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The Effects of Orthographic Mapping in Student Spelling Performance

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The Effects of Orthographic Mapping in Student Spelling Performance

A Quantitative Research Methods Proposal

A Project Presented to the Graduate Faculty of

Minnesota State University Moorhead

By

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In partial fulfillment of the Requirements for the Degree of

Master of Science in Curriculum and Instruction (M.S.)

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Abstract

The ability to accurately and automatically spell words shows a deep understanding of phonemes, graphemes, phonological context, morphology, and an understanding of language of origin. One approach to spelling instruction is through the explicit teaching of grapheme-phoneme correspondences. This 2023 study focused on the impact of orthographic mapping on student spelling performance of third grade students. Students completed a spelling pre-assessment. Then, students received orthographic mapping spelling instruction using sound boxes. At the conclusion of the study, students completed a spelling post-assessment. Student data was analyzed to gauge the effectiveness of orthographic mapping as a method of spelling instruction.

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Chapter 1

Introduction

Introduction

In recent years, national, state, and district-reading performance has not been meeting proficiency standards (Minnesota Department of Education, 2022; United States Department of Education, 2022). Failure to read and write proficiently has shown to have negative social, health, and economic impacts on individuals and society as a whole (Moats, 2019). Although research has been performed on best practices in the field of literacy, barriers have been in place to prevent teachers from utilizing these practices in their classrooms.

One such barrier has been the negative effects of the COVID-19 pandemic. In the spring of 2020, the COVID-19 pandemic resulted in school closures across the country. These closures resulted in a switch to asynchronous and virtual learning. School closures greatly impacted all students, but especially elementary school students who are learning foundational literacy skills during this period (Klosy et al., 2022). “More specifically, the results point to the fact that students in primary education were affected more severely than students in secondary education were” (König & Frey, 2022, p. 21). Additionally, the use of masking in schools further impacted instruction in foundational literacy skills such as phonemic awareness, phonics, and spelling.

With the effects of COVID-19 still being felt in classrooms, spelling performance of students has been significantly impacted in our district. This research aims to identify evidence-based best practices and utilize these practices in a third grade classroom. The main practice that will be utilized is practicing orthographic mapping with sound boxes.

Brief Literature Review

The development of literacy skills is most beneficial when instruction is delivered systematically, intensely, and explicitly (Alber-Morgan et al., 2016; Cohen et al., 2017; Joseph & Ross, 2019; Moats, 2019; National Reading Panel, 2000; Torgesen et al., 1999; Weiser & Mathes, 2011). As students are exposed to literature, they pass through phases of development (Ehri, 2005; Moats & Tolman, 2019). Teachers must understand the characteristics of each phase and have a deep understanding of their students' skills to deliver instruction that is developmentally appropriate.

An approach to support students' decoding and encoding development across multiple phases is through orthographic mapping. Orthographic mapping is the intentional focus on the connection between phonemes (sounds) and graphemes (letters). Orthographic mapping requires students to focus on each sound in a word and connect those sounds to the appropriate letter or letters that spell those sounds in context. Through explicit practice, instruction, and multiple exposures, students are able to retrieve the correct spelling of the word automatically.

Statement of the Problem

In recent years, there has been a decline in student reading and spelling performance at the elementary level (Minnesota Department of Education, 2022; United States Department of Education, 2022). Students are lacking appropriate skills to accurately decode and encode words independently. These trends have required educators to search for evidence-based practices to support their instruction and to improve the literacy skills of their students (Tolman & Moats, 2019). This research aims to explore the effects of orthographic mapping activities using sound boxes on student spelling performance.

Purpose of the Study

The goal of this study is to understand the effects of orthographic mapping using sound boxes and identifying whether or not it increases student automaticity and accuracy in spelling. The ability to accurately and automatically spell words shows a deep understanding of phonemes, graphemes, phonological context, morphology, and understanding of language of origin. Spelling is a complex task that is challenging for many students, especially when they lack mastery in foundational skills such as phonemic awareness, phonics, and decoding (Treiman, 2018). The findings of this study will impact the way decoding and encoding instruction is approached.

Research Question

The goal of this action research is to investigate the following:

What effect will orthographic mapping have on student spelling outcomes?

Definition of Variables

The following are the variables of study:

Independent Variable: Orthographic mapping using sound boxes

Dependent Variable: Student spelling performance on curriculum based assessments

Significance of the Study

The outcome of this study will provide a deeper understanding of spelling development and provide insight to tools and strategies that best support student progress. Additionally, the findings of this research will be accessible to district employees to implement changes and evidence-based practices into their classrooms. The participants of this study will gain knowledge of grapheme-phoneme correspondences, phonological context, morphology, and

language of origin. Study participants will utilize this understanding to become more proficient and independent spellers.

Research Ethics

Permission and IRB Approval

In order to conduct this study, the researcher will seek MSUM's Institutional Review Board (IRB) approval to ensure the ethical conduct of research involving human subjects (Mills & Gay, 2019). Likewise, authorization to conduct this study will be sought from the school district where the research project will take place (See Appendix A).

Informed Consent

Protection of human subjects participating in research will be assured. Participant minors will be informed of the purpose of the study via the Method of Assent (See Appendix B) that the researcher will read to participants before the beginning of the study. Participants will be aware that this study is conducted as part of the researcher's Master Degree Program and that it will benefit her teaching practice. Informed consent means that the parents of participants have been fully informed of the purpose and procedures of the study for which consent is sought and that parents understand and agree, in writing, to their child participating in the study (Rothstein & Johnson, 2014). Confidentiality will be protected through the use of pseudonyms (e.g., Student 1) without the utilization of any identifying information. The choice to participate or withdraw at any time will be outlined both, verbally and in writing.

Limitations

Factors that impact a student's ability to read and write are numerous. This study focused on grapheme-phoneme correspondences and a student's ability to accurately and automatically retrieve previously practiced spelling patterns. The researcher did not have access to students' at home reading and spelling practice or additional instruction outside of the classroom that may have impacted the results. This study has been conducted in a third grade classroom in rural Minnesota. This study is limited in the time allotted to conduct the research and participant's willingness to engage in the study. Additionally, other instructional methods and changes in the classroom may have impacted the results of the study. Student attendance may also be a limiting factor.

Conclusions

Acquiring adequate literacy skills is vital to the success of our society. The success of literacy instruction is dependent on teachers delivering instruction that is research-based and utilizes evidence-based best practices. This means delivering instruction that is explicit, intense, and systematic. Additionally, concern must be given to the developmental phase of each student in order to provide effective instruction. The next chapter will explore research supporting literacy instruction, spelling development, and orthographic mapping practice.

Chapter 2

Literature Review

Introduction

According to data collected by the Minnesota Department of Education (2022), nearly 50% of students in the state of Minnesota are not meeting state reading standards. This is a nation-wide problem, with national data indicating the largest average decline in reading scores since 1990 (United States Department of Education, 2022). This is due in part to effects of the COVID-19 pandemic, the lack of research-based literacy instruction in teacher preparation programs, and a general misunderstanding of how children learn to read and write (König & Frey, 2022).

This decline of literacy skills includes the skill of spelling, or encoding. A child must have strong phonemic awareness, phonics, decoding, and encoding skills to spell well (Treiman, 2018). Additionally, morphology and language of origin must be taken into consideration. This research aims to understand the skills and practices necessary to increase student spelling progress and mastery of developmentally appropriate words.

Body of the Review

Context

The articles used in this research outline the pillars of literacy, the relationship between reading and spelling, the components of spelling, the ideology behind orthographic mapping and the use of sound boxes, and the vital role of teacher knowledge in literacy skills.

Literacy Skills and Reading-Spelling Relationship.

Reading is a complex process. The five pillars of literacy include phonemic awareness, phonics, vocabulary, comprehension, and fluency (National Reading Panel, 2000). Effective literacy instruction addresses each of these components and supports each student's development as needed. Research has shown that the development of literacy skills is most beneficial when instruction is delivered in a systematic, intensive, and explicit manner (Alber-Morgan et al., 2016; Cohen et al., 2017; Joseph & Ross, 2019; Moats, 2019; National Reading Panel, 2000; Torgesen et al., 1999; Weiser & Mathes, 2011). "In the absence of a systematic approach, students are left to infer how orthography works from random exposure to words in print. Both reading and writing demand attention to orthographic processes, or the grapheme-phoneme correspondences, of words" (Moats, 2019, p.54)

One must be able to read before they are able to spell, because a writer needs to be able to read over the word they have written in order to check for spelling (Shahar-Yames & Share, 2008). Literacy instructors must take into consideration a child's ability to decode patterns and words with accuracy in isolation before expecting that same child to accurately encode words with the same patterns.

A study performed by Schaars et al. (2017) analyzed the relationship between reading and spelling in elementary students in the Netherlands. Through their research of over 1,000 children, they concluded that "...reading and spelling were related, and that word reading level predicted subsequent spelling level in grade 2" (p. 136). While reading and spelling are symbiotic processes, educators can use a student's reading level to identify spelling readiness for introducing new skills in an explicit and systematic way.

Components of Spelling.

To understand spelling development, one must be familiar with the idea of the alphabetic principle. The alphabetic principle is the concept that letters represent speech sounds (Alber-Morgan et al., 2016; Cohen et al., 2017; Joseph & Ross, 2019). As children begin formal literacy instruction, they are introduced to letter names and sounds and practice this principle. The English language consists of 26 letters, or graphemes, that can create 44 sounds, or phonemes (Larsen et al., 2020). To spell a word correctly, students must be able to segment a word into phonemes, recall which graphemes represent each phoneme, and take into consideration language rules that govern the placement or use of certain phonemes.

Research performed by Treiman et al. (1993) confirmed that not all grapheme-phoneme mappings are equal. The position of a sound in a word, the placement of phonemes in stressed or unstressed syllables, and categorization of vowel sounds versus consonant sounds contribute to the difficulty of spelling a word. Vowel phonemes typically have more spellings than consonant phonemes. Additionally, long vowels have more spellings and are less predictable than short vowels. For example, the phoneme /ē/ can be spelled eight different ways (ee, e_e, e, ea, ey, y, ie, ei). While the frequency of each spelling pattern varies, students will encounter and must be familiar with all eight patterns (Moats & Tolman, 2019). Larsen et al. (2020) discuss the idea that grapheme-phoneme correspondences (GPC) with multiple graphemes are more complex than GPC with single graphemes.

Acknowledging that GPC can vary in difficulty lends itself to the idea that educators need to be aware of the scope and sequence in which these graphemes, morphemes, and syllable types should be introduced. While each child's spelling development will be different, there are general principles and guidelines to ensure that encoding instruction is systematic and developmentally appropriate. For example, predictable consonants and short vowel sounds should be introduced

and mastered before long vowel sounds and consonant blends. Additionally, children should be taught how to encode single syllable words before moving to words that are multisyllabic or include more complex morphemes (Larsen et al., 2020; Moats & Tolman, 2019; Treiman et al., 1993).

Additionally, to spell a word correctly, attention needs to be given to the phonological context. In other words, one must be aware of neighboring phonemes to spell a phoneme correctly in a word (Treiman, 2018). Phonological context of phonemes should be taught explicitly and systematically, because the position of a phoneme in a word often determines which graphemes are used for its spelling. This instruction may also be incorporated in the practice of word study, or noticing patterns and generalizations in similar words.

Another element of spelling instruction is morphology. The English language is morphophonemic, meaning its spelling system represents both speech sounds and morphemes. Morphemes are the smallest meaningful part of language. Examples of English morphemes include word parts like graph, prefixes like un-, and suffixes such as -ful. The English language is considered a deep orthography, meaning the same morpheme can be pronounced multiple ways (Larsen et al., 2020; Moats & Tolman, 2019). A common example of this is the past tense suffix -ed. Depending on its use, it can be pronounced /t/ as in faked, /d/ as in played, and /ɪ/ as in wasted (Moats & Tolman, 2019; Richards et al., 2006). This makes learning to decode and encode the English language even more challenging.

A final factor to consider is the way that the English language has grown and evolved throughout its history. Many seemingly irregular spelling patterns can be explained when taking into consideration the language of origin of a word. A majority of words in the English language can be traced back to roots of Anglo-Saxon, French, Latin, and Greek. If students are able to

identify and understand features of each language of origin, they will have a deeper understanding of the phoneme-grapheme correspondences and will likely spell with increased accuracy (Moats & Tolman, 2019).

Traditional spelling instruction consists of rote memorization and drill and practice activities. Through analysis of their research findings, Weiser and Mathes (2011) describe the components of successful, evidence-based encoding instruction.

Encoding instruction is not limited to just teaching spelling patterns and memorization skills. Encoding instruction also includes explicitly teaching beginning readers and spellers to write words according to their phoneme-grapheme correspondences, to build words using manipulatives (e.g., letter tiles, plastic letters, etc.), and to learn to manipulate phoneme-grapheme relationships to make new words. (p. 171)

Students need multiple exposures to words and explicit instruction of all spelling components to be able to decode and encode them accurately and automatically and continue to advance their spelling development.

Orthographic Mapping and Sound Boxes.

Research conducted by Ehri (2022) explains that the process of creating grapheme-phoneme (GP) connections to store spellings is called orthographic mapping. “When GP units are known well, orthographic mapping is activated automatically to connect graphemes and phonemes to secure spellings bonded to their pronunciations in memory” (p.54). This allows students to write words accurately and automatically without much thought. When spelling

instruction is focused on orthographic mapping, students are more successful spellers (Sargiani et al., 2018).

Additionally, a comprehensive study completed by Richards et al. (2005) used fMRI scans to compare the brain activity of students with dyslexia and traditionally skilled readers and spellers before and after orthographic spelling treatments. After administering the orthographic treatment to the dyslexic group two times, their fMRI scans showed that their brains activated in the same way as the group of skilled spellers. These results conclude that emphasizing orthographic strategies is an effective way to support struggling students in their spelling development.

A technique that is used to support orthographic mapping are word boxes (also referred to as sound boxes or Elkonin boxes). Word boxes are created by drawing a rectangle and adding vertical lines to separate the rectangle into boxes for each sound in a word. When given a word, students say each sound they hear as they either make a mark in each box or slide a manipulative, such as a counter, into each box to count the sounds. Next, graphemes are mapped, or written, to take the place of the counters (Ross & Joseph, 2018; Alber-Morgan et al., 2016). The purpose of this practice is for students to focus on the GPC in each word. This explicit practice helps students map the words in their mental lexicon. After multiple exposures to the word, students will have incorporated it into their orthography and will be able to retrieve the spelling independently.

While practicing orthographic mapping skills with word boxes, educators are able to explicitly teach spelling patterns, phonological context, syllabication, morphology, and word origin to give students a deeper understanding of each word. Using a technique such as word boxes gives teachers a time to explain why a word such as ‘give’ has an e at the end and why /k/

in character is spelled with ch. As similar words are mapped using sound boxes, students may begin to notice patterns and create their own generalizations that they are able to transfer to their own writing (Alber-Morgan et al., 2016; Moats & Tolman, 2019; Ross & Joseph 2019).

Teacher Knowledge.

One factor that has significantly impacted literacy instruction of students nationwide is the knowledge of teachers and quality of teacher preparation programs. A study completed in 2016 by The National Council of Teacher Quality (NCTQ) pointed out that only 39 percent of the 820 undergraduate programs they evaluated provided instruction in all five components of reading instruction. “Using knowledge gained from decades of scientific research, effective reading instruction could cut this unacceptable rate of failure by two-thirds or more” (p. 4).

Additionally, a survey study of Arizona teachers conducted by Cohen et al. (2016) described teacher knowledge of literacy components as ‘low’. These results present a major problem because readers beginning their literacy development and struggling readers need explicit and systematic instruction. If teachers do not possess adequate knowledge of language structure and the five pillars of literacy, their struggling readers are less likely to develop sufficient reading skills. Reading programs do not teach students how to read—teachers do. Additionally, teachers need to be able to identify a reader’s strengths and weaknesses, prepare and implement activities and interventions, monitor progress, and adjust teaching strategies to fit each students’ skill development. “Adults who understand the reasons for children’s errors can monitor children’s progress more effectively and respond to their misspellings more helpfully” (Treiman, 2018, p.237).

Ongoing, indepth, and relevant professional development in literacy for general education, special education, and reading specialists has been shown to improve teacher knowledge and confidence when teaching literacy skills (Cohen et al., 2017; Moats, 2009; Treiman, 2018). The more knowledge and background teachers have in literacy skills, the better prepared they are to help students succeed.

Theoretical Framework

Spelling development relies on the accurate orthographic mapping of phonemes and graphemes (Ehri, 2022; Larsen, 2020; Treiman et al., 1993). The focus on developing orthographic mapping strategies to increase spelling skills in students is founded by the Phase Theory that explains a child's spelling development in terms of being able to map sounds to letters in an increasingly difficult manner (Treiman, 2017). The phases defined in this theory are the prealphabetic phase, partial alphabetic phase, full alphabetic phase, and consolidated alphabetic phase (Ehri, 2005; Moats & Tolman, 2019).

Due to the nature of this research and the classroom environment it will be taking place in, this study will be primarily focusing on spelling development in the later alphabetic and consolidated alphabetic phases. Using these phases as a guide, sound boxes were used to strengthen orthographic mapping skills using GPC that were developmentally appropriate for each students' needs.

Research Question(s)

The goal of this action research was to investigate the following:

What effect will orthographic mapping have on student spelling outcomes?

Conclusions

This chapter has presented research explaining the importance of explicit and systematic instruction in all five elements of literacy. The relationship between reading and spelling development has been explored and the components of spelling instruction in regards to the alphabetic principle, types of grapheme-phoneme correspondences, phonological context, morphology, and language of origin have been outlined. Additionally, the importance of orthographic mapping and the use of sound boxes to develop orthographic mapping skills has been explained. This study aims to understand the effects of orthographic mapping using sound boxes in third grade spelling development, which will be explored more in the next chapter.

Chapter 3

Methods

Introduction

This study examined the effect of explicit orthographic mapping instruction using sound boxes on student spelling retention and retrieval. Orthographic mapping is the intentional focus on the connection between phonemes and graphemes. Orthographic mapping requires students to focus on each sound in a word and connect those sounds to the appropriate letter or letters that spell those sounds in context. Spelling is an important foundational skill that is needed for success throughout school years and into adulthood (Moats, 2019). By focusing on orthographic spelling techniques, teachers can maximize time spent on spelling instruction as students will be able to encode words automatically after multiple mapping exposures (Ross & Joseph, 2018; Alber-Morgan et al., 2016).

Research Question

The goal of this action research was to investigate the following:

What effect will orthographic mapping have on student spelling outcomes?

Research Design

This study is quantitative and used data collected from the Quick Spelling Assessment (QSA) created by the Benchmark Education Company. The QSA consists of thirteen skill sets of foundational phonological skills and spelling words and is administered in the fall, winter, and spring of the school year to show student growth and spelling development (see appendix A).

Throughout the research phase, students were exposed to orthographic mapping instruction using

sound boxes in both whole- and small-group settings. Student data collected in the spring was compared to data collected in the winter to determine spelling progress. The researcher selected the quasi-experimental research design as students were assigned to classrooms by administration prior to the beginning of the school year.

Setting

This study was conducted in a suburban Minnesota elementary school. The population of the town is approximately 6,600 people. This community is known for its small-town feel and fourth of July parade and celebrations. The school in which the study took place serves approximately 600 students in kindergarten through third grade. The percentages of ethnicities enrolled at this school at the time of the study are as follows: Asian or Pacific Islander (0.06%), Black or African American (0.03%), Hispanic or Latino (3.3%), White (91.8%), two or more races (3.9%). Four percent of students qualify for reduced lunch and 9% of students qualify for free lunch. This study focused on participants in a third grade classroom. This school has strong parental involvement including an active parent-teacher committee, classroom volunteers, and various parent participation events throughout the school year.

Participants

Participants of this research study included 26 students with ages ranging between 8 and 9 years old. All participants were enrolled in third grade throughout the 2022-2023 school year. The sample population was made up of 13 females (50%) and 13 males (50%). All 26 students (100%) were white. Five students (19%) were on Individualized Education Plans. One student (4%) qualified for free and reduced lunch.

Sampling

The sample population of this study consisted of 26 students in one third-grade classroom. This is a purposive sample because all students were placed on a classroom roster at the start of the 2022-2023 school year.

Instrumentation

The instrument used for data collection was the Quick Spelling Assessment (QSA) designed by Benchmark Education (See Appendix C) as a part of the Benchmark Workshop curriculum. The QSA includes 13 skill sets and is administered to students one skill set at a time. Skill sets one and two focus on letter naming and letter sounds. Skill sets 3-13 focus on a specific spelling pattern and have ten words with each pattern. Each word is worth two points-one point for correctly using the target spelling pattern, and another point for correctly spelling the word. Students who score 9 or less on a skill set do not move on to the next skill set. The QSA was administered in small groups of students who were being assessed on similar skill sets. Time taken for the administering of each skill set varied between seven and twelve minutes, although students were given as much time as they needed. As recommended by Benchmark, skill sets were administered with breaks in between to limit fatigue. For the purpose of this research, students' spring results were compared to their winter data points. Two different task forms were used during both QSA administrations to ensure students had not memorized words from previous assessments.

Data Collection

The QSA was initially administered in January to all students enrolled in the study. The QSA was administered a second time at the end of March. Scoring was completed by the researcher once all QSAs were administered.

Data Analysis

After all QSAs were administered, the researcher scored and analyzed the results. Spring QSA results were compared to data collected during the pre-assessment in January. This data comparison allowed the researcher to determine student growth and progress in encoding skills. The researcher used this data to demonstrate how the participant’s scores were related to the effectiveness of explicit orthographic mapping instruction.

Research Question(s) and System Alignment

The table below (i.e., Table 3.1.) provides a description of the alignment between the study Research Question(s) and the methods used in this study to ensure that all variables of study have been accounted for adequately.

Table 3.1.

Research Question(s) Alignment

Research Question	Variables	Design	Instrument	Validity & Reliability	Technique (e.g., interview)	Source
RQ1 What effect will orthographic mapping have on student spelling outcomes?	DV: Spelling performance IV: Orthographic mapping using sound boxes	Quasi-Experi-mental	Quick Spelling Assessment by Benchmark Education	Different task forms used for fall, winter, and spring data collection	Quick Spelling Assessment by Benchmark Education	Third grade students Sample size: 26 students

Procedures

This study took place over an eight-week period during the 2022-2023 school year. The researcher used word sorts, spelling lists, and a phonics-skill scope and sequence from Benchmark Word Study Workshop. Each week, students were explicitly taught a new spelling or syllable pattern using sound boxes for orthographic mapping in a whole group setting for ten to twenty minutes, two to three times per week. Students were administered an eight-word assessment at the end of each week. This data was used by the researcher to form small groups for reteaching and enrichment. Students received five to ten additional minutes of orthographic mapping practice in a small group setting two to three times per week. At the conclusion of the study, students were administered a QSA at their previously mastered skill set and continued assessments until they received a score of ≤ 9 .

Ethical Considerations

The researcher obtained written consent forms from parents or guardians of participants prior to the start of the study. Names and other pieces of identifying data were removed from all results as a way to protect the participants. Educational activities and curriculum used in the study were the same as other third grade classrooms in the district. Students and parents had the option to opt out of the study at any time without negative consequences.

Conclusions

This chapter outlined the design, setting, participants, and procedures for this study. Additionally, ethical considerations and instrumentation were detailed. Results and data analysis will be discussed in the next chapter.

Chapter 4

Results

Introduction

Our nation has reported declining literacy rates in recent years (United States Department of Education, 2022). This is due in part to effects of the COVID-19 pandemic, the lack of research-based literacy instruction in teacher preparation programs, and a general misunderstanding of how children learn to read and write (König & Frey, 2022). Accurate spelling shows a deep understanding of a word's sounds, or phonemes, in conjunction with written letters, or graphemes. Therefore, a student who is able to accurately and automatically spell words with patterns that they have been previously taught is demonstrating mastery in multiple other levels of literacy simultaneously.

The purpose of this research was to determine whether explicitly teaching grapheme-phoneme correspondences (GPC) of grade-level spelling words with the orthographic mapping technique of sound boxes would positively or negatively influence spelling outcomes in third grade students. With various studies being conducted in the science of reading, the researcher wanted to explore how this knowledge could be implemented within a third grade classroom. To measure the effectiveness of instruction using orthographic mapping, the researcher utilized a pre- and post-assessment. In between, the researcher taught weekly spelling patterns with sound boxes and orthographic mapping techniques in both whole- and small-group settings.

Data Collection

Students were given a pre-assessment in January 2023. This pre-assessment, the Quick Spelling Assessment (QSA), is made up of thirteen separate skill sets ranging from letter naming and identifying letter sounds to words with four syllables. Due to previous knowledge of participant development and foundational skills, skill sets 1 and 2, identifying letter names and sounds, were omitted. For skill sets 3-13, students were given ten words to spell from each skill set. The skill sets are scored with a maximum of twenty points-one point for utilizing the correct spelling of the focus pattern of the skill set and an additional point for spelling the word correctly. For example, skill set seven focuses on r-controlled vowels. A student who spells the word corn as 'korn' would receive one point for utilizing the correct grapheme for the phoneme /or/, but would not earn the second point due to spelling the word with the incorrect grapheme for /k/. According to the QSA directions provided by the Benchmark Education company, students continue to be tested in skill sets until they score less than 10.

After the pre-assessment, students were explicitly taught a new spelling or syllable pattern using sound boxes for orthographic mapping in a whole group setting, for ten to twenty minutes, four times per week. Students were administered an eight-word assessment at the end of each week. This data was used by the researcher to form small groups for reteaching and enrichment. Students received five to ten additional minutes of orthographic mapping practice in a small group setting two to three times per week. The researcher utilized this method of spelling instruction for eight weeks.

At the conclusion of eight weeks, the students participated in a post-assessment. The same skill sets were used, but a different form of the assessment was given to ensure students had not memorized words used in the pre-assessment. Pre- and post-assessments were administered in both whole- and small-group settings over the course of three days. Students

were given skill sets until they scored less than 10. At this point, their level of spelling mastery has been found. The data collected was used by the researcher to identify positive or negative trends in utilizing explicit orthographic mapping during spelling instruction.

Results

Research Question: What effect will orthographic mapping have on student spelling outcomes?

Table 1 shows the mean, median, mode, and range for data collected in both the pre- and post-assessments. The average skill set during the pre-assessment was 9.5. After the eight-week intervention period, the average skill set was 10.9. This shows a growth of approximately 1.4 skill sets over the course of eight weeks. Overall, this demonstrates positive growth in student spelling performance when utilizing explicit orthographic mapping techniques during instruction.

Table 1

Level of Skill Set Mastery in Quick Spelling Assessment

	Pre-Assessment	Post-Assessment
Mean	9.5	10.9
Median	11	11
Mode	11	11
Range	7	6

Figure 1 provides a visual representation of the highest skill set in which students achieved mastery in both the pre- and post-assessments. Mastery in a skill set is achieved when a student scores ≥ 10 out of 20 possible points. Figure 1 shows a positive shift in student skill set

mastery. In the post-assessment, only one student was in a skill set lower than skill set nine as compared to twelve students in the pre-assessment. While the same number of students (10) demonstrated mastery at skill set 11 in both the pre- and post-assessments, there are eight students who have achieved mastery above skill set 11 in the post-assessment as compared to only four in the pre-assessment.

Quick Spelling Assessment Skill Set Mastery Comparison

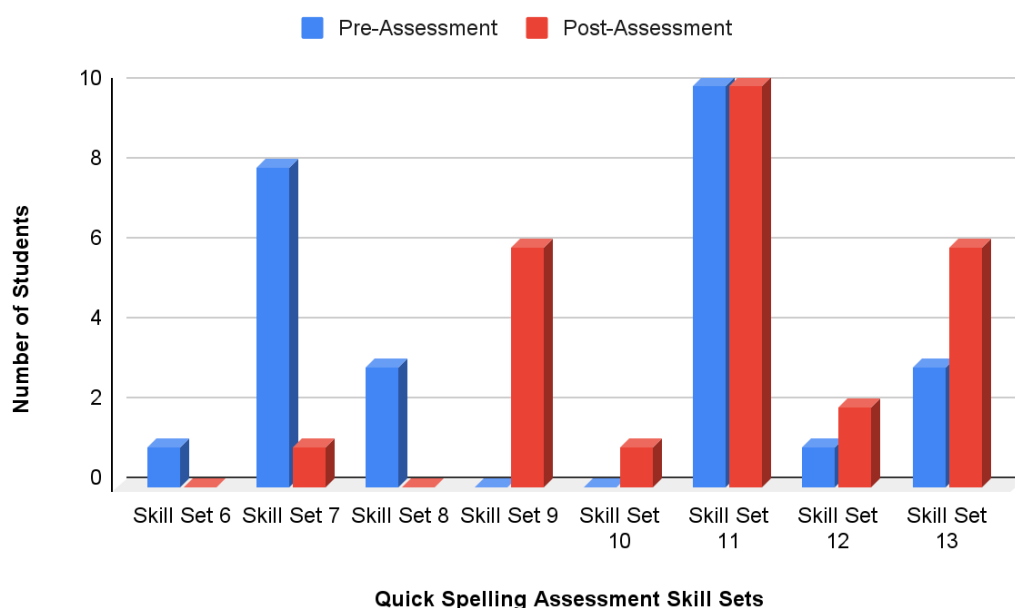


Figure 1. Quick spelling assessment skill set mastery comparison

Figure 2 exhibits the percentage of students who increased by a certain number of skill sets. While a group of students (34.6%) demonstrated mastery at the same skill set level during both the pre- and post- assessment, three of these students (11.5%) achieved mastery at skill set 13. Skill set 13 is the highest skill set available in this type of assessment, it is not possible for these students to demonstrate growth within this assessment. Sixty-five percent of students showed growth by mastering one or more skill set in the post-assessment when compared to pre-assessment data.

Number of Additional Skill Sets Mastered from Pre- to Post-Assessment

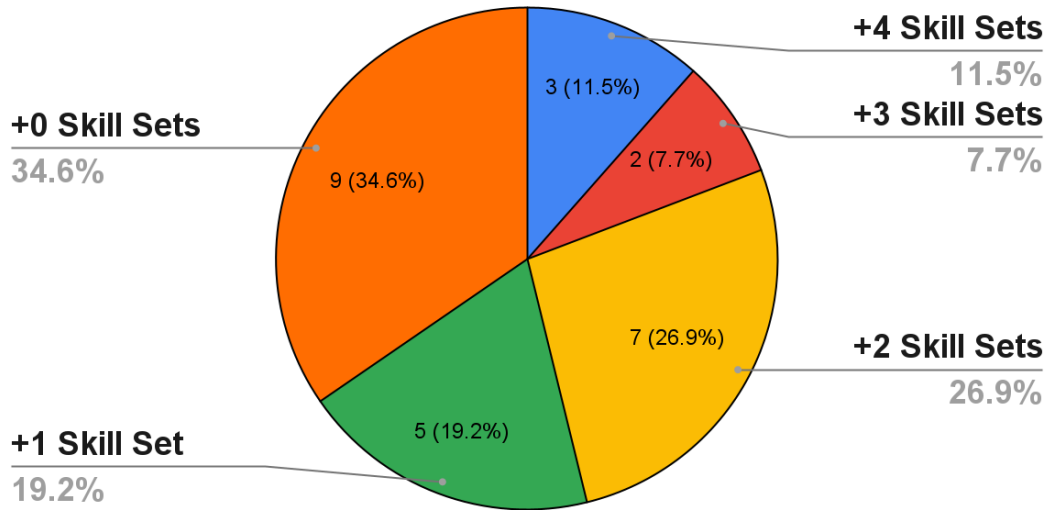


Figure 2. Number of additional skill sets mastered from pre- to post-assessment

Data Analysis

The results and data provided in the table and figures above all conclude that explicit spelling instruction with orthographic mapping leads to growth in student spelling performance. While there were six students (23%) who did not demonstrate an increase in skill set mastery in the post-assessment, the researcher was able to analyze each student’s spelling errors to create a plan for continued instruction and additional support. Three students (11.5%) had achieved mastery in the highest skill set in the pre-assessment and demonstrated similar mastery in the post-assessment. Overall, 65.5% of students were able to increase their spelling mastery by one or more skill set over the course of eight weeks.

The creators of the assessment utilized in this research, Benchmark Education company, did not identify grade level benchmarks aligned with skill sets when creating this assessment. For this reason, the researcher cannot determine which students are meeting grade-level spelling standards with this assessment tool alone. Instead, focus was maintained on individual student spelling development.

Orthographic Mapping and Sound Boxes.

The researcher utilized sound boxes for students to count each sound in curriculum-based words, map the correct grapheme with each phoneme, and link correct spelling patterns to each word. This instructional technique also allowed for the researcher and participants to discuss spelling generalizations, syllabication, the frequent use and identification of schwa, morphological word parts, various uses of the grapheme ‘e’ at the end of a word or syllable, and language of origin. This in-depth word study was practiced two to three times per week for the duration of the study.

Throughout the eight weeks of orthographic mapping spelling instruction, students were engaged and positive when engaging in their practice. Classroom participation was high and students were observed to have increasing confidence as they became familiar with the routines and procedures of utilizing sound boxes on a weekly basis.

While not documented in the data, the researcher’s observations note that as skill set difficulty increased during the post-assessment, students were observed counting sounds, separating words into syllables, and checking that each phoneme was represented with a grapheme independently. This behavior was not observed when administering the pre-assessment. This shows that for some students, orthographic mapping techniques have

changed the way they approach spelling unfamiliar words and have given them tools and strategies to use independently.

Teacher Knowledge.

Implementing spelling instruction utilizing orthographic mapping techniques requires educators to have a deep understanding of the logic of English and the multiple layers that it is composed of in order to explicitly teach students spelling generalizations and give rationale for specific grapheme phoneme correspondences. This knowledge is needed not only for the initial instruction of spelling, but also for the analysis of student errors to determine the need for the reteaching of a specific spelling pattern (Treiman, 2018).

Conclusions

Overall, explicitly teaching spelling using orthographic mapping techniques was shown to have a positive effect on student spelling outcomes. This aligns with previous research conducted by Weiser and Mathes (2011), Moats and Tolman (2019), and Ehri (2022). Utilizing orthographic mapping to teach grapheme phoneme correspondences two to three times per week can influence student spelling development and mastery in a positive way. Additionally, reteaching or reviewing previously taught patterns with students who need more support in a small group using sound boxes is also beneficial to spelling development.

CHAPTER 5**IMPLICATIONS FOR PRACTICE****Action Plan**

After analysis of the data within this research, it has been concluded that explicitly teaching spelling through the use of sound boxes and orthographic mapping is beneficial to student spelling performance. This is due largely in part to students discussing spelling generalizations, morphology, syllabification, language of origin, and other elements of encoding multiple times per week. Students need multiple exposures to words and explicit instruction of all spelling components to be able to decode and encode them accurately and automatically and continue to advance their spelling development (Weiser & Mathes, 2011).

The researcher plans to continue utilizing sound boxes and orthographic mapping instruction routines for the duration of the school year. Additionally, the researcher plans to begin next school year with this instruction in hopes of seeing even more positive student growth and development. The researcher will continue collecting data and plans to target unmastered spelling patterns and skill sets in a small group setting two to three times per week to help students continue to improve and make progress. In doing so, the researcher hopes that students will become increasingly automatic, accurate, and independent in regards to their spelling skills.

Plan for Sharing

The researcher plans to share the findings of this action research with her colleagues within Professional Learning Community (PLC) meetings. The researcher is prepared to share data, resources, and curriculum supplements that have been created and utilized throughout the action research process.

Additionally, orthographic mapping instruction could potentially benefit students in any grade level that engages in specific, explicit spelling instruction. This type of instruction could also be utilized in special education services as well as reading intervention classrooms. The researcher plans to share data and findings with district administrators and curriculum leaders to communicate the benefits of orthographic mapping in student spelling outcomes. The researcher has the intention to share, discuss, and collaborate with any colleagues willing to implement orthographic mapping into their daily spelling instruction.

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Appendix A

Dear Parent or Guardian,

Your child has been invited to participate in a study to see if using orthographic mapping techniques will help retain and transfer spelling patterns into student writing.

Your child was selected because he/she is in my regular education classroom. If you decide to participate, please understand that your child will be asked to do the following, and that these are typical classroom activities that involve no risk to your child.

1. Your child will be using sound boxes to identify the sound/letter correspondences for third grade spelling words in small- and whole-group settings.
2. Your child will be given a pre- and post-assessment to see how they retain spelling patterns.
3. Your child's daily writing will be analyzed for transfer of spelling patterns.

I have received permission from our principal, [REDACTED], to conduct this study. However, the information gathered will be used to help me complete my master's degree at Minnesota State University Moorhead and I need to have parental consent to use the data collected in an action research project that is required as part of my degree completion. Names will be removed from all data that I collect and share as part of my research project.

By signing this form, you are consenting to the use of the data I gather in this study.

If you have any questions regarding this study, please reach out at [kelli.simpson@\[REDACTED\]](mailto:kelli.simpson@[REDACTED]) or [REDACTED]. You may also contact my advisor, Michael Coquyt, at michael.coquyt@mnstate.edu.

I have attached a second copy of this letter for you to keep. Your signature below indicates that you have read the information above and are giving permission for your child to participate in this study. You may withdraw at any time without consequence of penalty to your child.

Appendix B

I will explain to the students that “your parents have said that it was alright for you to participate in a project that I am conducting, but you have a choice on whether you do or not participate. If you do not wish to participate, there will be no effects on your grade, our relationship, or your daily routines at school. This is totally voluntary. The only effect of this study is to help me decide how to help you learn to improve your spelling. Here is what will happen: You will come to class as you normally would, and we work on spelling activities together. I want to help you learn and understand spelling patterns as best as possible. Are there any questions?”

Appendix C

1. Letter Names

m	t	a	s	i
r	d	f	o	g
l	h	u	c	n
b	j	k	y	e
w	p	v	q	x
z				

2. Letter Sounds

/t/	/a/	/m/	/r/	/s/
/l/	/o/	/f/	/d/	/h/
/g/	/l/	/c/	/n/	/b/
/u/	/k/	/e/	/j/	/w/
/p/	/y/	/qu/	/v/	/z/
/x/				

3. VC and CVC

- | | |
|---------|--|
| 1. ran | The students <u>ran</u> around the track. |
| 2. dog | The <u>dog</u> barked loudly. |
| 3. fed | Tina <u>fed</u> the giraffe at the zoo. |
| 4. bad | The <u>bad</u> dog was digging up the flowers. |
| 5. hog | The <u>hog</u> likes to lie in the mud. |
| 6. hug | Joey asked his father for a <u>hug</u> . |
| 7. win | The black car will <u>win</u> the race. |
| 8. hit | They saw the rock <u>hit</u> the window. |
| 9. fun | It's <u>fun</u> to watch a bug on a leaf. |
| 10. leg | The boy's <u>leg</u> is in a cast. |

4. Common Beginning and Ending Consonant Digraphs

- | | |
|----------|--|
| 1. fish | The <u>fish</u> swam in the lake. |
| 2. them | He showed <u>them</u> a really cool magic trick. |
| 3. back | We put the groceries <u>back</u> on the shelf. |
| 4. when | <u>When</u> will it stop raining? |
| 5. sing | Jose will <u>sing</u> the national anthem. |
| 6. chop | Father will <u>chop</u> the vegetables for the soup. |
| 7. shop | We will <u>shop</u> for new shoes. |
| 8. king | The new <u>king</u> was crowned. |
| 9. rock | Nanette threw a <u>rock</u> into the river. |
| 10. bath | We gave our dog a <u>bath</u> . |

5. CVCC and CCVC

- | | |
|----------|--|
| 1. spot | The mud left a <u>spot</u> on my shirt. |
| 2. must | I <u>must</u> take out the trash on Friday. |
| 3. drag | Ali cannot <u>drag</u> the heavy box. |
| 4. jump | The girls <u>jump</u> on the trampoline after school. |
| 5. spin | It was Julie's turn to <u>spin</u> the top. |
| 6. glad | My family was <u>glad</u> to go on vacation. |
| 7. help | I raised my hand because I needed <u>help</u> . |
| 8. dust | It was so windy that <u>dust</u> blew across the road. |
| 9. sent | Sharon <u>sent</u> a letter to her friend. |
| 10. grip | Viktor had a firm <u>grip</u> on the football. |

6. Silent e

- | | |
|----------|---|
| 1. rode | Ellie <u>rode</u> the bus to school yesterday. |
| 2. tube | Phillip squeezed the <u>tube</u> of toothpaste. |
| 3. wide | The big truck was pulling a <u>wide</u> load. |
| 4. gate | Please make sure to lock the <u>gate</u> . |
| 5. made | I <u>made</u> my bed before I left for school. |
| 6. cake | The <u>cake</u> was delicious. |
| 7. cute | The puppy was <u>cute</u> . |
| 8. mode | She put the phone into silent <u>mode</u> . |
| 9. site | The pirates buried their treasure on this <u>site</u> . |
| 10. late | Sometimes mom is <u>late</u> for work. |

7. r-Controlled Vowels

- | | |
|----------|---|
| 1. curb | Do not park your truck next to a red <u>curb</u> . |
| 2. car | My family just bought a new <u>car</u> . |
| 3. barn | The horses sleep in the <u>barn</u> . |
| 4. third | Cursive handwriting is taught in <u>third</u> grade. |
| 5. girl | The mother gave birth to a baby <u>girl</u> . |
| 6. worn | The old uniforms are <u>worn</u> out. |
| 7. short | Enrique is tall, but his little brother is <u>short</u> . |
| 8. skirt | Penelope bought a new <u>skirt</u> for the dance. |
| 9. stern | The teacher was very <u>stern</u> with her students. |
| 10. pork | <u>Pork</u> comes from a pig. |

8. Advanced Consonant Sounds, Silent Consonants, and Consonant Digraphs/Trigraphs

1. city Traffic is heavy in the city.
2. box The big box was heavy to carry.
3. knelt He knelt down to pick up the pebble.
4. ledge Don't stand too close to the ledge.
5. fix The mechanic tried to fix the truck.
6. wreck Five cars got into a big wreck.
7. gnaw The puppy likes to gnaw on the furniture.
8. latch Please latch the door before you leave.
9. cell Brandon has a new cell phone.
10. quiet Please be quiet in the library.

9. Vowel Digraphs, Diphthongs, and Advanced Vowel Sounds

1. launch The rocket was scheduled to launch at 7 a.m.
2. small Only a few children can fit into that small space.
3. high The box was too high for me to reach.
4. play Jean-Claude likes to play chess.
5. rain The rain helps the plants grow.
6. clean I need help to clean up the mess.
7. gold Everything the king touched turned to gold.
8. found After searching for an hour, he found his keys.
9. toy She picked out a new toy for her friend.
10. toe Finn stubbed his big toe on the bed.

10. Common Prefixes and Common Suffixes

- | | |
|--------------|---|
| 1. prepare | <u>Prepare</u> for a test by studying your notes. |
| 2. uncertain | I am <u>uncertain</u> of the answer to this question. |
| 3. motion | The <u>motion</u> of the boat made some people sick. |
| 4. joyous | Holidays are <u>joyous</u> occasions. |
| 5. witness | I was there to <u>witness</u> the solar eclipse. |
| 6. drinkable | The natural spring water was <u>drinkable</u> . |
| 7. dampest | January was the <u>dampest</u> month because it rained every day. |
| 8. fearful | Boomer was <u>fearful</u> of thunderstorms. |
| 9. ageless | The painting was <u>ageless</u> in its beauty. |
| 10. fragment | I see a <u>fragment</u> of glass from the broken vase. |

11. Two Syllables

- | | |
|------------|--|
| 1. tender | The steak was not very <u>tender</u> . |
| 2. ticket | Officer Martha gave me a <u>ticket</u> for speeding. |
| 3. carpet | The <u>carpet</u> needed to be vacuumed. |
| 4. taken | Gordie has <u>taken</u> my place in the play. |
| 5. chapter | I'm reading the first <u>chapter</u> in this book. |
| 6. tractor | We used the <u>tractor</u> to plow the field. |
| 7. booklet | The student opened her test <u>booklet</u> . |
| 8. winner | I am the <u>winner</u> of the contest! |
| 9. candle | We lit the <u>candle</u> after it got dark. |
| 10. recent | <u>Recent</u> rainstorms flooded the area. |

12. Three Syllables

- | | |
|----------------|---|
| 1. argument | They had a heated <u>argument</u> . |
| 2. library | Lina took the book back to the <u>library</u> . |
| 3. condition | Angelo was diagnosed with a rare <u>condition</u> . |
| 4. concentrate | It is difficult to <u>concentrate</u> with loud music. |
| 5. fantastic | I had a <u>fantastic</u> day at school. |
| 6. together | The toddlers played <u>together</u> nicely. |
| 7. important | <u>Important</u> updates flashed across the TV screen. |
| 8. possible | Anything is <u>possible</u> if you put your mind to it. |
| 9. contemplate | Lee had to <u>contemplate</u> what class to take next semester. |
| 10. history | We learn from mistakes made throughout <u>history</u> . |

13. Four Syllables

- | | |
|-------------------|---|
| 1. information | <u>Information</u> is posted on the website. |
| 2. experience | This position requires three years of <u>experience</u> . |
| 3. appropriate | We expect <u>appropriate</u> behavior at all times. |
| 4. compatible | The software was not <u>compatible</u> with the new computer. |
| 5. identity | <u>Identity</u> theft is a serious crime. |
| 6. preparation | <u>Preparation</u> is one of the keys to success. |
| 7. development | There has been a new <u>development</u> in the case. |
| 8. manipulate | The baby is learning to <u>manipulate</u> blocks. |
| 9. immediate | This e-mail needs your <u>immediate</u> attention. |
| 10. confrontation | The bear had a <u>confrontation</u> with an angry dog. |