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The Use of Phoneme-Grapheme Mapping Practice To Improve Foundational Reading Skills In a First Grade Student

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The Use of Phoneme-Grapheme Mapping Practice
To Improve Foundational Reading Skills
In a First Grade Student

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Abstract

Literacy is widely accepted as a critical life skill in the United States, but many students struggle to acquire the necessary foundational skills. The National Reading Panel of the National Institute of Child Health and Development established The Big Five which identified five critical areas for effective reading instruction: phonemic awareness, phonics, fluency, vocabulary, and comprehension. There are 26 letters or graphemes represented in the English language and 44 sounds or phonemes. The connection between grapheme and phoneme is referred to as correspondences. A first-grade student, from a Midwest elementary school, was given a phoneme-grapheme mapping intervention to assist in strengthening her foundational phonics skills. This was done using *Phonics and Spelling Through Phoneme-Grapheme Mapping (*Grace, 2001) supplemental resource. The intervention was given three days a week, across seven weeks. The results suggest the phoneme-grapheme mapping practice did increase the student's fluency in letter-word-sound mapping. Although the student made progress, she will need to have intense instruction and support to gain grade level skills she needs. Additional factors to consider are her attention and district curriculum for reading.

ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

Reading is a fundamental skill for school and life. Certain students may struggle to learn the skills within reading and need additional supports to achieve success. According to the National Assessment of Educational Progress (2019) in 2019, 62% of fourth grade students in Minnesota were not reading at a proficient level when assessed by the National Assessment of Educational Progress (NAEP). This discrepancy in academic performance impacts all students but disproportionally affects marginalized groups. Black and Hispanic students have an average reading score 29-30 points lower than White students. Students who receive free/reduced school lunch, used as an indicator of low-income families, have an average reading score 29 points lower than those who do not receive free/reduced school lunch. The performance gaps for these groups have not seen a significant change in average scores since 1998. This impacts individuals' performance throughout school and their futures in major, systemic ways. As educators and student advocates it is our duty to not let our students continue to fall behind. The use of evidence-based interventions and a holistic approach to literacy is at the core of supporting at-risk readers. Over the decades, many have worked to develop different interventions to assist struggling readers. These interventions have focused on areas of phonemic awareness, phonics, and fluency. For this case study, I implemented a phonics-

based, phoneme-grapheme mapping intervention with a first-grade student. The setting of this study was in a Midwest elementary school. The student was experiencing difficulties with connecting auditory sounds to written expression. This ultimately resulted in a lack of fluency and ability to further develop vocabulary and comprehension.

A phoneme is a distinct unit of sound within a language. A grapheme is the smallest functional unit of a writing system. Phoneme grapheme correspondence is the process in which phonemes (the sound) is matched to the grapheme (the printed unit).This process of practiced repetition allows the student to develop their pronunciation of words and communication skills. Amy had difficulty determining the placement of phonemes within words, determining the correct grapheme, and overall fluency.

I used the phoneme grapheme mapping sheet from Grace (2001). This text aligns with Language Essentials for Teachers of Reading and Spelling (LETRS; Voyager Sopris, 2019) training, including teacher resources, tutorials, guidelines, and procedures. The primary goal is to help kindergarten through 6th grade students connect the sounds of spoken language to written language. This helps to build confidence in the student through strengthening their foundational reading and writing skills. The Literature Review will focus on the importance of literacy, structures of early phonics development, and phoneme grapheme correspondences. The studies and research to follow demonstrates the importance of early phonics development for later life success in reading, specific learning disabilities that impact reading, and a deeper dive into phoneme grapheme correspondences.

CHAPTER II

REVIEW OF LITERATURE

The National Literacy Trust (2017) explains literacy as the ability to communicate effectively through reading, writing, speaking, and listening. Literacy impacts all students in the United States and extends profoundly into every stage of life including school, work, and family. Having low literary proficiency may harm one's autonomy including reading books or newspapers, reading policies at a place of employment, or making informed medical decisions for yourself or loved ones. According to National Center for Education Statistics (2019), between the years of 2012 and 2017, there was not a statistically significant change in literary proficiency of adults living in the United States. A literary survey assessed adults' abilities to complete tasks of basic decoding, word recognition, fluency, and comprehension. The documents used in this survey were health-related materials and simple prose. In 2017, the United States had approximately 19% of adults in the lowest level of literacy, while 48% were placed in the highest level of literacy. This indicates an immense divergence within our adult literacy. Researchers and educators can see a clear association between early literacy development and later proficiency. The inequality in literacy abilities is not only impacting youth but rather it is impacting the entire collective.

Literacy is widely accepted as a critical life skill in the United States, but why is learning how to read and write so hard? Reading and writing are not natural processes.

Decades of research indicates literacy is highly unnatural and is not learned or developed

through the exposure to a literate environment (Lyon, 1998). There is a science behind

reading which includes the recognition of individual sounds, the ability to decode, and

the development of a diverse vocabulary. These three areas are critical to facilitate

growth for one's literacy abilities. If a student is lacking in any of these three areas, the

ability to gain mastery which includes comprehension and fluency will be hindered

(Defining Movement, 2021). Marginalized students including students of color, multi-

language learners, and students of lower socioeconomic status are all at a greater risk to

struggle with reading. These students may not have the ability to obtain books and other

reading materials to practice skills or have appropriate learning support in place to assist

in the learning process.

Due to the complex nature of literacy, many students struggle, and some need

additional help to meet standards. In Moat (2020) she stated that 95% of children can

learn to read. The key word in her statement is *can*. How we achieve that goal is a

complex journey. Students who struggle with learning to read are often diagnosed with a

learning disability; most commonly, the struggle with reading is called dyslexia. A

student with dyslexia may struggle with multiple areas of literacy regardless of

structured, evidence-based instruction. It is important to target the specific area of need

such as remediation with their phonemic awareness or phonics skills, or practice to

increase fluency.

Teaching and working with students with dyslexia is complex. Kearns and

colleagues (2019) stated, "The term dyslexia refers to difficulty in reading, a type of

specific learning disability, sometimes called a reading disability or disorder" (p. 175).

The researchers discuss the history of the term dyslexia and the different ways in which the brain organizes speech from a neurological basis. An explanation of a typical reading brain engages the inferior frontal gyrus of the frontal lobe, the temporoparietal region and the occipitotemporal region. These regions interact to link words, sounds, and meaning to allow for comprehension. Readers with dyslexia show less brain activation in the temporoparietal and occipitotemporal regions during reading tasks. The goal for students with any disability is to increase their abilities and gain skills. However, increasing opportunities to learn is not the only need for students with dyslexia (WETA Public Broadcasting, n.d.).

History of Reading Instruction

The persistent debate that surrounds which method of literacy instruction is the most effective has been coined the Reading Wars. The two opposing instructional methods are whole language reading versus phonics-based reading. Whole language instruction focuses on how language is present in everyday contexts. In theory, students will recognize words as a single piece of language rather than using decoding skills. Supporters of whole language do not believe that words should be 'broken down' into singular sounds as they do not assist in the context or meaning of the word at the phonics level. Whole language encourages sight words and the automaticity of word recognition. In contrast, phonics-based reading focuses on how learning phonemic awareness skills and phonics skills can assist students in pulling apart smaller pieces of a word to then understand how to read and write. The goal for phonics-based instruction is to allow the student to decode through matching sounds to letters and letters to sounds. Once the

process of decoding becomes fluent, the language processing becomes automatic (Kim, 2008).

These two theoretical approaches to reading clearly have their differences and conflicting philosophies. However, the most effective approach is both, together. Whole language focuses on the real-world application of language and memorization or fluency. Phonics focuses on decoding and forming an automatic word bank to increase fluency. The instructional method that assists students in developing both whole language fluency and phonics-based decoding abilities is called structured literacy. Structured literacy is an explicit method of teaching literacy that not only focuses on keystones of reading and writing such as phonological awareness, recognition of words, phonics, decoding, spelling and syntax, it has strategic guidelines on the time allotted and dedicated to each sub-category during different phases of acquisition. Structured literacy is based on The Big Five of reading. The areas of need must be targeted appropriately and met with evidence-based instruction for effective learning and progress.

The Big Five of Reading

In 2000, the National Reading Panel of the National Institute of Child Health and Development established The Big Five which identified five critical areas for effective reading instruction. In 1997, The National Reading Panel established a committee to address reading difficulties in young children. Through regional hearings in Oregon, Chicago, New York, Missouri, and Houston, key themes of concern were expressed on multiple occasions, across the country. Some concerns that were expressed were the importance of the role of parents in fostering reading development, early identification for at risk readers, importance of phonemic awareness, phonics, instruction, scientifically

based practices and information, importance of teachers and their role in professional development, and collaboration. The Panel decided on several topics as critical areas to study and develop more standard practice around.

The Panel coined these areas The Big Five. The areas include phonemic awareness, phonics, fluency, vocabulary, and comprehension. Phonemic awareness is the most basic starting point of developing literacy. Phonemic awareness is a completely auditory skill of identifying and manipulating sounds of the spoken language and is practiced without written letters or words. An example of practicing phonemic awareness is an instructor asking for the student to say the individual sounds in the word "tap", /t/ /a/ /p/. The word "tap" has three letters and three phonemes. To continue the practice, the instructor may ask the student to replace the /a/ in "tap" with an /i/ sound. The student would then say "tip", /t/ /i/ /p/. Words can have more letters than phonemes as well. An example of a word with four letters but three phonemes is "bean", /b/ /ea/ /n/. Phonics is the relationship between written letters and spoken sound. The explicit instruction of phonics focuses on how phonemes and graphemes connect to create sound and meaning. There is a predictable relationship with the sound and language patterns within the practice of phonics. The process of decoding is introduced in phonics as well. Decoding is the process of analyzing the individual parts of the word and 'sounding out' the word. Fluency refers to the student's speed, accuracy, and automaticity of the processes above. Fluency is a necessary skill to bridge the gap between decoding and comprehension. As decoding become automatic, understanding the material becomes the focus rather than using explicit effort to read each word. Additionally, fluency is an essential skill that allows the reader to have expression or prosody. Prosody is the ability to convey

emotions and feeling within the text which ties into comprehension. The skill of vocabulary in reading refers to the reader's knowledge of meaning and proper pronunciation of words. There are two types of vocabulary, expressive and receptive. Expressive vocabulary is how the student expresses themselves through speaking and writing. Receptive vocabulary is how the student understands others through listening or reading. Comprehension is the final of The Big Five and is the ability to understand and make sense of what you read or write. Reading comprehension requires all four of the prior skills of phonemic awareness, phonics, fluency, and vocabulary. Each of these five areas are needed for successful literacy and are integral parts of the Science of Reading or Structured Literacy. This method of literacy instruction takes the stages of reading-word development into account and tailors the amount of time and depth for each stage. Within the depth and time, the individual skills needed for reading proficiency and adequate foundation are made a priority prior to continuing forward with fluency and comprehension (The Brain Recovery Project, 2018).

The following research will focus on phonics-based reading, phonics, and the skills within that build towards reading fluency. Reading-word fluency and comprehensive literacy fluency are delineated through Ehri's (1996, 2014) phases of word-reading development. Moats, L. & Tolman, C. (2019)

Ehri's Phases of Word-Reading Development

Understanding the five areas of literacy offers insight to how reading skills are developed through Ehri's (1996, 2014) phases of word-reading development. Ehri's phases of word-reading development helps describe the different stages of recognition, fluency, and mapping abilities in readers. The first phase is Prealphabetic. In this phase,

the reader is developing a general concept of printed words and only focuses on the visual cues. This phase is before the reader can connect phonemes (sounds) with graphemes (letters). An example of this skill is when a child recognizes restaurant signs and can name them but cannot directly read the words. The second phase, Early Alphabetic develops letter sounds and names as well as emerging phonological and phonemic awareness, phoneme-matching, and syllables. For example, the reader can name the first letter and sound of the word "bus" as 'b' and say /b/. The third stage, Later Alphabetic is when some sight words emerge and includes phoneme-grapheme correspondences, segmenting and blending as well as phonemic awareness. Sight words are words that a reader automatically decodes and recognizes. Phoneme-grapheme correspondence is the cognitive process of matching phonemes to graphemes and vice versa (Moats & Tolman, 2019). Ehri additionally explained that there are four distinct ways to read: decoding (linking specific sound with letter), analogizing (learning a new word by applying the same pattern from previous), prediction (connecting what the reader currently knows about the text to gather meaning about what is expected next), and memory or sight (automatic). The first three methods listed require conscious effort and thinking while memory or sight is automatic (Parker, 2021). Memory or sight words occurs when the reader becomes fluent in the second and third stages of Ehri's reading-word development, so effort can now be used for comprehension of the text. The fourth and final stage is Consolidated Alphabetic. During this stage, the reader greatly expands their sight words, begins orthographic mapping, recognizing word families, patterns, and morphemes, as well as developing advanced phonemic awareness. This phase creates

more solid letter-sound connections which can lead into spelling, pronunciation, and meaning.

Within Structured Literacy, phonics is explicitly taught by connecting letters with corresponding sounds in the alphabet. Children learn how to blend, decode, and 'sound out' unfamiliar words. Ehri's (1996, 2014) phases of word-reading development can be used to help explain the developmental details and skills needed within the stages of phonics acquisition. The following section will explain the research behind phonics-based instruction.

Evidence for Phonics-based Instruction

The research completed by Double and colleagues (2019) found its basis from the 2012 British education movement to include synthesis of early phonics in early education. In a nationwide effort to strengthen literacy and identify potentially struggling readers, a phonics screener was developed and given to early elementary students across Great Britain. Elementary educators were given a phonics screener to complete with their first grade, 6-year-old students. Students were asked to read aloud 20 real words and 20 pseudowords. To pass the assessment, the student must have 32 of the 40 words correctly read aloud. Students were graded and placed in either a passed group or failed group. The passed group (Group 1) was given traditional instruction and did not have any major struggles with literacy throughout their education. The students that did not pass the initial phonics check (Group 2) were to receive evidence-based, guided interventions. The purpose of these interventions was to improve phonics skills and meet the next phonics check with a pass. A follow-up, second phonics check was given later that year to the students that had failed the initial phonics screener (Group 2). All students in

Group 2 were offered guided intervention prior to the second phonics check. The same criteria previously used to determine a pass was used again. Group 2 was then divided into two groups based on their passing or failing the second screener, those that passed (Group 2A) and those that failed (Group 2B).

Double and colleagues (2019) examined reading comprehension and performance of students in Group 2A versus Group 2B, approximately one to four years after the first phonics screener. They used databases through the English Department of Education and National Pupil Database, in comparison to the 2016 Progress in International Reading Literacy Study results. The data examined 4,641 students across 202 classrooms that fell within various demographics including student ages, gender, and socioeconomic status. Students within Group 2A did not initially have strong phonics skills but were later able to obtain the necessary skills through guided, evidence-based interventions. Group 2A had obtained comparable literacy skills to their peers in Group 1 after the interventions. Students within Group 2B, however, those who failed both phonics screeners, continued to have difficulties in reading and writing later in school. See Table 1 below for details.

Double and colleagues (2019) concluded early phonics mastery offers evidence to support early reading mastery. Since the implementation of the phonics check in 2012, students increased meeting the standard on their first attempt from 58% to 82% in 2018. The phonics check has strong concurrent validity with broader measures of reading and other phonics checks. In addition to early phonics, the results support that the development of phonics skills after their critical period can still have positive influences on reading fluency and comprehension. While phonics is known to be used to help with decoding, one of the phonics skills that receives minimal attention in the scope of literacy

instruction is using phonics for spelling. Through phoneme-grapheme mapping, phonics

connects the sound to the spelled letters in the form of graphemes.

Phoneme-Grapheme Correspondence Scope and Sequence

Phoneme-grapheme correspondence acquisition begins in the Later Alphabetic

phase of Ehri's (1996, 2014) word-reading development and falls under The Big Five of

Reading under phonics (Moats & Tolman, 2019). The phoneme is the auditory sound.

The grapheme is the written letters/word. Phoneme-grapheme mapping is an exercise to

develop word recognition and decoding skills. Within this exercise, the student writes the

word that is being verbally spoken. Phoneme-grapheme mapping is a research-based

activity that can assist readers in building word recognition skills. With guided practice

through evidence-based materials and instruction, students can use phoneme-grapheme

mapping to build decoding skills, increase fluency, and boost confidence.

Orthographic mapping (OM) is defined in LETRS by Moats and Tolman (2019)

as "the mental process used to store words for immediate and effortless retrieval. It

requires phonemic awareness, letter-sound knowledge, and the mechanism for sight word

learning" (p. 26). Phonemic-grapheme mapping is the practice within OM that establishes

and builds the ability to connect and retrieve information for sound-letter connections.

The Four-Part Processing Model for Word Recognition based on Seidenberg and

McClelland (1989) cited in LETRS, identifies the four major areas of how cognitive

processing systems in the brain work to read. The model illustrates the reading brain

activates phonology, orthography, meaning and context for comprehension. Phonology

and orthography interact to form phonics. Phonology and orthography individually

connect and interact to create meaning. Meaning and context interact and form a

reciprocal relationship. The Four-Part Processing Model for Word Recognition is a synchronous, interactive process that involves all parts for the brain to perceive stimuli such as auditory (phonological) or visual (orthographic) to create meaning and develop context.

There are 26 letters or graphemes represented in the English language and 44 sounds or phonemes. The connection between grapheme and phoneme is referred to as grapheme-phoneme correspondence (GPC). Letters or combinations of letters within the English language can take on different rules depending on the context, letter before or after, and placement of the letter. These GPC rules can create confusion and frustration for beginning readers. Within LETRS Volume 1 (Moats & Tolman, 2019) they explained Dr. Bruce Murray's Catalog of Spellings (Murray, n.d.). The catalog collects the different frequency occurrences of graphemes in English at their approximate percentage of usage. For example, the sound /f/ can be written as 'f', 'ph', or 'ff'. A single 'f' like in the word 'fox' occurs most frequently, about 75% of the time. The 'ph' spelling of /f/, like in the word 'phone', occurs about 15% of the time, and the 'ff' occurs about 10% of the time. Understanding and applying the frequency of these graphemes is demonstrated in the simplicity principle in the following study.

The simplicity principle is described as the idea that simpler explanations should be preferred over complex (Feldman, 2016). Applying the simplicity principle to frequency of grapheme occurrence is what Chen and Savage (2014) examined within the effectiveness to help at-risk readers. Chen and Savage examined how 38 at-risk readers could most effectively be introduced to complex GPC. They arranged two groups, Group 1 received a program that arranged GPC by their frequency and simplicity. Like the

example above with /f/, they would try 'f' before 'ph' and 'ff' because 'f' occurs

approximately 75% of the time in English literacy. Group 2 was given a 'word usage

condition'. In this group, the researcher would explain how to use the target word in

speech. Once explained, they would use the target word in sentences together. To finish

the session, they would practice writing sentences with the target word. All participants

completed the 9-week small group sessions.

Results were determined using post-test outcomes. Group 1 performed

significantly better than Group 2 on spelling, word recognition, and reading motivation.

The study supported the use of effective supplemental phonics interventions with

structuring by frequency and simplicity of GPC rules. The findings additionally

suggested that early reading remediation saw greater rates of improvement with simpler

GPC prompts, effective structuring, and supplemental phonics practice. This study

supports phoneme-grapheme mapping interventions with the evidence gathered through

the GPC rules, simplicity principle, and structuring. The use of phoneme-grapheme

mapping aids in the connection between sounds and symbols.

An additional study, conducted by Vadsey and Sanders (2021), supported the

scope and sequence of GPC exposure as key to influencing initial alphabet learning.

Vadsey and Sanders explored two key features influential for the introduction of English

to children. The rate of introducing alphabet correspondences and GPC that the child is

first exposed to has critical features to foundational knowledge. English possesses an

orthography or system of spelling that is more irregular, assigning multiple ways of

pronunciation for a single grapheme. Understanding this feature of English allows us to

understand why the introduction and exposure rate and method impacts understanding

and fluency. Vadsey and Sanders explored findings of the study that suggested students receiving mixed instruction were better able to decode, read, and spell on various tasks. This study offered insight and support to the importance of phoneme-grapheme correspondences due to the various points of contact for phonics, reading, and writing instruction.

Upon reflection of these studies, we can determine that early phonics when given through evidence-based instruction, can result in strong spelling, fluency, and comprehension. These foundational skills of phonics are ideally developed beginning in kindergarten then solidified through first grade and beyond. However, remediation to develop and establish foundational skills of phonemic awareness and phonics at any point can still be beneficial to later fluency and comprehension. The scope and sequence of instruction can greatly impact how the new reader can obtains the information and develop their skills.

Structured literacy incorporates explicit methods of teaching literacy (Defining Movement, 2021). This method not only has evidence-based research to support but also practice-based evidence to the effectiveness of instruction. Structured literacy offers strategic guidelines on the time allotted and dedicated to each sub-category (phonemic awareness, phonics, fluency, vocabulary, and comprehension) during different phases of acquisition. However, if skills are not taught sequentially or to fluency, building up to comprehension will be difficult. Phoneme-grapheme mapping is a critical skill within phonics and Ehri's (1996, 2014) Early and Later Alphabetic phases that impact one's literacy.

Instruction and Curriculum

Instruction and curriculum are often interchanged by those outside of education though they have distinct differences. Lee Flake wrote in Asian Journal of Education and Training (2017) "Curriculum is what is taught in schools, instruction is how curriculum is delivered and learning is what knowledge or skill has been acquired" (p. 83). According to the National Institute for Literacy (Armbruster et al., 2009), effective programming for phonics must incorporate multiple facets of systematic, explicit teachings. Instruction must involve relating letters to sounds, decoding, blending, and forming words, applying knowledge to reading words, sentences and texts and can adapt to needs of school, classroom, and individual students.

Multi-tiered systems of support (MTSS; Brown-Chidsey & Bickford, 2016) is a school-wide framework that increases effectiveness in identifying struggling students. The tiers of support are more commonly represented by a triangle. The MTSS triangle's base represented by roughly 80% of students in the school is labeled Tier I. Tier I is the core curriculum and includes the school-wide instruction of behavior expectations, social skills, active supervision, and engagement. The middle section of the triangle, 15%, is labeled Tier II. Tier II includes more specialized interventions for at-risk students. Examples of programs in Tier II are individual behavior interventions, small group counseling, and additional academic support. The top of the triangle, including 5% of students is labeled Tier III. Tier III includes individualized interventions that have intensive academic and/or behavioral components. Examples of programs in Tier III are individual therapy, crisis response, and academic remediation or accommodation.

Supplemental Phonics Programs

School districts must strive to implement evidence-based curriculums into their classrooms for students of all abilities and tier levels. When some students are still struggling after core, Tier I instruction, the decision to find appropriate supports must be explored. Tier II or Tier III interventions are necessary for students that require specific foundational supports. Supplement phonics programs offer students structured literacy support, remediation, and practice through phonics.

Bridge the Gap

Heggerty's *Bridge the Gap: Intervention Lessons* (VanHekken & Bottari, 2020) are structured and systematic. They follow a three-part curriculum that includes explicit instruction on phonemic awareness and phonics for those struggling with sounds. The program does not follow a weekly schedule but rather three parts that increase with difficulty. *Bridge the Gap* is intended for Tier 2 level support. Lessons are five to seven minutes long and delivered in small groups or individually. *Bridge the Gap* is one of Heggerty's programs that addresses phoneme isolation (isolating initial, final, and medial phonemes), blending (blending syllables and phonemes into words) and segmenting (segmenting words into syllables and phonemes). These skills are represented within Ehri's (1996, 2014) phases of word-reading development at the Early and Later alphabetic stages. Heggerty follows instruction aligned with The National Reading Panel, and the curriculum is supported by research and the Science of Reading.

Phoneme Track Workbook

Phoneme Track Workbook by Cryer (2004) is a supplemental curriculum to support phonemic awareness and phonics. This intervention focuses on hearing,

identifying, segmenting, and blending. *Phoneme Track Workbook* focuses on phonemic awareness and phonics skills and is suitable for first and second grade students or older learners with phonological difficulties. Within Erhi's (1996, 2014) phases of word-reading development, *Phoneme Track Workbook* identifies skills within Early and Later Alphabetic stages. The workbook addresses skills within phonemic awareness and phonics of The Big Five.

Phonics and Spelling Through Phoneme-Grapheme Mapping

Phonics and Spelling Through Phoneme-Grapheme Mapping by Grace (2001), is a supplemental manual that focuses on phonics and spelling. The practice of phoneme-grapheme mapping is used to enhance the learning of closed, open, silent, consonant, vowel, and controlled syllables, and morphology. Additionally, the resource includes a step-by-step process of phoneme-grapheme mapping. The primary goal for this manual is to help kindergarten through 6th grade students connect the sounds of spoken language to written language. This helps to build fluency and confidence in the student, through strengthening their foundational reading and writing skills. *Phonics Through Phoneme-Grapheme Mapping* aligns with Later Alphabetic and Consolidated Alphabetics of Ehri's (1996, 2014) phases of word-reading development. From The Big Five, it addresses skills within phonics, spelling, and fluency. This manual follows instructional methods of LETRS training and the Science of Reading (Moats & Tolman, 2019; Defining Movement, 2021).

Selecting an appropriate curriculum can be an overwhelming and difficult task. It is difficult to find a single curriculum to address all areas of need within a district, school, or student. One must consider selecting evidence-based curriculums that are supported by

The National Reading Panel when pursuing a new curriculum. Collaboration and consultation with colleagues are key aspects to finding the appropriate curriculum fit.

Summary

Literacy is the ability to read, write, speak, and listen in a way that lets us communicate. Reading and writing are not innate skills and require explicit instruction. The National Reading Panel (2000) established a committee to address effective reading instruction in young children in 1997. The Panel coined these areas The Big Five which included phonemic awareness, phonics, fluency, vocabulary, and comprehension.

Phonics is a method of teaching the English language by connecting letters with corresponding sounds in the alphabet. This teaches children how to blend, decode, and 'sound out' unfamiliar words. Phoneme-grapheme mapping is a skill within phonics and focuses on the connection between phonological processing (sound) and orthographic processing (writing). For this case study, the curriculum, *Phonics Through Phoneme-Grapheme Mapping* (Grace, 2001) was utilized to increase word reading fluency in a struggling first grade student.

CHAPTER III

METHODS

Participant

The participant in this case study was a seven-year-old, first grader named Amy. She is Caucasian and English is her primary language. During the time of this intervention, Amy attended an elementary school in a Minnesota suburban city and lived with her mother, older brother (10) and older sister (14). Her brother, who is in the 4th grade at the same school, has a diagnosis of attention deficit disorder (ADD). Amy was initially evaluated for special education during the spring of her preschool year (2019). Her file showed overall deficits in these areas: social, self-help, expressive language, language comprehension, numbers, and general development. The school's speech-language pathologist found deficits in articulation as well. Amy's mother completed a Child Development Inventory Profile and described Amy as a happy, strong-willed, spit fire child. She has strengths in imagination but struggles with recognizing other people's feelings, has challenging sleep habits, and is a picky eating.

According to Amy's file review, there were no vision or hearing concerns and she does not wear glasses. Amy's mother reported that she had a typical pregnancy with her, and that Amy met developmental milestones within normal periods. She did however described Amy as a 'late-talker'.

During the time of this case study, Amy's school day was impacted by the school district's COVID-19 pandemic measures. This shortened Amy's special education minutes as well as the overall school day. Students and staff wore protective face masks during the school day. During the study, Amy's district's literacy curriculum was *Leveled Literacy*. During the fall of her first-grade year, she received *Level Literacy* instruction. However, spring of her first-grade year, Amy's classroom was a part of a new literacy program *Ultimate Phonics Reading Program*. Additionally, Amy was receiving additional literacy support in her special education classroom for phonemic awareness and phonics. The intervention I implemented focused on phonics with an emphasis in phoneme-grapheme mapping practice.

It should be noted that Amy's fine motor abilities to write and manipulate a pencil were comparable to her peers and did not hinder her abilities to complete this intervention.

Materials

Phonics and Spelling Through Phoneme-Grapheme Mapping

The intervention selected was determined by Amy's special education teacher. She selected the skill that Amy was currently struggling with the greatest and was impacting her ability to develop fluency. *Phonics and Spelling Through Phoneme-Grapheme Mapping (*Grace, 2001) is a supplemental curriculum to assist students with matching sounds of letters to written expression. The program included a phoneme-grapheme mapping worksheet. Amy used a pencil to complete her mapping practice. This worksheet included boxes arranged in 13 rows and 10 columns. See Appendix A.

Assistive Materials

   Amy was given letter cards from her special education teacher that included the lower-case letter and a visual representation of the mouth when saying the letter sound. Certain cards included additional shapes and lines to signify streams of air, puffs of air, stop sounds or continuous sounds. Examples of these cards can be found in Appendix B. Additionally; Amy was given a small handheld mirror. This mirror was used to assist Amy to be aware of her mouth shape when expressing the sounds to assist in the connection between sound and writing.

Progress Monitoring Materials

   Tracking Amy's progress was critical to analyze the intervention's effectiveness. Progress was monitored using AIMSweb (The Colorado Department of Education, 2018) Letter Word Sound Fluency probes by Amy's special education teacher. This data examined her ability to identify letter sounds fluently and accurately. Separately, I collected data on Amy's phoneme-grapheme mapping completion. I used a timer and a paper tracking sheet. The paper tracking sheet was numbered from one to 13 with the real/nonsense consonant-vowel-consonant (CVC) words. These words would only include the letters she currently knows, and the cards associated. I used a timer on my phone to track her speed upon start and completion of each word grapheme correctly.

<div align="center">

Procedures

</div>

   During my first week of practicum in February 2021, my supervisor and I discussed potential students that may need additional academic assistance and could benefit from me working one-on-one with them. He mentioned Amy and that he works closely with both her general education and special education teachers. He sent Amy's

<div align="center">

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</div>

special education teacher an email for me to observe Amy and discuss potential

interventions for her academic needs. I observed three 30-minute special education

English lessons across two weeks. During these observations, I sat in the back of the

classroom where I was able to see Amy and her two classmates as well. I obtained

materials from Amy's special education teacher outlined above.

I met with Amy three times a week starting on March 23rd, 2021, between 12:00

pm and 12:30 pm. We initially worked on materials outside of the classroom in the 'team

center' area, but I noticed the environment was too distracting, so we moved locations to

the library after April 8th. Spring break was the last week of March between March 29th

and April 3rd, so we did not meet during that week.

When it was time to deliver my intervention, I would often enter the classroom or

meet her in the team center area. We would then walk together to the library. We would

sit down at a comfortable table for Amy and set out our materials. The materials included

the letter cards, mirror, phoneme-grapheme mapping sheet, and pencil. Once she

arranged the cards to her liking, I would ask if she was ready to begin. I would first say a

real or nonsense CVC word that included letters that she had previously learned. I did not

introduce any new letters during my intervention. However, when a new letter was

introduced in Amy's special education class, I would add it to our intervention during our

next session. All letters used were previously, explicitly taught in her special education

class. A few examples of words that were read to Amy were: "nib", "cap", and "mat."

Amy would repeat the word and begin writing. I started my timer on my cell phone once

I said the word and then stopped it once she completed writing the last letter, correctly.

To move forward with the next CVC word, Amy was required to write the grapheme

correctly; this corrective feedback and correction was included in the timing process. I would place my phone with the timer out of Amy's sight to avoid additional distractions. Her special education teacher also used a cell phone to time her during weekly/biweekly progress monitoring, so the phone did not appear to distract her. I noted her time and continued with the next word on the sheet. Once we finished our 13 words for the day, Amy would pick a sticker, eraser, or other small tangible reward that I provided throughout the intervention. Once she returned to her general education classroom, I would average her time for the day and input the data into a spread sheet.

Rapport and Relationship

Rapport and relationship building is often a forgotten crucial piece to academic interventions. However, it is known to be the most important factor in the helping relationship and impacts student success. Rapport building began before the intervention. During the observations prior to the intervention, Amy was able to see me in her special education classroom. This passive introduction helped facilitate later relationship building. On the first day of intervention, I introduced myself, explained that we would be working on a task she does in Ms. W's (her special education teacher) class, and that we would meet for the next few months together a few times a week. As part of rapport building but also as a motivating reward, Amy would receive small tangible rewards at the end of our sessions; the first few weeks were just stickers. I later asked what types of things she liked. She replied with "unicorns!" I then found and included unicorn erasers and other unicorn themed toys. Before and after the intervention, I would ask Amy about her day, how things were going in class, and reflect on our practice together. During the third to last week, I explained to Amy that I was also a student, and that we would be

meeting for two more weeks before we would be done. I reassured her that she has been making progress and will continue to make improvements in school. I reminded her the second to last week and the last week as well. These explanations and reminders were helpful for Amy to prepare for the end of our intervention.

Summary

Amy, a seven-year-old, first grader was the participant for this case study. She receives special education under the categorical label of specific learning disability. The intervention utilized the supplemental curriculum *Phonics and Spelling Through Phoneme-Grapheme Mapping* (Grace, 2001) to practice phoneme-grapheme mapping. Materials included phoneme-grapheme mapping sheet, letter cards, and a mirror. I collected time completion data for each day and averaged her speed.

CHAPTER IV

RESULTS

There were two primary modes of data collection during this intervention. The first was in place prior to the intervention and being collected by Amy's special education teacher on a bi-weekly/weekly basis. Amy's special education teacher collected Letter Word Sound Fluency data through the program, AIMSweb (The Colorado Department of Education, 2018). This data shows her fluency in identifying sounds of individual letters. For example, if she were to see an 'f' she would need to say */f/*. Amy's special education teacher collected data on how many correct sounds she was able to say in 60 seconds. Amy's baseline was established by data collected on 1/11/2021 through 3/8/2021. Her goal rate of improvement (ROI) was determined during Fall 2020 of increasing 1.39 correct letter sounds per week.

In September of 2020, she scored a zero for correct and 15 for errors. This means in 60 seconds she said the sounds for 15 letters, but all were incorrect (0% accuracy). On the last week Amy was present for the intervention, she named 27 letter sounds with 9 correct and 18 errors (33% accuracy). She increased the number of letters she named in 60 seconds. The errors included letter sounds that she had not yet been explicitly taught. Most of the letters that had been explicitly taught were identified correctly. However, she did have common errors with letter that have similar graphemes, for example, 'f' and 't'. This placed her above her goal rate of improvement. Amy's goal rate of improvement

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(ROI), which was determined and set in August 2020, was a weekly increase of 1.39 correct letter sounds per week. However, she increased at a rate of 2.08 correct letter sounds per week, surpassing her ROI. See Figure 2 below. The results from the phoneme-grapheme intervention were measured by the speed of completion of each grapheme. I independently collected Amy's average seconds to write each CVC word during our phoneme-grapheme mapping practice. This was started without collecting baseline data. See Figure 3 below. The average time decrease of phoneme-grapheme mapping represents that Amy is completing the mapping intervention with a higher accuracy and fluency than when initially started. Additional data was taken from a comparison peer in Amy's general education class. She was identified as being of average academic growth and cooperative. She completed 13 real and nonsense CVC words with an average three seconds per word. When reviewing Amy's speed during the last week of intervention, versus the comparison peer, there is still a significant gap in fluency. Amy completed a CVC phoneme-grapheme mapping prompt on average, 11 seconds slower than her peer.

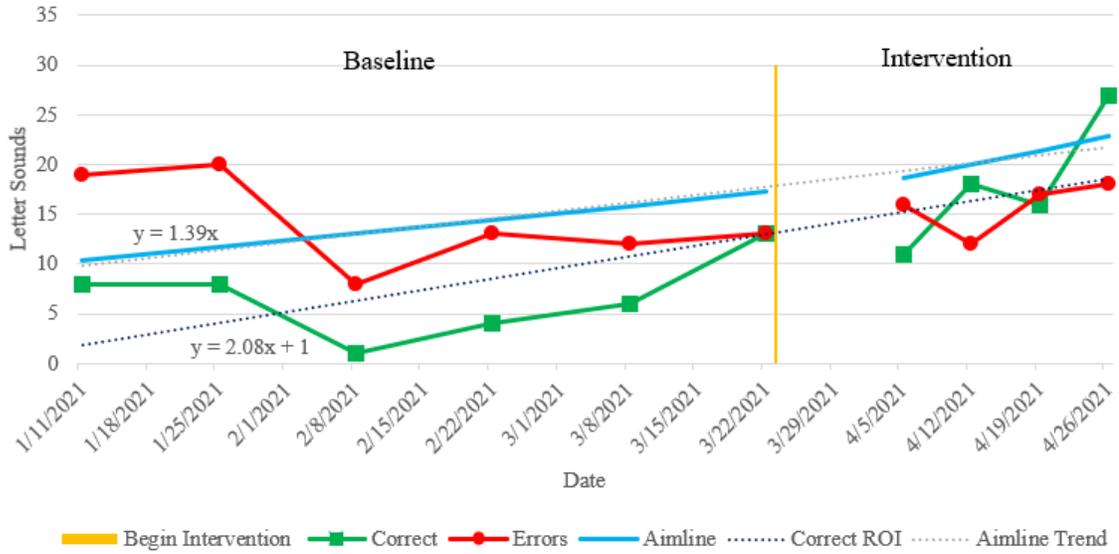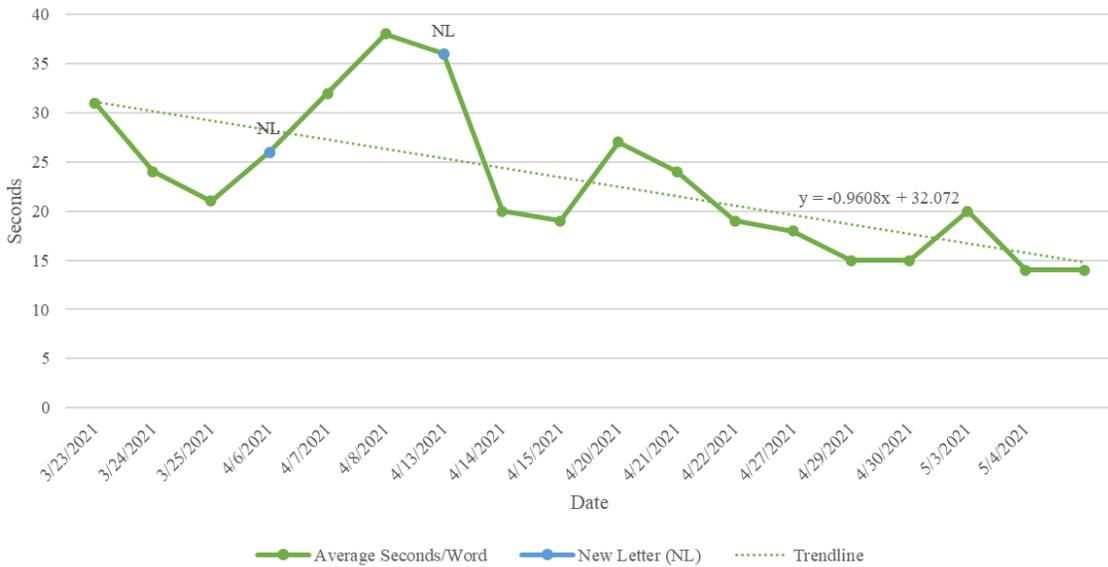**Figure 2**

Amy's Baseline and Intervention Data

Figure 3

Average Seconds Per CVC Word Written

Note. Amy's district had scheduled, no school days for the week of March 29th to April 2nd for spring break.

CHAPTER V

DISCUSSION

Data collection focused on mastery and fluency, which was tracked through accuracy and speed. The results included fluency of verbal and written expression through Letter Word Sound Fluency and phoneme-grapheme mapping practice. The Letter Word Sound Fluency expressed an increase in correct letter sounds identified, suggesting mastery and fluency. The phoneme-grapheme mapping intervention's trendline expressed a decrease in speed which attributes to mastery and fluency as well.

Amy's Letter Word Sound Fluency data, collected through AIMSweb (The Colorado Department of Education, 2018) by her special education teacher, increased from eight correct letter sounds identified to 27 correct letter sounds identified in 60 seconds. This expressed a ROI average of 2.08 letter sounds identified per week, which placed her above her aim line goal of 1.39. Amy's increase in correct letter sounds was significant; however, she is still critically behind her peers.

An area of concern that should be addressed is Amy's increase in errors on her progress monitoring data collected through AIMSweb (The Colorado Department of Education, 2018) by her special education teacher. The increase in errors was not a concern for Amy's special education teacher because she was increasing her accuracy on letters she had been taught while guessing on letters she did not know. The biggest takeaway from these scores was that in the fall, she had zero correct and, in the spring,

she had nine correct. This placed her above her goal rate of improvement. Although the number of errors is increasing in the data, she is becoming more fluent with the known letters.

I collected data on Amy's phoneme-grapheme mapping progress through daily time completion of her mapping intervention. On the first day of the intervention, Amy had an average phoneme-grapheme CVC word completed in 31 seconds. This data included corrective feedback and corrections. On the final day of her intervention, she completed her phoneme-grapheme mapping intervention words with an average of 14 seconds per word. This indicated that Amy was able to increase her speed and accuracy. A few factors contributed to her increase in speed. A factor that impacted her speed was that she reduced her use of assistive materials: letter cards and mirror. Since Amy was no longer referring to her assistive materials during the phoneme-grapheme mapping intervention, she was quicker to complete the word. Another factor that I believe increased her speed during the intervention was that she was gaining fluency thus she did not need to make as many corrections. As previously mentioned, corrections were included in the time completion data. Lastly, two other factors that impacted Amy were her environment and motivation. In procedures, I mentioned that the 'team center' appeared to be a distracting environment and moving to the library improved her focus during our meetings. Motivation was impacted by her increasing confidence and her general education classroom's activity she was away from during our session. On two separate occasions, she wanted to finish her phoneme-grapheme mapping practice quickly to return for a letter writing activity and a movie.

A peer in Amy's general education classroom completed 13 CVC words, all words were previously used in Amy's phoneme-grapheme mapping intervention. The comparison peer completed the phoneme-grapheme mapping prompts with an average of three seconds per word. All words were written accurately and fluently. When comparing the peer to Amy, there is a clear deficit in Amy's phonological processing as well as her ability to connect phonemes to graphemes.

In addition to her academic progress, her general education teacher reported that she enjoyed working on our phoneme-grapheme intervention on the days I was there. Her special education teacher reported that Amy was more confident and excited to work on writing during class after the intervention. Amy's engagement and focus on the task improved throughout the intervention asking me to "Go faster!" as we finished a word. During the last two weeks, she did not want to use her assistive tools such as letter cards or mirror. Amy not only completed the words quicker towards the end of the intervention, but she also was completing them without her assistive tools meaning the skills were becoming more automatic and fluent.

Limitations

There were a few factors that posed as limitations to Amy's academic growth prior and during the intervention. A major impact was the COVID-19 pandemic. The pandemic not only impacted her first-grade year, but severely disrupted her Kindergarten year as well. During March of 2020, all classes were canceled for two and a half weeks prior to distance-learning plans being approved. Additionally, students that continued to attend school for special education, had major differences in their school day and did not interact within their general education class. During Amy's first-grade year (August 2020

– May 2021), the school district had a total of three different COVID-19 contingency plans. This reduced the total school day and total special education minutes, impacted lunch time procedures, and all students and staff were required to wear protective face masks. Protective face masks may have impacted Amy's ability to benefit from adult modeling of how to pronounce sounds and words.

During the implementation of my phoneme-grapheme mapping intervention, Amy was receiving an additional 10 minutes of daily academic support from her special education teacher. This 10-minute session focused on strengthening phonemic awareness and phonics skills that had previously been explicated taught during her special education class time. The additional support was given to Amy and a peer after her special education mathematics class. This may have impacted the results of this study.

Amy's general education class was selected as part of piloting a new reading curriculum in January of 2021. Prior to January of 2021, the classroom was implementing *Leveled Literacy*, a Fountas and Pinnell program that teaches literacy (Fountas & Pinnell). Amy's classroom along with one other first-grade classroom began implementing *Ultimate Phonics Reading Program*, a Spencer Learning literacy program (Spencer Learning). The change in core reading program in Amy's general education classroom may have impacted her improvement in her Letter Word Sound Fluency and phoneme-grapheme mapping intervention.

Another limitation I saw within Amy was her attention. She did struggle with attention during our times working together as well as during class times that I observed. As noted in the participant information, there is a family history of ADD in her biological

brother. Attention paired with her learning disability may be impacting her ability to reach grade level more than we are aware.

In conclusion, Amy will need intense instructional support to gain grade level skills. The COVID-19 pandemic has caused major disruptions within Amy's school and community that may be hindering her learning. Additional academic changes such as core curriculum and the daily additional 10 minutes of phonemic awareness and phonics support are factors to consider when evaluating her progress. Inattention seems to be impacting her academics progress as well. Amy will continue to need academic supports to address her literacy needs and overall school success.

Recommendations

The skill that was targeted by the phoneme-grapheme mapping intervention with Amy, was a phonics skill within the phase of Later Alphabetic of Ehri's (1996 ,2014.) Although this is a critical skill to develop for students, I believe Amy's prerequisite phonemic awareness skills and Early Alphabetics were not yet fluent. This impacted her ability to move beyond to more complex phonics skills. Amy would benefit from an intervention that focuses more directly on Early Alphabetic skills such as individual letter-sound correspondences, phonological awareness skills, and the ability to identify and isolate initial sounds.

A potential intervention that could have been used to build Amy's phonemic awareness and early phonics skills would be Incremental Rehearsal (IR). IR is an intervention that uses repetition and a high ratio of known to unknown items. This is an evidence-based intervention and can be used with both mathematics and literacy (Joseph, 2006). For Amy, I believe she could have benefitted from an IR intervention with letter

sounds and letter names fluency. This is an Early Alphabetic skill that she had not yet mastered. Though Amy made progress over the seven-week intervention, without an adequate base of phonemic awareness and early phonics, she will continue to struggle to reach grade level.

Additionally, if I were to have the opportunity to implement a phoneme-grapheme mapping intervention in the future, I would incorporate a self-charting and reflection piece with the student. I believe this would help to motivate the student and provide an additional opportunity to build rapport.

Reflection

Overall, I enjoyed the process of this case study and paper, start to finish. This project was a learning experience that challenged me during different phases. First, I needed to be flexible and adaptable during the intervention and writing and research process. Second, I learned critical aspects of integrity, fidelity, and data collection. Third, I was able to collaborate with colleagues in the school. I observed and learned about the need and critical lack of evidence-based, effective literacy curriculums. Lastly, I experienced the importance of building relationships with at-risk students for academic success. Working with Amy and building a great relationship with her was a main highlight. I was able to see her personality shine and her confidence grow throughout our time together. I was able to apply my skills from various classes on relationship building and appropriate termination of a helping relationship. I worked closely with Amy's special education teacher and learned from her knowledge and experience as an educator. Amy's school psychologist, my practicum supervisor, was a huge support in my project

and growth as a future school psychologist. I see this project as having lasting impacts on

my professional development and am grateful for the experience.

REFERENCES

Armbruster, B. B., Lehr, F., Osborn, J., & Adler, C. R. (2009). *Put reading first: The research building blocks of reading instruction: Kindergarten through grade 3* (3rd ed.). National Institute for Literacy.

Brain Recovery Project (2018). Understanding the Big Five for early or struggling reader. https://www.brainrecoveryproject.org/wp-content/uploads/2018/10/Part-1-Understanding-the-Big-Five-for-the-Early-or-Struggling-Reader.pdf

Brown-Chidsey, R., & Bickford, R. (2016). *Practical handbook of multi-tiered systems of support: Building academic and behavioral success in schools*. The Guilford Press.

Chen, V., & S. Savage, R. (2014). Evidence for a simplicity principle: Teaching common complex grapheme-to-phonemes improves reading and motivation in at-risk readers. *Journal of Research in Reading*, *37*(2), 196–214. https://doi-org.trmproxy.mnpals.net/10.1111/1467-9817.12022

Cryer, L. (2004). *Phoneme track workbook.* David Fulton Publishers.

Defining Movement. (2021, February 21). *The science of reading: A defining guide.* https://www.whatisthescienceofreading.org/science-of-reading-guide

Double, K. S., McGrane, J. A., Stiff, J. C., & Hopfenbeck, T. N. (2019). The importance of early phonics improvements for predicting later reading comprehension. *British Educational Research Journal*, *45*(6), 1220–1234. https://doi-org.trmproxy.mnpals.net/10.1002/berj.3559

Ehri, L. C. (1995). Phases of development in learning to read words by sight. *Journal of Research in Reading*, 18(2), 116-125.

Ehri, L. C. (2014). Orthographic mapping in the acquisition of sight word reading, spelling memory, and vocabulary learning. *Scientific Studies of Reading*, 18(1), 5-21.

Feldman, J. (2016). The simplicity principle in perception and cognition. *WIREs Cognitive Science*, 7(5), 330–340. https://doi.org/10.1002/wcs.1406

Flake, L. H. (2017). A look at the relationship of curriculum and instruction and the art and science of teaching. *Asian Journal of Education and Training*, 3(2), 82-85. https://doi.org/10.20448/journal.522.2017.32.82.85

Grace, K. (2001). *Phonics and spelling through phoneme-grapheme mapping*. Voyager Sopris Learning.

Joseph, L. M. (2006). Incremental rehearsal: A flashcard drill technique for increasing retention of reading words. *The Reading Teacher*, 59, 803-807.

Kim, J. S. (2008). *Research and the reading wars.* Scholars at Harvard. https://scholar.harvard.edu/files/jameskim/files/bookch2.pdf

Kearns, D. M., Hancock, R., Hoeft, F., Pugh, K. R., & Frost, S. J. (2019). The neurobiology of dyslexia. *Teaching Exceptional Children*, *51*(3), 175–188. https://doi-org.trmproxy.mnpals.net/10.1177/0040059918820051

Lyon, G. R. (1998). *Why reading is not a natural process.* Association for Supervision and Curriculum Development.

Moats, L. (2020). *Speech to print: Language essentials for teachers*. (3rd ed.). Paul H. Brookes Publishing Co.

Moats, L. & Tolman, C. (2019). *LETRS.* Voyager Sopris.

Murray, B. (n.d.). *A catalog of spelling*. Retrieved from www.auburn.edu/~murraba/spcat.html

National Center for Educational Statistics. (2019). *Nation's report card*. https://nces.ed.gov/nationsreportcard/

National Literacy Trust. (2017). What is phonics? *What is literacy?* https://literacytrust.org.uk/information/what-is-literacy/what-phonics/

National Reading Panel. (2000). *The Big 5*. National Institute of Children Health and Development.

Parker, S. (2021). *The essential Linnea Ehri*. Parker Phonics.

The Colorado Department of Education. (2018). *Assessment Instrument Description: aimsweb*. https://www.cde.state.co.us/accountability/aims_web_ assessment_instrument_description_2018

The Nation's Report Card. (2019). *NAEP report card: Reading*. https://www.nationsreportcard.gov/reading/states/scores/?grade=4

U.S. Department of Education (2019). *2019 reading state snapshot report*. Institute of Education Sciences. National Center for Education Statistics.

Vadasy, P. F., & Sanders, E. A. (2021). Introducing grapheme-phoneme correspondences (GPCs): Exploring rate and complexity in phonics instruction for kindergarteners with limited literacy skills. *Reading & Writing*, *34*(1), 109–138. https://doi-org.trmproxy.mnpals.net/10.1007/s11145-020-10064-y

VanHekken, A., Bottari, M. (2020). *Bridge the gap:* P*honemic awareness intervention lessons*. Literacy Resources, LLC.

Voyager Sopris. (2019). *LETRS: Life-Changing Literacy Professional Learning.* https://www.voyagersopris.com/professional-development/letrs/overview

WETA Public Broadcasting. (n.d.). *Reading Rockets: Why some kids struggle.* https://www.readingrockets.org/helping/struggle

APPENDIX A

PHONEME-GRAPHEME MAPPING SHEET EXAMPLE

APPENDIX B

LETTER CARDS

APPENDIX C

DAILY PROGRESS TRACKING SHEET

Week 1	Time (min)	Task	Letters	Average Time/Word
3/23	8	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T	31
3/24	9	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T	24
3/25	9	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T	21
Week 2				
4/6	8	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I	26
4/7	11	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I	32
4/8	15	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I	38
Week 3				
4/13	12	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	36
4/14	7	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	20
4/15	6	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	19
Week 4				
4/20	10	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	27
4/21	10	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	24
4/22	6	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	19
Week 5				
4/27	10	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	18
4/29	7	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	15
4/30	8	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	15
Week 6				
5/3	7	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	20
5/4	8	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	14
5/5	9	Phoneme-Grapheme Mapping	A, C, F, L, M, N, P, S, T, I, B	14

APPENDIX D

AMY'S LETTER WORD SOUND FLUENCY AIMSWEB DATA

Language: English
Measure: LWSF Grade K
Period: Sep'20-Aug'21
Show Performance Details Table [toggle]
[View / Refresh]

	Baseline	9/14	9/21	9/28	10/5	10/12	10/19	10/26	11/2	11/9	11/16	11/23	11/30	12/7	12/14
Score	0	0						6		9					
Errors	15	15						9		9					
Goal ROI	1.39	1.39						1.39		1.39					
Trend ROI								0.95		1.07					
Intervention Trend ROI															

	12/21	12/28	1/4	1/11	1/18	1/25	2/1	2/8	2/15	2/22	3/1	3/8	3/15	3/22
Score				8		8		1		4		6		13
Errors				19		20		8		13		12		13
Goal ROI				1.39		1.39		1.39		1.39		1.39		1.39
Trend ROI				0.45		0.35		0.11		0.06		0.06		0.17
Intervention Trend ROI														

	3/29	4/5	4/12	4/19	4/26	5/3	5/10	5/17	5/24
Score		11	18	16	27				
Errors		16	12	17	18				
Goal ROI		1.39	1.39	1.39	1.39				