemination Budget

Budget Item	Year 1	Year 2	Justification
Social Media Marketing	$5000	$5000	Pop-up marketing on Facebook and other social media outlets targeting educators and administrators
Local School Administration Email Advertisement	$0	$0	Email digital pamphlet to NC DPI Literacy leaders and school administrators in NC districts
Conference Booth Design	$1000	$0	Creating an attractive booth will improve interest at trade shows and educational conferences.
Computers for Demonstration and Trial at conferences	$1400	$0	Computers purchased in year one will be reused in year two.
Travel	$3000	$4500	Estimated at approximately $1500 per trip including flight, hotel, and meals.
NCDPI AIM Conference Booth Fees	$3000	$3000	Estimated at approximately $3000 for a Standard Exhibit Table and Conference Social Media Engagement
LitCon Conference Booth Fees	$2000	$2000	Estimated at approximately $2000 for a 10'x10' corner booth and a Mini-Session for demonstration
ISTE Conference Booth Fees	$0	$6000	Estimated at approximately $6000 for a 10' x 10' booth.
Conference Giveaways	$5000	$5000	30,000 Printed golf pencils with Pencil Pointers website
	$8500	$8500	30,000 Printed sticky note pads with website logo and QR code
Additional Exhibit Staff	$3000	$4500	An educator would be invited to attend the conference with this author with all expenses paid (including conference entry), but no

			compensation for time spent in the booth. Expenses same as travel expenses for author.
Total	$31,900	$38,500	

Evaluation

In the first two years, the success of Pencil Pointers will be measured entirely by website data. The number of visits to the website and accounts created, the amount of time a visitor spends on the website, the number of repeat visitors, the number of videos that are watched and the number of printable PDFs that are downloaded will all be data points that indicate the effectiveness of dissemination efforts. In year one, these will all be free activities during the pilot period. In year two, success will be measured by the same data points in addition to paid subscriptions and income generated from content-appropriate advertisements based on website popularity. The goal will be to achieve the equivalent of five hundred individual website subscriptions in the second year.

Conclusion

Pencil Pointers is a web application that provides evidence-based, classroom-friendly, student-specific support to general education elementary educators regarding handwriting instruction and troubleshooting. Dissemination of information about this web application will begin with an email push to NCDPI literacy experts and North Carolina school district administrators with instructions to forward the email to literacy educators. These communications will include a digital brochure with a QR code for a free trial. At the same time, this author will begin building content on social media

targeting elementary educators.

In year one, two large educational conferences will be attended as an exhibitor and possible presenter. These conferences will require an investment in booth design, giveaways, and extra computers for visitors to have hands-on experiences with the web application. These expenses, except for the giveaways, will not be incurred in year two due to re-usability. However, depending on the success of conference attendance, a third conference will be added in year two. By the end of year two, the goal is to have the equivalent of five hundred individual subscriptions as well as funding from five content-appropriate advertisers on the website.

CHAPTER SEVEN – Funding Plan

Pencil Pointers is an online, interactive, handwriting troubleshooting resource for general education elementary educators. After creating a private teacher account and individual student profile, educators will answer questions about the student's grade level and handwriting challenges. They will also select a picture that most closely matches the student's pencil grasp. Based on various logarithms utilizing the answers provided and the selected picture, the website will present the teacher with a mini anatomy and physiology lesson to explain why the student's specific handwriting deficits may occur, followed by 5-7 evidence-based activities and strategies appropriate for addressing the student's specific needs. Additionally, users will be able to submit questions, make suggestions, and upload images of their student's pencil grasp, following caregiver-signed consent, that may not match those provided. This function will enable the author to provide customized solutions to the teacher and consider suggestions for future web application design modifications.

Available local resources

Web application design and maintenance will be the greatest costs incurred in implementing Pencil Pointers beyond this author's salary. This author intends to partner with faculty and students at the University of North Carolina at Charlotte to provide project and internship opportunities to students interested in website application design. If this partnership is not successful, a website designing company such as Fingent or Netguru will be employed. The web content will be designed with the assistance of co-

workers and family members for video editing, pdf design, and original images used in the mini anatomy lessons.

Needed resources: Budget

For year 1 and year 2 of the Pencil Pointers website, this author anticipates being the only paid personnel besides a potential, part-time web application designer who will design, update, and maintain the web application. Equipment needed will include a computer and internet access as well as a cellphone and cellphone service. Approximately 15 hours per week will be required to complete research on evidence-based intervention strategies, meet with web application designer, and respond to user inquiries. In year 2, membership fees will be collected, thus a payment gateway will be required. Costs will also be incurred for marketing materials and traveling to conferences to demonstrate and market the web application. See Table 6.1 for budget details. Evaluation of Pencil Pointers in the first two years will be derived from the website data indicating the number of users, frequency of website visits, user return to the website, length of time spent on the website, and the number of video views and pdf downloads.

Table 7.1

Budget Details

Budget Items	Pencil Pointers Year 1	Pencil Pointers Year 2	Justification
Personnel (Self) Salary for content building and responding to user inquiries	$36,000	$36,000	Approx. 15 hours per week at $50 per hour.
Website Design	$37,500	$0	If unable to secure volunteers. This is the cost of a mid-level designer at $75 per hour for an approximate 500 hours.
Website Maintenance	$50	$10,000	If unable to secure volunteers. Cost for first year is for domain name only during website design. Cost for second year covers updates to content and website maintenance.
Computer	$700	$0	Replacing current, outdated computer with a new version in year one, but this should not need to be replaced in year 2.
Internet Connection	$1500	$1500	Necessary for website management.
Cellphone (Apple iphone 15)	$1200	$0	Replacing current outdated cellphone with new version in year one, but this should not need to be replaced in year 2.
Cellphone Service with Visible	$360	$360	Prepaid plan $30/mo.

Payment Gateway with Square (3.5% + $0.15 per transaction)	$0	$200	Memberships will be offered in Year 2 following the initial year of development and piloting of the program.
Dissemination Plan	$31,900	$38,500	See Table 7.1 for details.
Total	$109,210	$86,560	

Potential funding sources

Initially, grant funding will be explored to support Pencil Pointers Year 1 expenses for web application development, owner salary, equipment, and marketing (see Table 6.2). Pencil Pointers is a teacher resource that will support teachers across the country and eventually around the globe. Teachers in urban areas, rural areas, areas with students living in low socioeconomic conditions, and international settings will be able to access the information and suggestions provided by Pencil Pointers. Pencil Pointers's mission is to provide classroom-friendly evidence-based strategies. The intent is that teachers will be able to implement the suggestions using low-cost materials that may be found within their school setting. Research has shown handwriting legibility to be one of the key factors indicating future academic success (McCarroll & Fletcher, 2017). Thus, students who do not receive explicit instruction in handwriting due to a lack of teacher knowledge or insufficient funds for curriculum are at an academic disadvantage.

Table 7.2

Potential Funding Sources

Funding Sources:	Information:
McCarthy Dressman Education Foundation Academic Enrichment Grant	Application Available: January 15 – April 15 or until 200 submissions have been received
	Eligibility: Employed by a school or non-profit organization, background and expertise to complete the program, direct and regular contact with students pre-k to 12, work with students from low-income households, are willing to collaborate with the Foundation
	Grant award: Up to $10,000 per year for a maximum of 2 years.
The Ford Foundation	Supports programs that aim to advance equality and justice around the world – including through education.
	Eligibility: Organizations, institutions, and individuals who aim to reduce inequality.
	Median Grant: $250,000
The Spencer Foundation Research on Education and Vision Grants	Invests in research to improve education and specifically, equity within education.
	Application deadlines vary by grant.
	Research Grants on Education: Small awards up to $50,000. Research Grands on Education: Large awards between $125,000 and $500,000.
W.K. Kellogg Foundation	Invests in "the promotion of the welfare, comfort, health, education, feeding, clothing, sheltering and safeguarding of children and youth, directly or indirectly, without regard to sex, race, creed or nationality…" (W.K. Kellogg Foundation, Who We Are page, Overview paragraph, 2024).

	Applications accepted anytime.
	Mean Award: $175,000
Amazon Small Business Grant	Supports small business (less than $1MM annual revenue) owners who are Amazon Business customers
	Applications deadline: May 24, 2024
	Awards: up to $25,000
AOTF Implementation Research (IR) Grant Program	Purpose is "to improve both individual patient outcomes and overall public health through better use and integration of evidence-based practice…and to advance the adoption and integration of evidence-based health interventions into clinical and community settings" (AOTF, 2024).
	Letter of intent deadline: August 14, 2024
	Award for 1-year pilot: $50,000
Institute of Education Sciences Transformative Research in the Education Sciences Grants Program	Supports "innovative research that has the potential to make dramatic advances towards solving seemingly intractable problems and challenges in the education field" (IES, 2024)
	Letter of intent deadline: June 6, 2024
	Average award over last 5 years: $380,000

Ultimately, Pencil Pointers will be funded through membership fees paid individually or by the school administration (see Table 6.3) unless continued grant funding, donations, and advertisement revenue are received that allow this to remain a free resource for teachers. After the initial pilot program, teachers will enroll as individuals starting at $20 per year. School administrators will also have the option to enroll in various subscription packages based on the number of teachers/users they intend to fund. As the web

application grows in popularity, third-party paid advertisements and an option to choose an advertisement-free membership will generate additional revenue.

Table 7.3

Estimated Membership Subscription Fee Schedule

Membership Type	Revenue per year
Individual	$20
Group of 4–20 memberships	$18/membership
Group of 21–40	$16/membership
Group of 41–60+	$14/membership

Conclusion

Pencil Pointers is projected not to be profitable in the first two years due to the high expense of the initial web application design and creation. Ongoing design updates are not expected to incur significant expenses on an annual basis. Pencil Pointers is expected to be marginally profitable beginning in year three depending on interest, advertisement revenue, and membership subscriptions. The web application design and maintenance for Pencil Pointers is the largest expense beyond this author's compensation for content development and responding to user inquiries. Ideally, web application design will be completed by students at the University of North Carolina at Charlotte as a project or internship related to attaining a degree in computer science with a concentration in web application design. If this partnership does not succeed in a timely manner, a web application company will be contracted to design Pencil Pointers.

Initially, grant funding will be pursued through multiple venues (see Table 6.2). After

the first year, Pencil Pointers is anticipated to be funded with membership (see Table 6.3)

and advertisement revenue.

CHAPTER EIGHT – Conclusion

Children in grades kindergarten through fifth grade continue to consistently engage in the occupation of handwriting. A large percentage of students struggle with handwriting legibility which is concerning because handwriting has been identified as one of the key indicators of academic success. Teachers are responsible for explicit handwriting instruction, but report a lack of confidence in handwriting instruction due to a lack of undergraduate coursework related to this topic. In addition, time is limited in the instructional day. Common Core State Standards have high expectations of what teachers will cover in all content areas. Educators benefit from collaboration with occupational therapy practitioners for explicit handwriting instruction and troubleshooting, however many school-based occupational therapy practitioners carry large caseloads of students who have been identified as requiring specially designed instruction (SDI) and they have limited time and resources for assisting teachers with students who are not on their caseloads. Teachers will benefit from a handwriting resource that is efficient in providing evidence-based activities and strategies that are student- and deficit-specific with both video and printable modeling and instructions to address handwriting instruction and troubleshooting in the general education classroom.

APPENDIX A – Teacher Survey Study Article

Teacher's Observations of Handwriting Challenges and Preferred Method of

Support for Handwriting Troubleshooting

By: Jennifer Waid, OTR/L

Abstract

Background: Students in grades kindergarten through twelve are using technology in the

classroom with greater intensity, but that does not change the fact that handwriting

remains a primary occupation of students, especially in grades kindergarten through fifth

grade. Research has shown that "up to 27% of children in elementary school are reported

to have handwriting problems" (Steinhart et al., 2021, p.2). Teachers are responsible for

initial, explicit handwriting instruction; however, they report feeling under-prepared to

provide explicit handwriting instruction or assist students with handwriting challenges

due to a lack of coverage of these topics in their undergraduate studies (Collette et al.,

2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016). This is concerning

considering that handwriting has been identified as one of the key skills that indicate

future academic success (McCarroll & Fletcher, 2017).

Method: A mixed methods approach survey was conducted with twenty-three general

education elementary teachers to inform the design of an online handwriting resource for

general education elementary teachers.

Findings: The most common handwriting deficits teachers reported observing included

letter formation, spacing within and between words, and alignment of writing on the

writing line. They expressed the least confidence in helping students increase

handwriting speed, correct letter formation, improve letter size consistency, improve

alignment on the writing line, and correct non-functional pencil grasps. Teachers

expressed a desire to learn more about improving handwriting speed, pencil grasp, letter

size consistency, and letter formation. The majority expressed a preference for printable

handouts and videos that model activities. When asked to identify the "biggest

challenge" for handwriting instruction, teachers overwhelmingly reported "time."

Conclusion: Teachers would benefit from a handwriting resource that is efficient in

providing evidence-based activities with both video and printable modeling and

instructions to address handwriting instruction and troubleshooting.

Introduction

Students in grades kindergarten through twelve are using technology in the

classroom with greater intensity, but that does not change the fact that handwriting

remains a primary occupation of students, especially in grades kindergarten through fifth

grade. Students utilize handwriting both for acquiring knowledge and for demonstrating

knowledge and creativity. Research reveals that handwriting challenges are the most

common reason for referral to school-based occupational therapy (Brown & Link, 2016;

Caramia et al, 2020; Steinhart et al., 2021). "Up to 27% of children in elementary school

are reported to have handwriting problems" (Steinhart et al., 2021, p.2). This is

concerning considering that handwriting has been identified as one of the key skills that

indicate future academic success (McCarroll & Fletcher, 2017). The ramifications of

slow, illegible handwriting are well documented (Brown & Link, 2016). Avoidance of

handwriting tasks, simplified written responses, and failure to complete assignments in the allotted time are a few observations of students with handwriting challenges in upper grades (Brown & Link, 2016; Lin et al., 2017). Finally, research has shown that teachers assign lower scores to less legible papers regardless of the quality of the content (Graham, 2018; Wallen et al., 2013). Having a history of handwriting deficits can result in low self-esteem and academic failure (Brown & Link, 2016; Steinhart et al., 2021).

Before considering school-based occupational therapy intervention, the educational team must determine that adequate handwriting instruction occurred in the general education setting. Teachers are responsible for general education handwriting instruction. Unfortunately, explicit handwriting instruction receives inadequate classroom time. This is reportedly due to a lack of teacher confidence and the absence of standardized, evidenced-based curricula (Puranik et al, 2013; Nye & Sood, 2018). In addition, general education teachers report that they do not feel prepared to deliver handwriting instruction or assist students who struggle with handwriting challenges (Collette et al., 2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016). Common Core standards delineate elevated expectations for written expression at all grade levels but do not contain any standards related to handwriting legibility (Collette et al., 2017; Common Core Standards Initiative, 2021). Expectations and requirements are elevated in all core subject areas under Common Core (Common Core Standards Initiative, 2021). As a result, teachers report having little to no classroom time to provide explicit handwriting instruction and even less to provide specific assistance to students with handwriting challenges (Collette et al., 2017). The topics covered in undergraduate

education programs are directly impacted by the Common Core Standards. As a repercussion, teachers report receiving inadequate instruction pertaining to explicit handwriting instruction in their degree programs (Collette et al., 2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016).

Review of the Literature

Teachers consistently reported feeling under-equipped to provide handwriting instruction due to a lack of formalized training during their own education (Donica et al., 2012; Nye & Sood, 2018). According to the results of the survey performed by Donica et al. (2012), 62.5% of North Carolina elementary education programs that responded to the survey report that they include information on handwriting instruction, however, 48% stated that no contact hours specific to handwriting instruction were required. In the same study, only 35% of teachers reported receiving handwriting instruction in college and 66.3% reported having no courses that included handwriting instruction content. According to the study by Nye and Sood in 2018, 11% of the teachers involved reported "formal" training in handwriting, 56% reported "informal" training, and 33% reported no handwriting training.

Research Design

This study was a mixed methods approach survey design.

Purpose of the Study

The purpose of this study was to inform the design of an online handwriting resource for general education elementary teachers.

Respondents

Survey respondents were currently employed, as general education teachers in grades kindergarten through fourth grade at two suburban charter schools in North Carolina. Twenty-three teachers elected to participate. All respondents were female.

Data Collection

Survey data were collected for five weeks. Emails were sent to the administrators of the two charter schools to be forwarded to all of the kindergarten through fourth-grade general education teachers at each school. The email described the purpose of the study and contained a link to the Qualtrics survey.

After a teacher accessed the link, more detailed information about the study was provided along with informed consent. Consent was obtained electronically. After providing consent, the respondent was prompted to enter demographic data including name, date of birth, gender, current grade teaching, number of years teaching current grade, total number of years of teaching experience, and email address. After completing the demographic data, teachers were presented with the survey questions. There were three closed-ended and three open-ended questions pertaining to handwriting deficits observed in the classroom, teacher confidence level regarding their ability to help struggling students, handwriting topics for which teachers desire more information, type of resource that teachers would find most helpful, biggest challenges to providing handwriting instruction in the classroom, and what type of information teachers would benefit from to support handwriting instruction.

Data Analyses

Quantitative data gathered was analyzed within the Qualtrics software and printed as a Word document. Qualitative data gathered was manually coded using NVivo 20 software to determine themes.

Findings

Demographic Data

As noted above, all respondents were female. The mean age was 39.6 years. Respondents represented grades kindergarten through fourth with one respondent not reporting her current teaching grade. The mean years of teaching in the current grade was 3.86 (see Figure A1 for all responses). The mean total years of teaching was 10.4 (see Figure A2 for all responses).
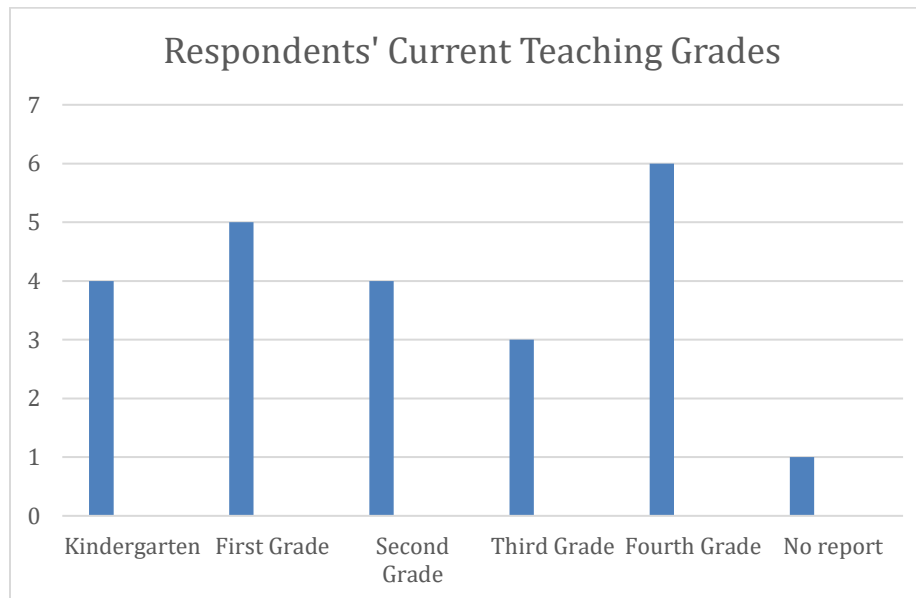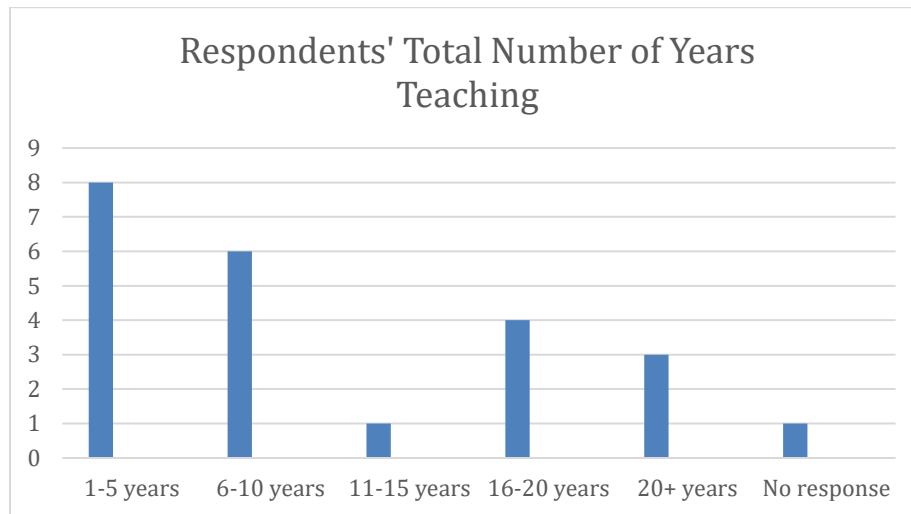
Figure A1

Respondents' Current Teaching Grades

Respondents' Current Teaching Grades

Figure A2

Respondents' Total Number of Years Teaching

Respondents' Total Number of Years Teaching

Closed-Ended Responses

Respondents answered 3 closed-ended questions which were intended to discover the most common handwriting challenges observed in the classroom, the teachers' confidence level in addressing these challenges, and what types of resources would be most helpful when troubleshooting handwriting challenges in the classroom. Respondents were directed to "choose all that apply" when identifying handwriting challenges observed in the classroom. Of the twenty-three respondents, 91.3% reported observing deficits in letter formation and 86.9% reported observing deficits in both spacing between and within words as well as alignment of handwriting on the writing line.

Next respondents were asked to rank their confidence level regarding their ability to help students with the observed handwriting challenges. This required teachers to rank

their confidence on a Likert scale with 5 options including "not at all confident," "slightly confident," "somewhat confident," "moderately confident," and "extremely confident." Teachers reported being least confident with helping students improve in the area of handwriting speed. Of the respondents, 47.83% ranked their confidence in this skill as "slightly confident." Teachers reported being most confident with assisting students with written expression. Of the respondents, 52.17% ranked their confidence in this skill as "moderately confident." The majority of teachers were moderately to extremely confident in their ability to help students produce accurate spacing within and between words. The majority were somewhat to moderately confident with helping students produce correct letter formation, achieve letter size consistency, and align handwriting on the writing line. Confidence in the ability to assist students to achieve functional pencil grasp was scattered from "Not at all Confident" to "Moderately Confident" (see Figure A3).

Figure A3

Teacher Confidence Levels Regarding their Ability to Help Students Who Struggle with

Handwriting Skills
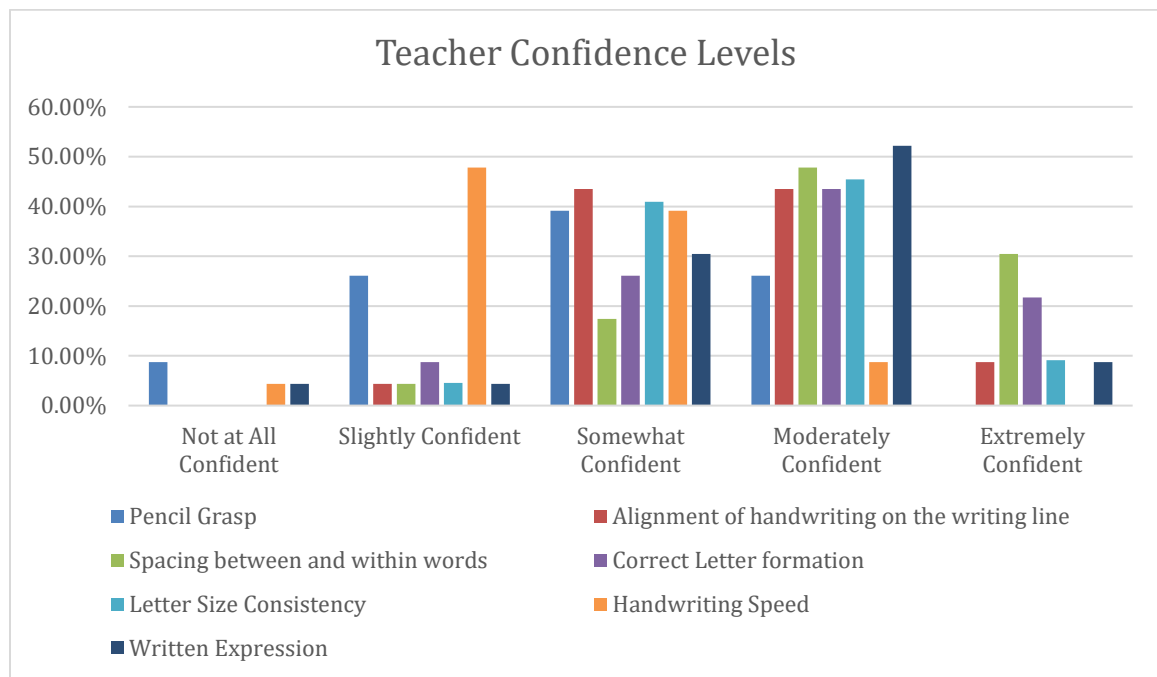
The final closed-ended question asked teachers to indicate their preferred method of gaining information regarding handwriting troubleshooting. Respondents were again instructed to "choose all that apply." Printed handouts and YouTube videos were preferred by a large margin. Of the respondents, 73.9% indicated a preference for printed handouts and 69.5% indicated a preference for YouTube videos. "Reference book" and "Website" were selected by 39% and 34.7% respectively. Much less popular options included "Smartphone application," "podcast," "webinar," and "social media account."
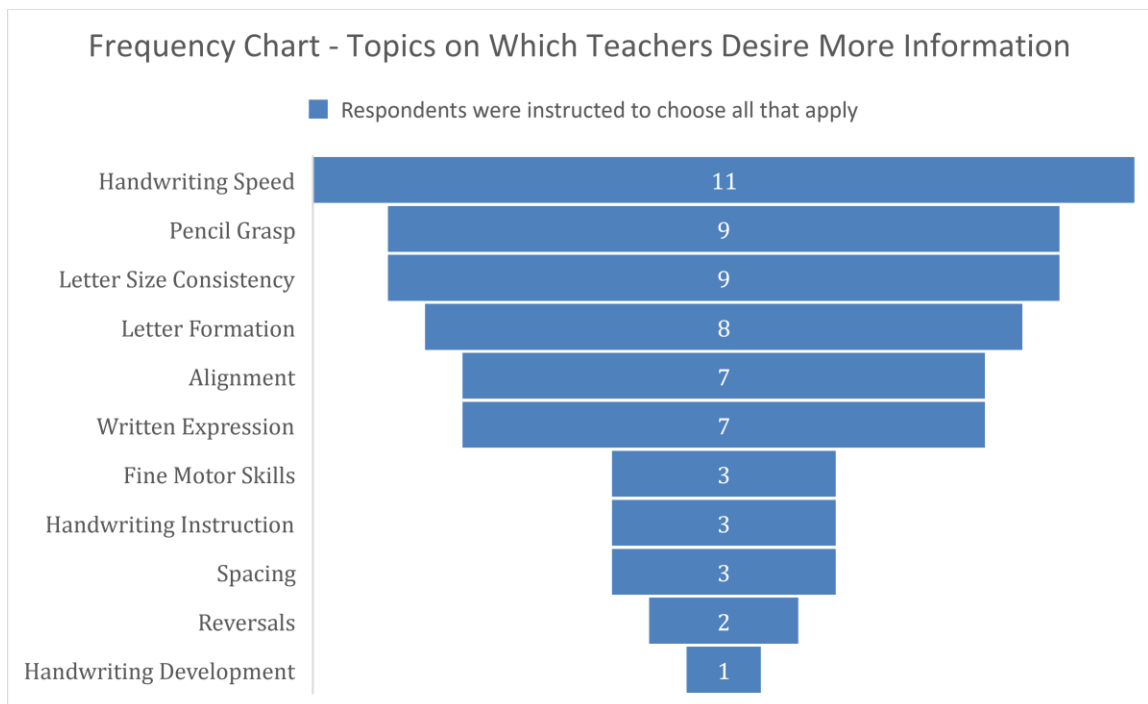
Open-Ended Responses

Respondents answered 3 open-ended questions. These questions were used to ascertain areas related to handwriting troubleshooting that teachers would like to have

more information, the biggest challenges interfering with providing handwriting

instruction in the classroom, and the type of information that would support their

instruction of handwriting. Teachers were asked to list three areas of handwriting

instruction and troubleshooting that they would like to have more information about. The

most common response was related to handwriting speed followed by pencil grasp, letter

size consistency, and letter formation (see Figure A4).

Figure A4

Topics on Which Teachers Desire More Information

Frequency Chart - Topics on Which Teachers Desire More Information

■ Respondents were instructed to choose all that apply

Topic	Frequency
Handwriting Speed	11
Pencil Grasp	9
Letter Size Consistency	9
Letter Formation	8
Alignment	7
Written Expression	7
Fine Motor Skills	3
Handwriting Instruction	3
Spacing	3
Reversals	2
Handwriting Development	1

When asked to identify the "biggest challenges to providing handwriting

instruction in the classroom," there was a clearly defined theme. Of the twenty-three

respondents, seventeen (73.9%) indicated that one of the biggest challenges was "time."

Some of the statements included "Not enough time," "There is not a lot of time to teach

handwriting specifically," "Our day is so jam-packed, finding time to fit in a handwriting lesson seems challenging with our schedule," and "Time to help individual students." Second to the theme of limited time, four teachers indicated challenges with differentiation, especially when numerous students in the same classroom require individualized instruction and handwriting troubleshooting. "It takes a lot of one-on-one attention next to a child to help them with a handwriting assignment. This is difficult when there are multiple children who need help!" "That there are many different challenges every student faces. There isn't one blanket lesson or skill for everyone."

The final open-ended question pertaining to the type of information teachers would like to receive about handwriting troubleshooting indicated that the respondents would like to have a resource that contains strategies for common handwriting challenges with models showing how to perform the activities. As two respondents stated, "More resources that model the lessons and suggested activities" and "Modeling of common problems and how to help students resolve them." Respondents also indicated a need for additional professional development.

Discussion

As has been established, handwriting remains a primary occupation of elementary-age students. Handwriting proficiency has been identified as a key indicator of ongoing academic success. Teachers are responsible for initial, explicit handwriting instruction; however, they report feeling under-prepared to provide explicit handwriting instruction or assist students with handwriting challenges due to a lack of coverage of these topics in their undergraduate studies (Collette et al., 2017; Donica et al., 2012; Nye

& Sood, 2018; Sharp & Titus, 2016). There are no Common Core standards related to handwriting legibility (Common Core State Initiative, 2021). The standards guide expectations at each grade level, school day academic schedules, evidence-based curricula that are provided for teachers, and topics covered in undergraduate education programs. Respondents in this survey overwhelmingly report limited time to provide handwriting instruction and variable levels of confidence in addressing a variety of handwriting challenges. Strong interest was expressed in a resource that provided modeling of activities and printable instructions. Specific handwriting deficits respondents expressed the most interest in gaining more assistance with included pencil grasp and handwriting speed followed by legibility factors of alignment on the writing line, letter size consistency, and letter formation.

Summary

Teachers are expected to provide explicit handwriting instruction and assist students with handwriting challenges, but they report that they are not consistently taught how to teach handwriting. Based on the results of this survey, teachers would benefit from a handwriting resource that is efficient in providing evidence-based activities with both video and printable modeling and instructions to address handwriting instruction and troubleshooting.

APPENDIX B – Executive Summary

Pencil Pointers: An Evidence-Based, Online Handwriting Resource for Elementary

Educators

Advances in the use of technology in the classroom have not changed the fact that

handwriting remains a primary occupation of students throughout their educational careers. A

recent study stated that "up to 27% of children in elementary school are reported to have

handwriting problems" (Steinhart et al., 2021, p.2). Despite this fact, explicit handwriting

instruction receives inadequate classroom time. For handwriting to become a functional skill,

it needs to become automatic. Automaticity is developed through explicit instruction and

sufficient practice (Montgomery & Zwicker, 2020). When faced with handwriting challenges,

elementary school educators report not feeling equipped to help students with pencil grasp and

handwriting deficits (Nye & Sood, 2018). Students who experience handwriting challenges

often avoid writing by complaining about hand pain and discomfort or generating short,

simplified written responses. These factors interfere with work completion and overall

academic success.

Project Overview

Pencil Pointers is an online, interactive, evidence-based, deficit-specific,

handwriting troubleshooting resource for general education elementary educators based

on Experiential Learning Theory and Social Learning Theory. The intent is to provide

quick and accurate, evidence-based, classroom-friendly activities and strategies for

deficit-specific handwriting troubleshooting. Pencil Pointers will begin by providing

information about developmentally appropriate handwriting skills by grade level and

functional pencil grasp patterns. If the teacher ascertains that the student of concern is

demonstrating a deficit and not a developmentally appropriate pattern, the teacher will be

guided through a series of questions and pictures requiring responses that relate to the

student of concern. Based on the teacher's responses to these questions, this new

resource will recommend activities and strategies that are deficit-specific, evidence-

based, and easy to implement within the teacher's scope of practice while waiting for an

occupational therapy consultation to occur.   Teachers will be provided with video

modeling and printable versions of the activity or strategy instructions as well as data

collection sheets for progress monitoring.

Key Findings

As explained by Cultural Evolution Theory (CET), the focus, priorities, and

methods within the education system of the United States have changed over time

(Brahm & Poblete, 2022; Mesoudi, 2015). Throughout its course, the culture of

education has adopted new characteristics and lost others in a process akin to Darwin's

natural selection. These facets of evolution in the education culture have occurred in

response to many events and innovations. Three factors implicated in the current lack of

explicit handwriting instruction are the knowledge explosion of the industrial revolutions,

the adoption of whole language theory which favored process writing instead of phonics

instruction and explicit handwriting instruction, and the rush to incorporate the use of

technology in the classroom to ensure digital literacy.

The knowledge explosion of the industrial revolutions has resulted in more topics

to cover in all subject areas.   R. Buckminster Fuller was a futurist and inventor who

conceived the "Knowledge Doubling Curve" in 1982 (Carroll, 2022). Fuller surmised

that in 1900 the knowledge base of humanity doubled every hundred years. He estimated

that by the end of 1945, the rate had quickened to doubling every twenty-five years, and

by 1982 every thirteen years. It is now estimated that the knowledge base of humanity is

doubling every twelve hours (Carroll, 2022). This is reflected in the high expectations

outlined in both the Common Core standards and the North Carolina Standard Course of

Study in all subject areas. The importance of explicit handwriting instruction has been

largely crowded out and ignored. The Common Core Standards include no standards

related to handwriting legibility (Collette, 2017) and the North Carolina Standard Course

of Study includes only one handwriting standard out of 40-42 English Language Arts

(ELA) Standards per grade level for grades K-2 (NCDPI, 2021).

Whole-language theory was widely adopted in the United States in the 1980s.

The adoption of this teaching method negatively impacted explicit handwriting

instruction (Donica, 2010; Farris, 1991). Whole-language theory asserted that students

would naturally learn to write legibly during the use of process writing techniques (Farris,

1991). This is commonly known as the "caught vs. taught" strategy. Explicit

handwriting instruction was only to be provided to individual students who demonstrated

deficits in handwriting (Farris, 1991). This practice was time-consuming and inefficient

for teachers and has been largely contradicted by recent research that supports explicit

handwriting instruction with frequent periods of practice for all elementary-age students

(Montgomery & Zwicker, 2020). Providing direct handwriting instruction allows for the

development of automatic handwriting skills which are integral to effective process writing activities.

A recent increase in the emphasis on the use of technology in the classroom and digital literacy starting in the early elementary grades is connected to the knowledge explosion and current cultural evolution toward the increased use of technology throughout society. Many current jobs require, at minimum, basic digital literacy. However, children are not developmentally ready to begin learning how to type on a keyboard until third grade (Farris, 1991). As a result, handwriting remains the primary mode of written language through elementary school (Donica, 2010; Robert Joan, et al., 2012; McCarroll & Fletcher, 2017; Montgomery & Zwicker, 2020). Research has shown that children who struggle with handwriting struggle academically (McCarroll & Fletcher, 2017). Regardless of the use of technology, legible handwriting remains a critical and necessary skill.

As a result of these cultural shifts in the focus of elementary education, explicit handwriting instruction and evidence-based handwriting curricula are inconsistently included as topics in undergraduate degree program requirements (Collette et al., 2017; Donica et al., 2012; Sharp & Titus, 2016). This leaves teachers feeling under-prepared to provide explicit handwriting instruction in the classroom regardless of the fact that teachers agree that explicit handwriting instruction is important for academic success (Collette et al., 2017; Donica et al., 2012; Nye & Sood, 2018; Sharp & Titus, 2016). Websites, blogs, and videos with extensive, generalized lists of activities to "improve handwriting" or "fix pencil grasp" are plentiful, but confusing. Which activities are

evidence-based? Which activities will help with specific handwriting deficits or

maladaptive pencil grasp patterns observed in a particular student? Which strategies are

appropriate for use with a second-grade student? Which activity should be first and is

there a correct sequence for addressing the issue? A more specific resource will be

beneficial to both educators and students.

Recommendations

When an elementary student struggles with handwriting legibility or reports pain

and fatigue when writing, it is recommended that the student's teacher request an

occupational therapy screening and consultation. Depending on the school district and

availability of the school-based occupational therapist, fulfillment of this request may

occur quickly, take months, or not happen at all. It is recommended that all elementary

educators have access to the Pencil Pointers web application for deficit-specific guidance

and support with handwriting troubleshooting for students in the elementary general

education classroom who demonstrate handwriting challenges that have the potential to

negatively impact their current and future academic success.

Conclusion

Despite the increased use of technology throughout our culture, handwriting is

still the primary method of written communication for elementary-age students. Due to

multiple factors, inadequate time is allocated to explicit handwriting instruction in the

general education elementary classroom. Teachers report feeling under-prepared by their

undergraduate studies for explicit handwriting instruction and handwriting

troubleshooting (Nye & Sood, 2018). Some schools no longer provide curriculum or time

for explicit handwriting instruction. As a result, nearly a third of elementary school

students are classified as having handwriting problems (Steinhart et al., 2021). Handwriting

has been identified as a key factor in indicating future academic success (McCarroll &

Fletcher, 2017). All elementary educators and their students would benefit from access

to Pencil Pointers interactive, evidence-based, deficit-specific web application for support

with handwriting troubleshooting, thus improving students' current and future academic

success.

APPENDIX C – Fact Sheet

BOSTON UNIVERSITY

Jennifer Waid, OTR/L
OTD Candidate

Pencil Pointers

An evidence-based, online, handwriting resource for elementary educators

The Problem: Elementary educators report feeling unequipped to help students with handwriting challenges

Student Factors

"Up to 27% of elementary students have handwriting problems" (Steinhart et al., 2021, p. 2).

Research has shown that children who struggle with handwriting struggle academically (McCarroll & Fletcher, 2017).

Lack of Standards

The Common Core State Standards contains no standards related to handwriting legibility (Collette, 2017).

Excluded from Undergraduate Education

Explicit handwriting instruction and evidence-based handwriting curricula are inconsistently included as topics in undergraduate education degree programs (Collette et al., 2017; Donica et al, 2012; Nye & Sood, 2018; Sharp & Titus, 2016).
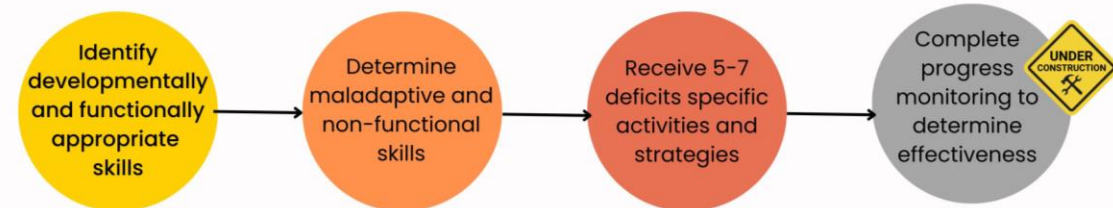
Time Factor

"Common Core increased instruction requirements in other areas, resulting in insufficient or no time for handwriting instruction" (Collette et al., 2017, p. 5).

Disclaimer: The activities and strategies provided by this web application are not intended to substitute for or replace occupational therapy intervention. When an elementary student struggles with handwriting legibility or reports pain and fatigue when writing, it is recommended that the student's teacher request an occupational therapy screening and consultation. Handwriting deficits are often complex, involving multiple foundational skills deficits. The activities and strategies provided by Pencil Pointers are intended to remain within the scope of practice for an elementary educator, prevent the formation of maladaptive habits, and, in some cases, protect joint integrity.

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The Solution: Pencil Pointers is an online, interactive, evidence-based, handwriting troubleshooting resource for general education elementary educators.

Identify developmentally and functionally appropriate skills → Determine maladaptive and non-functional skills → Receive 5-7 deficits specific activities and strategies → Complete progress monitoring to determine effectiveness (UNDER CONSTRUCTION)

Functional and Efficient Pencil Grasps: Dynamic Tripod, Dynamic Quadrupod, Lateral Tripod, Lateral Quadrupod

Non-Functional and Inefficient Pencil Grasps: Fisted, Fisted thumb tuck, Interdigital Brace, Digital Grasp, Hyper-extended index, Hyper-extended thumb

Activities:
1. Use a wooden or plastic clothespin backward as tongs to move 20 items (pom-poms, small legos, small balls of play dough, etc.) into a container.
2. Hold 6 pennies in the preferred hand and place them in a container one at a time without using the other hand. (video link)
3. Color with broken pieces of crayon that are approximately 1-inch in length.

Recommendations:
1. Write, draw or color on a slanted or vertical surface
2. Put a Grotto Grip® on the student's pencil and explicitly teach how to use it.

Not separating the two sides of the hand. Weakness of the muscles that flex (bend) the index and middle fingers. Weakness of the skilled thumb triad muscles.

Program Goals:

Increase educator's knowledge and confidence in handwriting troubleshooting → Improve student's handwriting outcomes → Improve student academic success in all content areas

Theoretical Basis:

Experiential Learning Theory	Social Learning Theory
The learner is a self-guided adult who actively seeks out, constructs, and participates in learning The teacher (Pencil Pointers) acts as a facilitator/learning coach Direct, hands-on experiences related to real-world problems are the basis of learning	Video modeling of activity and strategy instructions allows learner to observe and learn from others performing the task. An upcoming addition to the web application will be a platform for learners to share their core content adaptations of various activities and strategies.

Implications for OTPs

School-based occupational therapy practitioners (OTPs) are typically viewed as handwriting specialists. Elementary educators are responsible for the initial explicit handwriting instruction for all students despite reporting a lack of confidence and knowledge in this content area. The Pencil Pointers web application will provide educators with the support they need to provide evidence-based, deficit-specific, activities and strategies within their scope of practice to prevent the development of maladaptive handwriting habits. This will ultimately improve student handwriting outcomes and academic success.

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