EFFECTS OF A MORPHOLOGICAL INTERVENTION ON THE ABILITY OF 9TH AND 10TH GRADERS WITH DISABILITIES TO READ MULTISYLLABIC DERIVED WORDS

By

Jessica McPherson Dainty

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Literacy Studies

Middle Tennessee State University
December 2022

Dissertation Committee:

Dr. Timothy Odegard, Chair

Dr. Amy Elleman

Dr. Eric Oslund

Dr. Stuart Bernstein

I have too many people to thank to do so in such a small space. First, thank you to my family for enduring my many breakdowns and always encouraging me. Thank you for the space and patience to complete this work. Thank you to my mother for all your help with copy editing and feedback when I wasn't sure I was going in the right direction. Jay, thanks for enduring multiple years of a cluttered, non-functioning dining room as my papers took over our house.

Thanks to my friends who have encouraged and supported me.

Thanks to my cohort, Molly Risley, Susan Porter, Jen Grow, and Bingshi Zhang. I am so grateful to have had the time together in person pre-pandemic and for the personal and professional relationships we have formed. Best cohort!

Thank you to the Literacy Studies Program for its financial support throughout my degree work. Additionally, thank you to the benefactors of the Sawyer-Rudler Research Fellowship, the Ethel Bowden Stricklin Merit Scholarship, and the Walton O. Warren Scholarship. Your generosity has made this process easier in such an important way.

Thank you to the team at the Center for Dyslexia, especially Dr. Melinda Hirschmann, Dr. Erin Alexander, Dr. Emily Farris, and our amazing lab team. Working at the Center was more than an assistantship. Thanks to all who provided feedback, guidance, support, resources, and encouragement during my time at the Center.

Thank you to the past and present director of the program, Dr. Jwa Kim and Dr. Amy Elleman. Thank you to my committee, Dr. Eric Oslund, Dr. Stuart Bernstein, and Dr. Amy Elleman, and my chair Dr. Timothy Odegard—thank you for your intellectual and emotional support as well as your thoughtful guidance and feedback. Tim, thank you for

the hours on zoom, the confidence in my abilities, and your enthusiastic support of the study I wanted to do (despite its limitations).

Thank you to Amanda Cunningham who committed to implementing my study with fidelity and did a tremendous job of engaging her kids. Lastly, thank you to my team at Putnam County Schools, for your encouragement throughout this process as well as your professional support when I was overwhelmed.

Abstract

Some students still reach secondary level schooling without proficient foundational reading skills. Students who struggle to decode words accurately and efficiently will fail to adequately access grade-level texts independently, furthering the gap between themselves and their peers. Despite a subgroup of students reaching high school with word reading deficits, very few studies aimed at improving word reading/identification have been done with this age group. Phonics instruction has a rich research base for teaching children how to read. At the same time, research focusing on morphology may help address the unique needs of an older student demographic due to the prevalence of multisyllabic and morphologically complex words in grade-level texts. However, most reading intervention studies for secondary-age students focus on vocabulary and comprehension rather than decoding and word reading skills. The proposed research seeks to investigate the effectiveness of explicit morphology instruction (structural word analysis, syllable type instruction, and syllabication practice, and study of Latin bases and affixes) on the ability of 9th and 10th graders (N = 23) with decoding deficits to read morphologically complex words. Students identified with reading difficulties and registered for a special education reading intervention class received roughly 20 hours of intervention over 10 weeks. The gains in reading skills achieved by the treatment group in response to the intervention were compared to other students identified with reading deficits who did not participate in an intervention period. On measures of word reading and morphologically complex word reading, the experiment group performed better than the control group when controlling for performance at pretest, though without statistical significance. Hedge's g effect sizes for morphological knowledge (g = 0.97), word

reading (g = 0.67), and complex word reading g = 0.60) suggest practical efficacy when compared to current literature. The results of this study provide important information needed to help inform how we address the instructional needs of students in high school struggling to read.

Keywords: reading intervention, high school, decoding, word reading, morphology

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

Many students—both with and without disabilities—are reaching high school without proficiency in reading, which significantly limits their ability to independently read grade-level texts (National Association of Educational Progress, NAEP, 2019). Less than 40% of twelfth graders in 2019 scored at or above proficiency levels for reading, and yet over 60% applied or were accepted to a four-year university (NAEP, 2019). Students entering high school with foundational deficits have limited time to close deficit gaps that will continue widen as they move through the grades (Shaywitz et al., 1999; Stanovich, 1986; Vaughn & Fletcher, 2012). Baye et al. (2018) go so far as to say that "[t]he reading performance of students in U.S. middle and high schools is one of the most important problems in education" (p. 133).

While oral language skills overtake decoding skills in predicting reading performance beyond primary grades, students who never become proficient decoders will continue to struggle with accessing increasingly complex texts independently (Carlisle, 2010; Castles et al., 2018; Stover et al., 2015; Toste et al., 2017b). In upper elementary school, students are expected to shift from learning to read to reading to learn, texts become more complex in terms of language, morphology, and structure, and students encounter unfamiliar formats, vocabulary, and syntax at a higher frequency (Castles et al., 2018; Catts et al., 2011; Leach et al., 2003; Toste et al., 2017b). While many students can compensate with adequate oral language skills, students who are limited in their access to grade-level text and increasingly complex language and vocabulary may be at

risk of underperforming in reading and falling behind their peers (Castles et al., 2018; Shaywitz et al., 1999; Stanovich, 1986).

Despite stronger frameworks for providing evidence-based, targeted instruction in many grades, some middle and high school students still cannot accurately and efficiently read grade-level, multisyllabic, morphologically complex words (Dennis, 2012; Toste et al., 2017b). The framework of multi-tiered systems of support (MTSS) is now being implemented to provide reading instruction to students and catch those who start to struggle before they fall too far behind. It was designed to provide intervention earlier to all students who need it (Lindstrom, 2018; Vaughn & Fletcher, 2012), but MTSS is primarily implemented within elementary schools (Cantrell et al., 2016; Lindstrom, 2018; Vaughn & Fletcher, 2012). Most students struggling with foundational reading skills are expected to have been identified and remediated in elementary school (Toste et al., 2017b; Vaughn & Fletcher, 2012).

State standards in third grade and beyond primarily focus on comprehension, higher order thinking, problem-solving, vocabulary, and writing (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010; Tennessee State Board of Education, 2021). In addition, interventions provided to older students are more likely to focus on vocabulary and comprehension. While beneficial, instruction focused on comprehension will be inadequate for students struggling with more foundational deficits directly impacting their abilities to decode and read words (Toste et al., 2017b; Vaughn & Fletcher, 2012). Moreover, there is less research on the efficacy of interventions to improve the word reading skills of middle and high school students compared to elementary students.

While some deficit gaps can be addressed quickly in the early grades of elementary school (i.e., Kindergarten through second grade), students who reach middle or high school lacking foundational word reading and decoding skills can take years to catch up—time they do not have (Vaughn & Fletcher, 2012). Research shows that students with learning difficulties who continue to fall behind are less likely to graduate and matriculate into post-secondary education experiences, and they are more likely to be un- or under-employed in higher-paying jobs and to commit crimes (Boudah, 2018; Horowitz et al., 2017; Partanen & Siegel, 2014; Shaywitz et al., 1999; Townsend et al., 2020). Therefore, the stakes are high and more research exploring interventions for middle and high school students with foundational literacy skills deficits is needed. There is evidence that those in this age group with difficulties "can continue to profit from explicit reading instruction" (Scammacca et al., 2007; Vaughn & Fletcher, 2012, p. 245). Because the gap between skill and grade-level text complexity is wider than it is during earlier grades when texts are not as difficult, and because students have fewer years left in school, more research is needed about which instructional programs, methodologies, and strategies are the most effective and efficient at improving multisyllabic, morphologically complex word reading.

Morphology's Role in the Acquisition and Development of Reading Skills

All children, except a few, develop oral language skills (Castle et al., 2018). However, reading is not a natural process (Castle et al., 2018; Seidenberg, 2017). Reading the English language involves 'cracking the alphabetic code' and learning how to map speech sounds (phonemes) onto visual representations of print (graphemes; Ehri, 2005; Ehri & McCormick, 1998). Phonological skills play a prominent role in early

reading development and predicting reading success (e.g., Castles et al., 2018; Harm & Seidenberg, 1999; Schuele & Boudreau, 2008; Shaywitz et al., 1999). However, morphological awareness overtakes phonological awareness in predicting reading performance in upper elementary grades (Kuo &Anderson, 2006; Mann & Singson, 2003; Nagy et al., 2006; Nagy et al., 2013). Morphology contributes uniquely to many aspects of reading, including word identification and decoding (e.g., Deacon & Kirby, 2004).

Morphological awareness is the awareness of and ability to attend to the morphemic components in words and manipulate them to create new words, much like phonological or phonemic awareness is to individual sounds (Carlisle, 2010; Levesque et al., 2021). Morphological knowledge is a constellation of skills encompassing phonology, syntax, orthography, and semantic information, and the overlap between them. Factors involved in morphological knowledge include tacit processing and strategic analysis (Goodwin et al., 2017). Tacit morphological processing is the process that allows students to combine free morphemes (standalone base words) and affixes, and it contributes to both the reading and spelling of words (Carlisle & Kearns, 2017; Goodwin et al., 2017). Tacit morphological processing is related to speech development, linguistic skills, and the depth of an individual's lexical representations obtained with exposure to text (or speech; Goodwin et al., 2017; Perfetti, 2007). This is a naturally developing skill, and tacit processing is all that is needed to process simple words with inflectional morphemes, as these are less complicated and do not necessarily change the meaning of the word, part of speech, or pronunciation/spelling.

A morpheme is a unit of meaning in language. Morphemes can be free or bound, and words formed with the additions of bound morphemes can be inflectional or derivational. Free morphemes are morphemes that can stand alone as words (e.g., *house*, *build*, *cat*), while bound morphemes are units of meaning that must be paired with other morphemes to produce a word. For example, the Latin base *struct* is a bound morpheme that carries meaning (i.e., *to build*) but is not a word unless paired with other word parts, such as in *construct, structure,* and *destructive*. A root, base, or stem can all be used interchangeably to describe a morpheme that is left when all affixes have been stripped away. Technically, a root word will always be a bound morpheme. For the purposes of this paper, the terms *base* or *base word(s)* will be used to encompass the morpheme that remains when all affixes have been peeled, regardless of whether it is a free or bound morpheme (i.e., a root).

Prefixes and suffixes are morphemes that can provide important information about meaning, function, and origin when added to a word. Affixes can be inflectional or derivational. Suffixes such as *-s, -es,* and *-ed* are inflectional and indicate plurality or tense. All prefixes are derivational because adding one creates a word with a meaning different from the base word. Many suffixes are derivational. As words are derived, they can shift in both spelling and sound, making the original base more difficult to recognize. However, the general stability of morphemes across words is apparent in the fact that "morphological structure is preserved in orthography despite pronunciation changes and that graphemes are never split across morpheme boundaries [which is] evidence that morphology is a key organizing feature of English orthography" (Murphy & Diehm, 2020, pp. 547-548).

Because morphemes function as both meaning and orthographic units, they can provide cues to the reader. While the application of phonics to decode predictably patterned one-, two-, or three-syllable words is relatively well understood, there is more debate on what happens when people attempt to read derived, morphologically complex words with two or more syllables. Does semantic familiarity play a role in word recognition? Are people predisposed to decompose morphemes using tacit processors? Do individuals read high and low-frequency words with morphological complexity differently?

Research has suggested that readers tend to decompose words according to their morphemic constituents regardless of semantic familiarity or word frequency (Coch et al., 2020; Dawson et al., 2018; McCormick et al., 2009; Rastle et al., 2004). When determining whether a word was a real word or non-word in lexical decision tasks, the results highlighted that readers tend to deconstruct the word into morphemes, regardless of these features. Frequency can support the rate at which decomposition of word parts happens, but not whether or not it occurs (McCormick et al., 2009; Rutherford, 2014). Even children as young as seven showed signs of morphological decomposition, but reaction time and accuracy across groups suggest that morphological awareness and knowledge contribute more as development progresses (Dawson et al., 2018). This increase in skill as students advance developmentally is likely due in part to increased exposure to morphologically complex words across varied contexts and the continued development of both tacit and explicit morphological knowledge.

As previously stated, knowledge beyond letter-sound relationships and syllable types is needed to decode morphologically complex, multisyllabic words. Students

typically gain more knowledge and perform better at reading such words as they age (Carlisle & Stone, 2005). While such factors as transparency (i.e., how closely a derived word resembles its original form), frequency (i.e., how often a word appears in our general lexicon), and semantic connection (meaning) can influence access, evidence suggests that readers are predisposed to attend to morphemic components, even if words are unfamiliar and less common. Overall, these findings indicate that the morphological processing of words plays a role in reading words with morphological complexity, even for younger students. As students get older, increased exposure to text and greater explicit morphological knowledge may improve performance when reading more complex words.

Morphology and Older Students

In the general acquisition of reading and spelling skills, readers typically draw on a wide range of strategies, not just a single or finite set of discrete skills (Rogers & Patterson, 2007; Sheriston et al., 2016). Less is known about how older students navigate various resources, strategies, and processes to attack unfamiliar or irregular words (Sheriston et al., 2016). However, researchers do understand the structure of the English language and how morphology becomes increasingly essential as children develop. As previously mentioned, morphological awareness is an increasingly important predictor of measures of reading as children get older, and it overtakes phonological awareness in predicting reading performance and achievement after fifth grade (Kuo &Anderson, 2006; Mann & Singson, 2003; Nagy et al., 2006; Nagy et al., 2013). Therefore, morphology may benefit middle and high school students who encounter multisyllabic, morphologically complex words in coursework.

Morphologically complex words, at least those with derivational affixes, are typically multisyllabic, and these words increase in frequency throughout schooling (Kearns & Whaley, 2018; Toste et al., 2017b). Studies have shown that beyond fifth grade, most unfamiliar words that students encounter are morphologically complex derivations (Mann & Singson, 2003; Nagy, 1989). More than 90% of new words have multiple syllables (Kearns et al., 2016). Affixed words occur at a 4:1 ratio compared to base words in third through ninth-grade texts (Nagy & Anderson, 1984). Additionally, Nagy et al. (1989) and Moats (2010) highlight that, although most new words are morphologically complex, roughly 60% of them are sufficiently transparent in structure and meaning for a child to make connections to other familiar words that share morphological components.

Additional arguments for the utility of morphology for older students have to do with their developmental skill sets. Tacit processors are developing in younger students, and some argue that this early age is the ideal time to start targeting such skills (Carlisle & Stone, 2005). However, older students likely have more lexical representations acquired through exposure to text and are more likely to be familiar with and have some experience with morphologically complex word forms (Nippold & Sun, 2008; Perfetti, 2007). In addition, these older students are better able to practice metacognition, which is necessary to analyze and think about the structure of words and their understanding of them (Nippold & Sun, 2008). Both tacit and explicit skills become more natural and developed as students age (Carlisle & Stone, 2005; Singson et al., 2000).

The ability to attend analytically to words is essential because strategic morphological analysis may be necessary for complex words that are not frequent enough

in everyday language to have high lexical representations. Additionally, words with derivational affixes and Greek or Latin bases often change parts of speech or go through phonological or orthographic shifts in their derivations (Abbott & Berninger, 1999; Carlisle, 2010; Casalis et al., 2004; Goodwin et al., 2017; Kuo & Anderson, 2006; Mahony et al., 2000; Nippold & Sun, 2006; Reed, 2008). Therefore, morphology may be especially useful in addressing word reading deficiencies in older students.

Dimensionality of Morphology and Corresponding Skills

Tacit processing and strategic analysis are necessary tools for reading morphologically complex words. The two processes are not entirely separate. Instead, morphology and morphological awareness are multi-dimensional (Goodwin et al., 2014; Goodwin et al., 2017). Goodwin et al. (2017) found that seven distinct skills comprised the overarching concept of morphological skill and knowledge, with tacit processing and strategic analysis being joint factors. Similarly, Goodwin et al. (2014) found unique contributions at each level of their model to a student's ability to separately read, spell, and self-rate knowledge of the meaning of words.

In a validation study for middle school students, Goodwin et al. (2019, 2022) assessed four teachable skills across seven tasks gamified through their computer-based assessment Monster, P.I. The seven tasks relate to the dimensions identified in Goodwin et al. (2017). The four skills are as follows: identifying units of meaning, using suffixes for syntactic information, using morphology for meaning, and reading and spelling morphologically complex words.

These skills address both tacit and explicit skills and combine the importance of word form and meaning. In designing instruction for students in the area of morphological-based interventions, it is important to consider the dimensionality of morphology.

Direct Instruction in Morphology

The literature on phonics instruction for teaching foundational reading skills is rich. However, phonics programs typically do not address multisyllabic, morphologically complex words that populate complex text older students are asked to read. If they do, it is late in programs designed to teach the most frequent, predictable patterns of English orthography. Morphemes, like phonics patterns, are orthographic units that can be consolidated. This is congruous with the consolidated alphabetic phase (Ehri, 2005; Ehri & McCormick, 1998), where readers chunk orthographic units for more efficient reading. It is reasonable to expect that focusing explicitly on morphemic units that can be generalized, like recognizable phonics patterns that can be chunked and generalized across words, may aid readers in deciphering unfamiliar or unknown multisyllabic morphologically complex words.

Comprehension is the ultimate goal of reading, but students must be able to read the words to extract meaning (Carlisle & Stone, 2005). Deacon et al. (2015) found that aspects of morphological knowledge accounted for 8% of the variance in reading comprehension, including morphological decoding. Without decoding, there is no independent reading comprehension. While students need some degree of mental representation of constituent morphemes in their lexical processing systems to *use* them in the understanding of text (Reichle & Perfetti, 2009; Taft, 2003), research suggests that readers decompose words even before making semantic connections (Rastle et al., 2004;

see Baayen (2014) for reviews of opposing theories). Transparency (i.e., how closely a derived word resembles its original form) and frequency (i.e., how often a word appears in our general lexicon) matter in terms of ease of recognition (e.g., Reichle & Perfetti, 2003), but even sight words are regularly decomposed, rather than recognized as whole units (McCormick et al., 2009). Students become more efficient at breaking words apart as they age (Carlisle, 2000; Carlisle & Stone, 2005; Singson et al., 2000).

Despite arguments that instruction in morphology is more beneficial for students in upper elementary and beyond, more studies of morphology have been conducted with younger students than older students and adults. Murphy and Diehm (2020) argue that empirically, the largest effect sizes are observed with younger students. However, they also concede that "the appropriateness of morphological intervention does not appear to be limited to students at specific ages, grades, or ability levels…" (p. 547). Of the studies that have included older students, few focused on word reading outcomes alone but instead on vocabulary acquisition, comprehension, or some combination of such areas of reading (Carlisle, 2010). The studies performed on middle school or high school students found that the effects of morphological awareness contributed uniquely to many areas of reading, including comprehension, vocabulary, spelling, and decoding (e.g., Bernstein et al., 2020; Goodwin et al., 2013, 2014, 2017; Law et al., 2015).

The consensus from the extant research on morphology does suggest that attending to and explicitly connecting word parts and morphemes to meaning can further solidify both phonological and orthographic representations of words (Kearns & Ghanem, 2019; Mahony et al., 2000; Perfetti, 2007; Reed, 2008; Reichle & Perfetti, 2003), and not doing so can put students at a disadvantage (Arnback & Elbro, 2000; Yap

& Balota, 2009). Levesque et al. (2021) go so far as to say, “morphology is critical to literacy development” (p. 11). The interaction between word identification and understanding is at the core of many reading theories, including the Simple View of Reading (Gough & Tunmer, 1990), the Reading Systems Framework, and Lexical Quality Hypothesis (Perfetti, 20007; Perfetti & Stafura, 2013), and the Direct and Inferential Mediation Model of Reading Comprehension (DIME; Cromley & Azevedo, 2007). Efforts to pinpoint morphology’s role in reading acquisition have led to more refined studies and frameworks such as the Morphological Pathways Framework (Levesque et al., 2021), which explores the relationship between and among phonology, orthography, meaning, general knowledge, and other related areas.

These various reading theories illustrate how decoding and word reading interact with oral language and linguistic skills in support of proficient reading. The consolidated alphabetic phase, like reaching high lexical representations, is a crucial step in becoming an automatic and proficient reader. However, doing so also relies on stable grapheme-phoneme-correspondence patterns, limited orthographic and phonological shifts, and some level of crossover from unfamiliar words to words that already exist in one’s vocabulary (i.e., reading by analogy). This crossover is problematic because the English language is represented by a deep orthography (Kessler & Treiman, 2001; Kuo & Anderson, 2006). This means that the phoneme-grapheme relationships are not as consistent as in some other languages, making applying the same rules to all words more challenging. For example, in English, the long /a/ sound can be represented not just by *a* but also by *ay, a-e, ea,* and *eigh*, among other orthographic patterns. Part of this is due to the printed word becoming more widespread with the creation of the printing press,

which cemented the spellings of words while the spoken language continued to evolve and change (Moats, 2010). For example, the base word in the word *health* is *heal;* the spelling was kept despite the pronunciation shifting (Kessler & Treiman, 2001). In addition, while English is a Germanic language, it borrows from many other languages with unique spelling patterns, such as Latin and Greek (Moats, 2010).

About half of the words in English are predictable by phoneme-grapheme correspondence, and another third of the words in English are predictable within a single error (Moats, 2010). Moreover, Moats (2010) stated that "ten percent more are spelled accurately if word meaning, origin, and morphology are considered" (p. 110), which leaves less than 10% of the words in English as true outliers. Other research indicates that skilled readers not only notice but utilize the regularities and irregularities that occur in morphologically complex words to aid in decoding and spelling, which may be expected, and in deciphering meaning (Bowers & Bowers, 2017; Rastle, 2018; Ulicheva et al., 2018).

Morphologically complex words are also typically multisyllabic. By this reasoning, the percentage of English words most challenging to read and spell could be made less difficult by understanding morphology. According to Rastle (2018, p. 47), "[o]ne particularly interesting aspect of English morphology is that the writing system sacrifices regularity between spelling and sound in order to communicate … important information about meaning," which often results in phonological shifts away from the original base word. English is a morpho-phonemic language, and attention to meaning, orthography, and phonology is essential for tackling unfamiliar and complex words (e.g., Kearns & Ghanem, 2019; Perfetti, 2007; Reichle & Perfetti, 2009).

Instruction in morphological awareness skills as well as in specific strategies such as structural analysis, alphabetic principle training, identification of bases and affixes, and the pairing of phonological and orthographic representations have all been supported by research for older students (e.g., Abbott & Berninger, 1999; Berninger et al., 2007; Mahony et al., 2000; Nagy et al., 2006). In addition, explicit instruction in morphology may be especially beneficial for older students who have had more interactions with morphologically complex language and more maturity to analyze their knowledge, thought processes, and the structure of words (Nippold & Sun, 2008).

Students who struggle with decoding into adolescence cannot independently access text, especially text with multisyllabic, morphologically complex, and unfamiliar words (Toste et al., 2017b). Therefore, by focusing on morphological contributions to spelling and reading and on morphological meaning to reinforce lexical (i.e., orthographic and phonological) representations, the goal is to improve word reading and automaticity as focused instructional targets. Goodwin and Ahn's (2013) meta-analysis of morphological interventions on school-age children determined that the effectiveness depends on the measured literacy outcome. They reported that intervention has moderately sized positive effects on Morphological knowledge, phonological awareness, vocabulary, decoding, and spelling but not reading comprehension and fluency. However, of the effects that were observed, they were greater for elementary opposed to middle and high school students.

Carlisle (2010) suggested that the design and quality of studies on morphology at the point of her integrative review indicated morphology as an "emerging area of research" (p. 464). The need for research on the use of morphology in general but

specifically for older students with word reading deficits is motivated by the promise of the inclusion of morphological training and the limited research in this area with middle and high school students. As such, this study aims to examine the effectiveness of a morphologically-based intervention on 9th and 10th-grade students with identified word reading deficits and disabilities.

CHAPTER TWO

REVIEW OF LITERATURE

Morphology contributes uniquely and valuably to many aspects of reading, including word identification and decoding. It may be beneficial for older students in accessing multisyllabic words with morphological components. While phonics-based interventions with secondary-level students have produced favorable results (e.g., Edwards, 2008; Giess et al., 2012; Gwernan-Jones et al., 2018; Jeffes, 2016), basic phonics instruction may still fail to teach secondary struggling readers grade-level complex words. Morphology contributes uniquely beyond phonology and grapheme-phoneme correspondences in reading skills, and its use may compensate for areas of word recognition that standard phonics instruction may not cover (Arnbak & Elbro, 2000; Murphy & Diehm, 2020). The current literature on morphology related to word reading is growing, but what exists is wide and varied. For this study, the literature review focused on intervention studies published since 2000.

Morphology and How It Contributes to Word Reading

Reading multisyllabic, derived words is not the same as reading monosyllabic, predictably patterned words (Bhattacharya, 2020). Phonological awareness skills and direct phoneme-grapheme correspondences support early readers with cracking the alphabetic code. As students become more efficient, their accuracy and speed of word recognition increase, to which morphological awareness contributes (Kirby et al., 2012). When readers move into higher grades, the concentration of multisyllabic words increases. Morphological knowledge and awareness, as defined in Chapter 1, can support readers in identifying and reading multisyllabic derived words. As morphological

awareness overtakes phonological awareness in predicting reading performance, both tacit and explicit morphological processors contribute to reading skills. Knowledge beyond letter-sound relationships and syllable types is needed to decode morphologically complex, multisyllabic words. Students typically gain more knowledge and perform better at reading complex words as they age (Carlisle & Stone, 2005).

For example, Mahony et al. (2000) asked participants to differentiate between word pairs with a morphological connection (e.g., *nature/natural*) and those related in spelling but not morphology (e.g., *ear/earth*). Across two experiments ($N = 98$; $N = 101$), they found that sensitivity to derivational relationships increased with grade level, was associated with decoding ability, and contributed uniquely to predicting word reading skills.

The findings reported by Carlisle and Stone (2005) also suggest that student performance on morphologically complex words increases with age. Their findings support the results of many lexical decision task studies in that students were more successful at decoding words with two morphemes (i.e., base plus suffix) than those with one (e.g., *shady/lady*). In the word *lady*, a student may decompose the word as they read, realize what is left is not a real word, and therefore be slowed down in their accuracy and fluency. The connections between morphology and vocabulary would also support this result, a relationship identified across many studies (e.g., McCutchen et al., 2008).

Regardless of age, lexical representations are multidimensional and rely on meaning, spelling, and word-reading (Goodwin et al., 2014; Perfetti, 2007). Phonological and orthographic transparency and frequency influence performance, as do reader characteristics of morphological awareness and vocabulary knowledge (Goodwin et al.,

2013; 2014). Phonological and orthographic transparencies affect access to words that typically populate texts beyond the fifth grade (e.g., Carlisle & Stone, 2005), as well as familiarity, frequency, part of speech, and semantic connection (Kearns, 2015; Nippold & Sun, 2008; Rastle et al., 2004; Yap & Balota, 2009).

When phonological shifts are present, students read slower than when the derived word is transparent (Carlisle & Stone, 2005). Accuracy can also be impacted when words are not transparent or are low frequency (Kearns, 2015). However, morphological awareness development may be more critical in these instances than phonological awareness (McCutchen et al., 2008). Regardless, congruous to Perfetti's *constituent binding*, it can be argued that "morphological knowledge comprises phonological, orthographic, and semantic components, with the combination being more than the sum of the three parts" (McCutchen et al., 2008, p. 310).

Ghanem (2017) looked at the role of morphology and context (semantic connection) in acquiring whole word representations. After controlling for phonological decoding and orthographic knowledge, morphological knowledge contributed to acquiring orthographic representations of complex words, regardless of reader skill level. However, Ghanem observed that overly focusing on meaning detracted from the acquisition of orthographic representations—an inverse finding of Goodwin et al. (2017). Goodwin and colleagues observed that the connections between morphologically related derivatives might be lost to the detriment of comprehension when too heavily focused on spelling over meaning. However, both agree that word reading and spelling are highly correlated dimensions. In their response to Bowers and Bowers (2017), Rastle and Taylor (2018) concluded that attending to print-sound regularities is more important in acquiring

long-term learning of words than attending to print-meaning regularities. However, some research highlights the opposite relationship (Levesque et al., 2021). What is known is that morphology has a deep connection to semantics, and the effects of semantics on reader access to derived words should not be overlooked (Kearns & Ghanem, 2019; Levesque et al., 2021). Most research agrees that both orthographic representations and semantic connections contribute to word reading (e.g., Kearns & Ghanem, 2019; Mahony et al., 2000; Perfetti, 2007; Reed, 2008; Reichle & Perfetti, 2003; Taft, 2003)

Yet, tasks in reading and spelling that require a higher level of morphological knowledge may be more challenging for students with dyslexia or reading disabilities (Siegel, 2008). Despite the need, this group is less frequently the focus of intervention studies with language-based interventions (Collins et al., 2020). Weaker morphological awareness may contribute to reading and spelling deficits in such students, suggesting the importance of appropriate morphological assessment and instruction for students with reading disabilities (Siegel, 2008). Indeed, Law and colleagues (2015) found morphological awareness to be more predictive of word reading and spelling performance for those with dyslexia than those without. Furthermore, the relationship between morphological awareness and word reading was stronger than the relation between word reading and other literacy measures and vocabulary.

Morphological awareness may play an important role in supporting reading outcomes in students with dyslexia. Individuals with dyslexia who had compensated for their word reading deficits since an earlier diagnosis performed better than non-compensated dyslexics and were comparable to the control group (Law et al., 2015). The contribution of morphological awareness to word reading above phonology, and the

strategies individuals with dyslexia use to overcome their word reading deficits, may explain why the reliance on morphological awareness was stronger in the group of individuals with dyslexia than in the control group. Instruction in morphological awareness may help individuals with dyslexia and others with similar deficit profiles further compensate for weak phonological processing skills, providing them explicit tools to read derived words and access meaning. This conclusion is supported by a study by Arnbak and Elbro (2000). Additionally, Brimo (2016) observed students in the experimental group with identified deficits in basic reading, phonological awareness, reading comprehension, and working memory to make the most gains.

Developmental studies on morphology indicate that students become more sensitive to the morphological structure of words as they age, even without direct, explicit instruction. While much of the extant research does not include children with identified learning disabilities (Mahony et al., 2000; McCutchen et al., 2008; Nippold & Sun, 2008), the findings from studies with typical learners paralleled the studies that focused on or included students with identified deficits and disabilities (Carlisle & Stone, 2005; Nagy et al., 2003). Goodwin and Ahn (2010), in a meta-analysis of 17 independent studies on the effects of a morphological intervention on literacy achievement for children with literacy difficulties, found that morphological instruction had a significant impact on overall literacy achievement ($d = 0.33$) and showed particular promise for English language learners and struggling readers. Bowers et al.'s (2010) systematic review of 22 studies on morphological instruction from pre-school to Grade 8 also found that morphological instruction was of particular benefit for less capable readers. These studies motivate the provision of explicit instruction in morphemic structure, derivational

affixes, and the use of both orthographic and phonological representations as instructional targets.

Intervention Studies

Many aspects of morphological awareness, such as inflectional morphology, are typically acquired tacitly or implicitly through language acquisition and general exposure to print. While increased and continued exposure to complex texts and morphologically complex language can increase a student's morphological knowledge and awareness to improve the tacit processing of complex words, many students who struggle with reading have weaker phonological and orthographic representations for even simple words (Birsh & Carreker, 2018). Brimo's (2016) descriptive analyses showed that students identified with reading disorders improved their ability to identify morphemes in nonwords, even without explicit instruction. However, instruction in morphology can be made explicit through practices and strategies involving structural word analysis, vowel alert, peeling, and the explicit study of Greek and Latin bases and affixes. If incidental exposure can improve morphological processes, exploring how explicit instruction influences performance is warranted.

Morphological awareness and knowledge can contribute to reading performance in areas related to word reading and decoding. Studies included in this section looked at the effects of a targeted intervention using morphological components on readers with a variety of profiles of readers. All research included an intervention with morphological features, but study designs varied.

The studies were reviewed across two subcategories, existing interventions (i.e., boxed, scripted, or trademarked programs or established strategies) and novel

interventions (i.e., researcher-designed lessons). The studies were then reviewed for their instructional targets, the outcome measures used, and practical implications. An overview of intervention design appears in Table 1. Participants received explicit instruction in morphology in between testing to determine its effectiveness. Due to the interests of the current experiment, studies focused exclusively on comprehension or vocabulary outcome measures were excluded. All studies reviewed here included at least one word reading or word identification measure. In addition, studies primarily focused on second or English language learners (ELLs) were excluded, as were studies on participants younger than kindergarten. Only studies conducted on the English language writing system were included, though they were not limited to American English. Some studies that included applicable tasks, such as McKeown et al. (2018), were ultimately excluded due to a narrow focus on a target other than word reading.

Table 1

Intervention Studies for Primary Grades through Adult Learners

Study	Sample	Grades	Duration	Intervention Characteristics	Related Outcome Measures
Apel et al. (2013)	*N* = 61	K-2	15h	explicit morpheme instruction	MA, TOWRE-2
Bhattacharya & Ehri (2004)	*N* = 60	6-10	3 h	graphosyllabic analysis	WRMT-R, WL3P, SMT
Devonshire et al. (2013)	*N* = 120	1-2	6mon	Structured Word Inquiry	Schonell Reading Test
Georgiou et al. (2021)	*N* = 48	3	12h	Structured Word Inquiry	MA, WRAT-4,
Gray (2019)	*N* = 17	13+	8h	explicit morpheme instruction	target word identification, target word analysis
Kim et al. (2016)	*N* = 483	6-8	1y	*STARI*	RISE (MA, WI)
Kirk & Gillon (2009)	*N* =16	2-5	19.4ses	word pattern study	WRMT-R
Lovett et al. (2012)	*N* = 351	9-10	60h	PHAST PACES	WRMT-R, Challenge Words Test

Study	Sample	Grades	Duration	Intervention Characteristics	Related Outcome Measures
Lovett et al. (2017)	*N* =172	1-3	125h	Triple Focus	WRMT-R, TOWRE-2, Challenge Words Test
Moats (2010)	*N* = 555	6-10	1y	*LANGUAGE!*	WJ-R
Murphy & Diehm (2020)	*N*=10	1-4	6w	Structured Word Inquiry	DIBELS ORF, target word analysis
Toste et al. (2017a)	*N* = 59	3-4	16h	vowel alert, explicit morpheme instruction	WJIIINU, TOWRE-2
Vadasy et al. (2006)	*N* = 46, *N* = 21	2-3	20w	structured word analysis	WRAT-R, WRMT-R, TOWRE-2
Woodruff et al. (2002)	*N* = 62	9	4-8w	Word Identification Strategy	Slosson Diagnostic Battery

Notes. mon=months; h=hours; w=weeks; y=year(s); ses=sessions; MA=morphological analysis; ORF = oral reading fluency; MA=morphological awareness; WL3P=Word-Learning Three-Part Test; WI=Word identification; WRAT-R = Wide Range Achievement Test; WRMT-R = Woodcock Reading Mastery Tests (Revised), WJ-III-NU = the Woodcock Johnson-III Normative Update; TOWRE-2 = Test of Word Reading Efficiency (2nd ed.)

Features of Existing Intervention Programs or Established Strategies

Four studies utilized boxed programs, such as Triple Focus (which is a combination of PHAST and RAVE-O), *LANGUAGE!*, and STARI. Some interventions included established and soft-scripted strategies, such as Structured Word Inquiry (SWI, Bowers & Kirby, 2010) and Word Identification Strategy (WIS, Lenz & Hughes, 1990).

Commonalities across studies with established strategies and published interventions were high. Strategies such as structured word analysis, structured word inquiry (Bowers & Kirby, 2010), and the explicit teaching of affixes, were incorporated throughout the boxed and scripted interventions. For example, *peeling*, or removing affixes from a base word to determine familiarity of the base, appears in structured word inquiry, word identification strategy, Triple Focus, and various iterations of PHAST.

Structured Word Inquiry highlights the interrelations between phonology, morphology, and etymology. Four guiding questions related to word meaning, how the word is built (i.e., are there affixes?), relationships to other known words (i.e., etymology), and the stability and function of graphemes (Georgiou et al., 2021). A distinguishing feature of structured word inquiry is the use of *word sums*, where words are written out like equations to examine the multiple parts (e.g., dis + re + spect + ful). For words that undergo an orthographic shift, the writing out of whole morphemes before spelling the final word with correct patterning can "provide concrete representations of the underlying morphological structure of the words and the surface realisations [sic] that we see in print" (Georgiou et al., 2021, p. 138).

The word identification strategy is similar to structured word inquiry. It follows six steps: Discover the context, Isolate the prefix, Separate the suffix, Say the stem,

Examine the stem, and Check with someone/try the dictionary (Woodruff et al., 2002). Readers attend to meaning and word parts to identify words. Like structured word inquiry, word identification strategy involves *peeling* away known prefixes and/or suffixes to see what is left and if what is left is a known word or base. They both include attention to context and meaning first, followed by problem-solving steps to break the word down. Word identification strategy, however, focuses purely on decomposing the word for identification and meaning connection, while structured word inquiry makes the connection to orthographic representations and spelling more explicit.

The PHAST Program (Lovett et al., 2000), PHAST PACES (Lovett et al., 2012), and Triple Focus Program (i.e., PHAST + RAVE-O, Lovett et al., 2017) integrate features similar to structured word inquiry and word identification strategy into a systematic, scripted program. PHAST, which stands for the Phonological and Strategy Training Program, takes the program Phonological Analysis and Blending/Direct Instruction Program (PHAB/DI), which is designed to build phoneme-grapheme knowledge and support the blending of words and partners it with the Word Identification Strategy Training Program (WIST). WIST teaches students how to apply four metacognitive strategies when decoding unfamiliar words. PHAB/DI supports students in the learning relationships between individual phonemes and graphemes, while the WIST focuses on larger units. By supporting both the phonological skill domain and the metacognitive processes of developing readers, PHAST provides a broader generalization to real English words (Lovett et al., 2000).

PHAST PACES pairs the PHAST program with text comprehension strategy instruction (Lovett et al., 2012), but the decoding (PHAST) path can be taught in parallel

with the comprehension tracks or independently. Lovett and colleagues (2012) looked at this program's effects on high school students struggling with reading. The Phonological and Orthographic Knowledge Track teaches five specific word identification strategies and metacognitive strategies to support independent reading practice. The five strategies parallel those found in the other programs and include attempting to sound out the word, using analogy or rhyming to figure out the word, peeling off affixes, vowel alert, and a strategy called "Spy," where students try to find small familiar parts of words.

The Vowel Alert strategy, part of PHAST, is also used in variations across multiple morphological and word reading interventions. Taken and altered from the WIST program, Vowel Alert asks students to pay attention to the vowels, trying various possible sounds until the word makes sense. This is also used in flexible syllabication approaches, which are supported by multiple studies (e.g., Bhattacharya & Ehri, 2004; Henry, 1988, 2019).

The Triple Focus Program combines PHAST and RAVE-O (Retrieval, Automaticity, Vocabulary, Engagement with Language, and Orthography; Lovett et al., 2017). RAVE-O is meant to accompany a systematic phonological intervention, such as PHAST, and it aims to help readers integrate "all their knowledge about a word as quickly as possible" (Lovett et al., 2017, p. 893). This approach combines the explicit phonological focus and the explicit word identification strategy work with activities meant to improve lexical representations and engagement.

STARI, or Strategic Adolescent Reading Intervention, begins with minilessons on decoding, morphology, or comprehension. An essential keystone of this intervention is using authentic texts of high interest and meaningfulness to adolescent readers, extended

fluency practice, and silent reading followed by discussion. STARI has the least explicitly defined description of the programs outlined in this section of the decoding and morphology portions. However, an important feature of this program is that the instructional targets during the decoding and morphology lessons are heavily featured in the oral fluency passages for "repeated exposure to challenging words" (Kim et al., 2016, p. 366).

LANGUAGE! is a mastery-based, three-year program designed for older poor readers. Separate curriculum strands, including "phonemic concepts, phonemic awareness, phoneme-grapheme associations, syllabication, word recognition, vocabulary development, text reading, comprehension, spelling, orthographic concepts, mechanics, composition, grammar and usage, syntax and sentence structure, semantic relationships, figurative language, and morphology" are taught systematically through daily lessons so that students develop the skills "in relation to one another" (Moats, 2004, p. 147). Through the lessons for morphological processing, *LANGUAGE!* explicitly teaches morphemes to help students make connections between words that share roots and/or affixes. This, again, is similar to the intentional focus on word parts, meaning, orthography, and etymology the other previously mentioned programs and strategies rely on.

Most of the programs mentioned above are built upon the foundation created by the structured word inquiry and word identification strategy strategies. Commonalities across all programs are the explicit attention to word parts, the meaningful engagement with multisyllabic words, and the utilization of metacognitive strategies for independent application and problem solving. Strategies such as the peeling of affixes, flexible

syllabication and attention to vowels, semantic connections, and explicit attention to orthographic representations of morphemes are included in these instructional programs.

Novel Interventions

Studies that implemented novel interventions also contained many of the strategies prominent in existing morphology-rich instructional programs. For example, Murphy and Diehm (2020) implemented a six-week orthographic intervention focused on morphology called The Inquiring Minds literacy program. This program was heavily modeled on structured word inquiry, and the majority of facilitator training was in structured word inquiry specifically. In Toste et al. (2017a), a seven-step intervention was designed to improve multisyllabic word reading. The seven steps included activities such as the explicit teaching of target word patterns and the explicit teaching of affixes. Their Word Play step was congruous to structured word inquiry's word sums. Repeated practice, as well as reading in connected text, were also key features. Toste and colleagues also embedded a motivational belief aspect into one of their experimental groups, following the Triple Focus Program's insistence on meaningful engagement with text and student motivation.

Vadasy et al. (2006) built their intervention on the structural analysis model, which instructs students on the division of words into recognizable subunits. Units may include syllables, phonetic letter patterns, affixes, and morphemes, including bases. The first half of the 20-week intervention focused heavily on phonological skills and phonics instruction. The second half of the intervention was more explicitly scripted and focused on orally segmenting complex words into syllables, learning common affixes, practicing

the reading and spelling of multisyllabic words, and applying flexible syllabication strategies. The lessons integrated peeling, vowel alert, and reading and spelling practice.

Similarly, other programs used some iteration of word study or word analysis to drive their instructional lessons. Kirk and Gillon (2009) focused on orthographic shifts and spelling rules driven by vowel sound length, and they integrated practice with common inflectional morphemes. Devonshire et al. (2013) also focused on vowel awareness, syllables, identifying common morphemes, and using words in written sentences. Bhattacharya and Ehri (2004) used instruction in graphosyllabic analysis to help struggling adolescent readers access complex words. Graphosyllabic analysis integrated vowel alert strategies, flexible syllabication, attention to orthographic representations and semantic connections, and repeated practice. It has similarities to structured word inquiry and word identification strategy. However, students are provided the appropriate meaning and pronunciation up front rather than moving through the steps to figure out the word. Graphosyllabic analysis lacks practice in connected text, but students receiving it had repeated exposures to the words and syllables in isolation. Graphosyllabic analysis also focused more intensely on syllables than morphemes. However, many of the syllables in target words were final stable syllables that were morphemes, such as *-tion* and *-ment*.

Other common features in novel interventions were the explicit teaching of common affixes, Latin and/or Greek bases, and their connections across words (Apel et al., 2013; Gray, 2019). Across the studies, the framework for the lessons was predicated on the concept that the English orthography makes sense. This is a common thread throughout most of the morphological interventions in the literature; the designs

capitalize on what is stable in the English orthography and how morphology contributes to that stability. The most prominent features across all studies were the inclusion of orthographic and phonological interactions with complex words, explicit attention to vowels and recognizable word parts, application to reading and spelling, and the importance of repeated practice.

Instructional Targets, Outcome Measures, and Results

Fourteen intervention studies involving morphological components and some aspects of word reading as instructional targets for primary grades through young adults are discussed here. The majority of studies in this section looked at the effects of an intervention on students or young adults who were below average in reading, at risk, or identified with a disability (Bhattacharya & Ehri, 2004; Georgiou et al., 2020; Gray, 2019; Katz & Carlisle, 2009; Kim et al., 2016; Lovett et al., 2012, 2017; Moats, 2004; Murphy & Diehm, 2020; Toste et al., 2017a; Vadasy et al., 2006; Woodruff et al., 2002).

Studies ranged from four weeks to multiple years, and all studies provided at least eight hours of intervention treatment. Sample sizes ranged from $N = 10$ (Murphy & Diehm, 2020) to $N = 555$ (Moats, 2004). All studies used both phonological and orthographic representations of words, drew explicit attention to the function and existence of morphemes and/or syllables in words, and involved the reading, analyzing, and spelling of words with morphological components. Refer back to Table 1 for instructional targets and outcome measures used.

The majority of studies utilized standardized tests or subtests of word reading, word identification, or word attack as their primary or only outcome measure for word reading related growth. This was achieved using tests such as the Wide Range

Achievement Test (WRAT-R), the Woodcock Reading Mastery Tests (revised, WRMT-R), the Woodcock Johnson-III Normative Update (WJ-III-NU), and the TOWRE-2 (Apel et al., 2013; Devonshire et al., 2013; Georgiou et al., 2013; Kirk & Gillon, 2009; Moats, 2010, Toste et al., 2017a, Vadasy et al., 2006; Woodruff et al., 2002). Such standardized tests are good indicators of word reading proficiency. They are structured, to begin with simple, noncomplex words and get more difficult as the participant progresses through the test. They often include subtests of real and non-words to measure a student's decoding ability. Some are timed (TOWRE-2), but many are untimed with ceiling discontinue rules (e.g., WRMT-R).

Measures of word identification, word attack, and word decoding are often used in the identification processes for students with reading disabilities. A concern with using such tests to measure growth in studies targeted to improve the reading of morphologically complex words is that poor readers may not progress enough in the test to attempt multisyllabic words with derivational components. On the TOWRE-II Form A subtest of Sight Word Efficiency, the first word with more than one syllable is not until item 36, and the word is morphologically simple (Torgesen et al., 2012). Using such tests as measures of general word reading ability or inclusion criteria to determine if a student has a reading deficit is reasonable. However, such tests may not provide targeted information on complex word reading (e.g., Kern & Hosp, 2018).

Some of the studies included measures that focused on target word reading, challenge words (i.e., lists of morphologically complex words and/or nonwords), and tests of morphological knowledge that addressed the multidimensionality of morphological awareness (Bhattacharya & Ehri, 2004; Gray, 2019; Kim et al., 2016;

Lovett et al., 2012, 2017; Murphy & Diehm, 2020). Apel et al. (2013) and Gerogiou et al. (2021) did not include morphologically complex-specific word reading tests, but they did have measures of morphological knowledge and awareness. In interpreting results and effect sizes, the alignment of outcome measures to instructional targets is important. Some studies implemented the same strategies but used different outcome measures, making comparisons of outcomes across studies a challenge. Therefore, results are reported according to instructional or design similarities, and commentary on interpreting results is included.

Both Georgiou et al. (2021) and Murphy and Diehm (2020) observed students in elementary school and younger to have benefited from structured word inquiry. Specifically, Georgiou and colleagues (2021) looked at structured word inquiry versus a researcher-designed intervention called Simplicity. Simplicity focused on sound-symbol correspondence and other activities in line with traditional phonics instruction. Both treatment groups were analyzed relative to a control group. Both groups outperformed the control group, but the structured word inquiry group had a larger effect from the beginning to the end of the intervention (pretest to posttest and delayed posttest) than the Simplicity group. Georgiou et al.'s (2021) effects on word reading were $d = 0.98$, and the effects related to morphological knowledge ranges from $d = 0.33$-1.81. While effects were medium to large, neither intervention produced growth in the word reading measure used. However, this finding could be explained by the fact that most words on the WRAT-4 Word Reading are morphologically simple and do not align with the instructional targets of the intervention provided.

In their clinical trial with no control group, Murphy and Diehm (2020) reported descriptive statistics based on pre and posttest, showing that the students who received instruction in SWI improved in target word reading, target word spelling of words, target word spelling of morphemes, and on a standardized test of spelling in most instances. Relating the results of this study to others was limited by the lack of effect sizes or markers of significance. However, Murphy and colleagues' outcome measures were more closely aligned to the instructional targets of the intervention, which has both clinical and practical implications.

Gray (2019) explored the difference between tutoring in morpheme analysis and syllable analysis with adults ($N = 16$). While the instructional target was vocabulary, Gray also had word reading and spelling measures. On target word tasks, the students who received instruction in morpheme analysis outperformed those who received instruction in syllable analysis ($d = 2.60$). This makes sense, given that only the morpheme group was explicitly taught how to attend to morpheme constituents. On the word attack subtest of the WJ-III, both groups grew comparably, suggesting that both strategies and instructional approaches can aid in improving basic decoding skills. In general, effect sizes for the WJ-III measures were smaller, likely due to the misalignment of instructional targets with the WJ-III subtests. On the Target Word Measures, which included word recognition, word analysis, spelling, definition matching, and sentence comprehension, the morpheme group outperformed the syllable group on word recognition and word analysis ($d = 2.47, 2.46$; $d = 2.60, 1.54$, respectively). The syllable group showed more growth in spelling, definition matching, and sentence comprehension. These findings support the inclusion of both explicit instruction in

morphology and in syllable types in intervention with older learners to address various gaps in word reading, word identification, and word decoding.

Apel and colleagues (2013) studied Kindergarten through second-grade students (N = 61) who participated in a feasibility study that asked them to analyze and recognize words and morphemes, attend to the phonology of morphologically complex words, and attend to spelling. Students in Apel et al.'s (2013) study increased their morphological awareness and literacy skills as measured by the various tasks completed. Effect sizes for all three grades on word decoding and reading measures were medium to large (range *d* = 0.50 to 0.87).

Apel and colleagues used the timed standardized test TOWRE-2 as a measure of word reading and decoding, limiting the interpretability of these results. However, they also included a measure of morphological awareness, which had four tasks to assess various aspects of the participants' morphological skills. The range of effect sizes for all grades on the morphological awareness tasks was *d* = 0.74-2.96. These finding demonstrate the potential of explicit instruction in morphological components, even without access to a boxed or published program. All words on the morphological awareness tasks were phonologically transparent, however. This is reasonable for the age of the participants, which was kindergarten through second grade. At the same time, the types of words assessed on the morphological awareness tasks do not fully represent the reality of morphologically complex words that older students encounter in complex texts.

Toste et al. (2017a) performed a randomized controlled trial with third and fourth graders (N = 59) and examined word reading and motivation as factors leading to improved reading outcomes. A group focused on multisyllabic word reading, a group

focused on multisyllabic word reading plus training in motivational beliefs, and a control group comprised the study. Both experimental groups outperformed the control group across measures. For measures focused on more unconstrained skills, such as sentence comprehension, the group who also received motivational belief training performed best. Regardless, the implementation of an intervention targeting multisyllabic word reading had moderate effects in areas related to foundational reading skills ($g = 0.31$) on the TOWRE-2 and Woodcock Johnson III.

Kirk and Gillon (2009) and Vadasy et al. (2006) looked at younger learners with identified deficits or disabilities related to reading, spelling, or language. Both studies included control groups. Kirk and Gillon used participants with identified spelling deficits. They provided focused instruction in morphological and linguistic awareness to improve reading and spelling skills in students aged 8 to 11 ($N = 16$). Vadasy and colleagues studied second and third graders with below-average word reading skills across two studies ($N = 46$, $N = 21$). The lesson structure included phoneme-grapheme correspondence, structural analysis of multisyllabic words with morphological components, exposure to rule exceptions, and oral reading practice. It is important to note that the multisyllabic words and affixes were restricted to inflectional derivations, which does not address multisyllabic derived words. These words are more likely to undergo phonological and orthographic shifts than inflected words, making them more challenging to read.

Vadasy and colleagues (2006) and Kirk and colleagues (2009) observed greater gains in posttest measures in their experimental groups than in their control groups. Kirk and Gillon observed participants to transfer skills taught as part of the intervention to

words and targets not directly taught as part of the intervention sessions. This finding could be especially meaningful because morphemes are constituent parts that appear in many words that are often related in meaning, orthography, and phonology. However, Kirk and Gillon used the WRMT-R Word Attack and Word Identification subtests to measure reading directly, which are limited in the number of morphologically complex words included.

In Vadasy and colleagues (2006) first study, they observed the experimental group to have outperformed the control group in reading efficiency, spelling, and comprehension. They introduced minor modifications to the lesson structure in their second study and observed similar results. Both experiments performed by Vadasy and colleagues used standardized tests (WRMT-R, WRAT-R). Yet, a key design element in this set of studies is that paraprofessionals, not certified teachers, implemented the intervention. The researchers sought to answer whether non-certified tutors could successfully implement such instruction. Despite the misalignment of the outcome measures, the results suggest valuable implications for practical application in the everyday classroom, especially for students with disabilities, where paraprofessionals often run small groups, direct instructional groups, and support students in general education settings.

Devonshire and colleagues (2013) performed a cross-over design study of five- to seven-year-old children (N = 120) who received a phonics intervention and a novel intervention that incorporated explicit instruction in morphology, etymology, phonology, and orthographic form. Each group received each intervention but in an alternate sequence. Both groups increased as a function of time, but both groups showed a more

drastic rate of improvement following the novel intervention. They used the Schonell Reading Test, which measures basic decoding and comprehension skills. A benefit of this test is the high ceiling rule (10 consecutive errors), which may allow students to progress further and access more complex words that align with the instructional targets of the intervention provided. Regardless, the greatest indication of this study is that students as young as five years old can be taught the concept of morphology, attend to form, and apply the instruction received to reading and spelling. As morphological skills increase, such explicit instruction could offer similar or greater benefits to older students.

Lovett and colleagues (2017) investigated the effects of the Triple Focus Program, a combination of PHAST and RAVE-O, on first through third graders ($N = 172$). This study looked at the importance of early intervention, and results showed that those who received intervention in first grade made almost double the gains as those who got the intervention during their third-grade year. This might suggest some concerns for the participants of the proposed study, but Lovett and colleagues (2012) performed a similar study with struggling high school students ($N = 351$). Participants received 60 to 70 hours of instruction in the PHAST PACES program. The intervention produced significant gains in the sample in word attack, word reading, and reading comprehension. Of particular interest was the Challenge Test, which consisted of multisyllabic words. Lovett and colleagues found medium effects for complex multisyllabic word reading ($d = 0.57$). Across the three test points, participants in the experiment group could consistently identify more words than in previous assessment sessions, ending the study more than 15 words ahead of participants in the control group. The experiment group also had a medium effect in the area of word attack on the WRMT-R ($d = 0.45$), which consists of

nonwords, suggesting the intervention program also improved general decoding skills. While only reading comprehension scores maintained the upward trend at a one-year follow-up, the immediate and short-term gains in access to multisyllabic words are promising for older students with disabilities.

Kim et al. (2016) used another boxed program, Strategic Adolescent Reading Intervention (STARI). While the growth in morphology was small for the experimental group, there were large descriptive gains in the areas of word recognition, vocabulary, and word reading efficiency. STARI participants showed greater improvements than the control group in multiple areas, including word recognition ($d = 0.20$) and morphological awareness ($d = 0.18$). These effects of word recognition and morphological awareness were larger in these areas when student behavioral engagement was included as a factor ($d = 0.35$; $d = 0.32$, respectively), suggesting the importance of student engagement in the instruction provided. Integrating student choice, feedback and praise, and goals that matter to the student may help improve the effectiveness of interventions with older learners. This is supported by Toste et al. (2017a) and the consideration given to student engagement in Lovett et al. (2012).

Moats' (2010) study of a comprehensive, intervention had the largest sample of all reviewed studies ($N = 555$). It studied sixth through tenth-grade students for over a year of instruction in the *LANGUAGE!* Program. The dosage of this intervention was approximately 270 hours across a school year, with participants receiving daily instruction for about two hours each day. While struggling learners comprised the sample, and many were labeled non-readers, only 14 participants were formally eligible under special education. Overall, growth across measures was significant for all grades

on at least two comparisons. On the WJ-R Letter-Word Identification and Word Attack subtests, average effect sizes across grades were $d = 0.39$. Unfortunately, there was no measure to serve as a proximal measure of reading multisyllabic, complex words. However, the overall growth seen by participants supports the effectiveness of a comprehensive, structured literacy and language intervention program.

Bhattacharya and Ehri (2004) and Woodruff et al. (2002) utilized researcher-developed strategy instruction rather than a boxed or published intervention program. Woodruff and colleagues implemented Word Identification Strategy (Lenz & Hughes, 1990) with high school students at risk for failure or who had learning disabilities ($N = 124$). Bhattacharya and Ehri implemented a different but related strategy with sixth through tenth-grade students ($N = 60$). They had students assigned to one of three groups. The two treatment groups either got instruction in graphosyllabic analysis or whole word reading, while the control did not receive instruction in either strategy. Both studies found greater performance at the posttest for the treatment groups utilizing word analysis strategies.

In Bhattacharya and Ehri (2004), the whole word group performed the same as the control group, who received no instruction. Compared to the whole word group, the graphosyllabic analysis group performed significantly better on all posttest measures, except for a measure of reading pseudowords by analogy. The whole word group only exhibited greater performance than the control group when spelling words presented during the intervention. Bhattacharya and Ehri did use the WRMT-R as a measure of word reading. Still, they also used tests that asked students to read multisyllabic words, segment syllables, and read nonwords with subtle misspellings. The alignment of these

measures to the instructional targets of the intervention facilitates the interpretability of results.

Woodruff and colleagues (2002) used the Slossen Diagnostic Battery, which requires students to read sets of words aloud. The experiment group grew between 2.8-grade levels and 3.8-grade levels across the general population. Of particular interest to the proposed study is that students with learning disabilities had a mean gain of 3.9-grade levels. While the outcome measures may not allow for comment on the direct effect on reading morphologically complex words, the implications of morphological interventions on students with identified disabilities are valuable.

Summation

In reviewing the literature, it appears that readers are inclined to attend to morphological components in words, regardless of familiarity or frequency, and that the processes that support this strengthen across development. In addition, evidence suggests that the explicit teaching of morphological knowledge, strategies directed at explicit word part awareness and analysis, and the use of both phonological and orthographic representations of multisyllabic, morphologically complex words and their morphemic constituents are beneficial for readers in supporting a range of skills related to reading, such as vocabulary acquisition, comprehension, word reading, word identification, and word decoding. This is true of both typical and struggling readers. Moreover, evidence exists that such strategies are effective in improving word reading related skills with struggling readers despite the likelihood that they have weaker literacy foundations, weaker orthographic representations, and less experience with advanced texts and complex words (e.g., Park et al., 2020).

All of these findings support the need for further study in the use of interventions with older students with reading deficits and disabilities. The proposed study seeks to answer whether morphological interventions involving explicit instruction in affixes, Latin bases, syllable types, syllabication patterns, practice with encoding multisyllabic words and morphemes, and oral reading practice of connected texts with target morphemes can improve the accuracy of 9th and 10th graders with disabilities when reading multisyllabic derived words. The following research questions are presented:

Research Question 1

What effect does the morphological-based intervention have on students' morphological knowledge?

Research Question 2

What impact did the intervention explicitly teaching structural word analysis and Latin roots and derivational affixes have on students' abilities to read multisyllabic and morphologically complex words?

To address the limitations of misaligned outcome measures found in much of the literature, the proposed study will include measures of morphological knowledge, general word reading and decoding measures, and measures assessing multisyllabic, derived word reading.

CHAPTER THREE

METHODS

The following methodology was implemented to investigate the effect of the intervention on improved word-reading of morphologically and multisyllabic words of 9th and 10th graders with disabilities.

Participants

Participants were twenty-three 9th, and 10th grade students enrolled in a public high school in a suburban county in the Southeastern United States. The principal researcher was a consulting teacher of special education in the school district. The students in the experimental group were recruited from existing reading intervention classes for students with mild to moderate disabilities and reading deficits identified under special education. The control group was recruited from other students with mild to moderate disabilities and reading deficits who had an IEP. They were not enrolled in a targeted, special education reading intervention during their school day. Potential participants (N=75) were informed about the study and asked to participate. Informed parental and participant assent were obtained for 25 potential participants to perform pre and posttest measures and, if they met criteria, to participate in the study.

The WIAT-III and the TOWRE-2 were used as criteria for participation in the study. All students presented with a deficit in word reading as identified by scoring below the 30th percentile on both the Word Reading subtest of the WIAT-III and the Sight Word Efficiency subtest of the TOWRE-2. This is consistent with the literature in which scoring below the 37th percentile or the equivalent of a standard deviation below average was used as inclusion criteria (e.g., Toste et al., 2017a; Vadasy et al., 2006). Due to its

untimed administration and incorporation of opportunities to read multisyllabic, derived words, the WIAT-III was also used as a proximal measure at the posttest. The groups were not statistically significant on the WIAT-III Word Reading subtest ($t(21) = 1.20$, $p = 0.24$) or the TOWRE-II Sight Word Efficiency subtest ($t(21) = 1.70$, $p = 0.10$). Participant demographic and qualifying scores are presented in Table 2.

Twenty-three students met criteria for inclusion in the study. One participant was not present for posttesting and was excluded from the analysis. Complete data were obtained for 23 participants and were retained for analysis.

Participants were 9th and 10th-grade students ($N = 23$) identified as a student with a disability under IDEA (median age in months = 187.52; 15.63 years). Fifteen males and eight females participated in the study. The groups did not differ in sex, X^2 (1, $N = 23$) = 0.08, $p = 0.78$. All students were served under an IEP. Of these students, 56.5% had a primary eligibility category of specific learning disability in one or more components of reading. Participants with an identified disability in reading comprised most of the experimental (55.6%) and control (60.0%) groups. The groups did not differ by IDEA eligibility classification, X^2 (1, $N = 23$) = 0.03, $p = 0.86$.

One teacher was responsible for multiple sections of reading intervention throughout the school day. The teacher is a veteran teacher with 17 years of experience and a license in K-12 special education, mild to moderate disabilities. She was trained in a four-hour session on the lesson structure and implementation, data collection, and fidelity. The teacher implementing the intervention had previously attended the 30-hour training from the Institute for Multisensory Education (IMSE) and has background knowledge in syllable types and syllabication. However, the training reviewed all

components of the proposed intervention, including background knowledge, because teachers have been observed to lack knowledge and skill in the area of morphology (McMahan et al., 2019; Moats, 1994; Washburn & Mulcahy, 2019). Fidelity checks were performed throughout the intervention by the researcher and building-level administrators. The form is available in Appendix A.

Materials

Intervention Binders

Each participant in the experimental group received a binder, which was kept in the intervention room and used during intervention lessons. The binder included materials for 40 lessons, with the exception of target connected text passages, which were handed out at the time of use and then kept in the teacher's binder to avoid students receiving additional practice with passages before the intended time.

Lesson Structure

Lessons followed the same structure each day, and each lesson (except for two review lessons) introduced at least one new concept while continuing to review and utilize previously taught concepts across various activities. Similar lesson structures and activities are supported by Bhattacharya (2020), Bhattacharya and Ehri (2004), Goodwin et al. (2012), Henry (1988; 2019), Kearns and Whaley (2018), Lovett et al. (2000), Toste et al. (2017a, 2017b) Vadasy et al. (2006), and Woodruff et al. (2002). Lessons averaged 47 minutes. All lessons were scripted. Appendix B contains two sample scripted lessons.

1) Syllable type, base, and affix drill (7-10 minutes)

Table 2

Participant Demographics and Mean Qualifying Criteria at Pretest

Variable	Group	*n*	%	*M*	*SD*	Range
Demographics						
Age (months)						
	Exp	18	78.2	187.11	8.24	172-202
	Con	5	21.7	189.00	11.49	174-202
Gender						
	Exp					
	Female	6	33.3			
	Male	12	66.7			
	Con					
	Female	2	40			
	Male	3	60			
IDEA[a]	Exp	10	55.6			
Eligibility	Con	3	60			
WIAT-III WR[b]						
	Exp			69.67	12.48	40-91
	Con			61.60	16.09	45-81

Variable	Group	*n*	%	*M*	*SD*	Range
TOWRE-2 SWE[c]						
	Exp			79.50	9.32	55-93
	Con			71.00	12.00	57-81

Note. Exp = Experiment group, Con = Control group, WIAT-III WR = Wechsler's Individual Achievement Test, (3rd ed.), Word Reading subtest; TOWRE-2 SWE = Test of Word Reading Efficiency (2nd ed.) Sight Word Efficiency subtest. *p* value indicates equality of variance at pretest established through independent samples t-test.

[a] Identifies several students whose primary eligibility category under the Individual's with Disabilities Act is a specific learning disability in one or more components of reading.

[b] Standard score ($M = 100$, $SD = 15$)

[c] Standard score ($M = 100$, $SD = 15$)

   a. To review all previously taught concepts, whole group, small group, or partners used a drill pack with notecards or a digital display of targets. Response focus varied (e.g., identification, spelling, meaning)
   b. Upon introduction of the new concept(s), students created a new notecard that they added to a set of notecards kept in their binders

2) Application activities: Extended practice with target morphemes (10 minutes)
   a. Activities in this section varied but included the completion of graphic organizers such as word builders and word maps, whole group word-creation brainstorms, blending activities, and structural word analysis
   b. An activity with the new concepts focused intensely on practice with the target base or affix. Other activities included previously taught concepts.
3) Flexible Syllabication Practice (8-10 minutes)
   a. The teacher modeled an example of syllabication procedures for a word with that day's instructional target morpheme(s)
   b. Students syllabicated multisyllabic, morphologically complex words presented in isolation using flexible syllabication rules and strategies such as vowel alert, peeling, and knowledge of syllable types.
4) Encoding (7-10 minutes)
   a. Upon introducing a new concept, students practiced spelling the word part multiple times. Other concepts were included for continual remediation of skills.
5) Connected text passage reading (5-7 minutes)

a. Students read independently, with a partner, or with the teacher. Passages were researcher-made and featured a mix of phonetically regular and decodable words, high-frequency sight words, and multisyllabic, morphologically complex words that contain instructional targets that have been explicitly taught up to that point. Note, that the word parts had been explicitly taught, but the unique words in the passages may or may not have been presented during instructional time.

Lesson Features

Because morphological knowledge is multi-dimensional, each lesson included visual and auditory representations, explicit and modeled instruction and examples, reading and writing, and direct practice (Carlisle, 2003; Devonshire et al., 2013; Goodwin et al., 2020; Henry, 1988, 2019; Mahony et al., 2000; Moats, 2010; Reed, 2008; Reichle & Perfetti, 2003). Over the first week of intervention, students received instruction in the six main syllable types (closed, open, vowel-consonant-e, vowel team/diphthong, r-controlled, and consonant-le) and in syllabication patterns (VCCV, VCV, VVC, Cle; Henry, 1988, IMSE, 2016b; Templeton, 2020). The concept of the schwa syllable was also directly taught as a seventh syllable type due to the prevalence of the schwa sound in multisyllabic words with affixes. While these were explicitly taught, students were guided to use flexible syllabication approaches when attaching unfamiliar words throughout the intervention. See Table 3 for syllable type definitions, syllabication patterns, and examples.

Additionally, the intervention targeted twenty-five affixes of Greek and Latin origin (twelve prefixes and thirteen suffixes) typically identified as the most common.

Table 3

Pattern Categories, Definitions, and Examples

Syllable Pattern	Definition	Example
Closed	Syllable that ends with a consonant sound and contains a short vowel sound	*c**a**t, spl**a**sh, j**u**mp, b**i**g*
Open	Syllable that ends with a single vowel which is long	*s**o**, m**y**, b**e**, w**e**, m**e***
Vowel-consonant-e	Syllable that has a vowel-consonant-e pattern where the final e is silent and the vowel is long	*m**a**k**e**, str**i**p**e**, tr**o**p**e**, n**a**m**e**, fl**u**t**e***
Vowel Team	Syllable with two or more vowels that produce a vowel sound; in this study this includes diphthongs	*t**ea**m, r**ai**n, b**oa**t, gr**ee**t, j**oi**n*
R-controlled	Syllable with a vowel followed by -r and in which the *r* manipulates the vowel sound	*f**ur**, b**ir**d, g**ir**l, c**or**n, b**ar**n*
Consonant-le	Syllable with a consonant-le; features a schwa vowel sound	*peo**ple**, cir**cle**, guzz**le**, spar**kle***
Schwa	Unstressed syllable where the vowel makes the /**ŭ**/	***con**nect, **e**lect, pres**i**dent*

The affixes chosen for this intervention were compiled from sources such as Henry (1988; 2019), IMSE (2016a) and Manyak et al. (2018). According to White et al. (1989), almost 3,000 prefixed words found in third through ninth grade begin with *un-, re-,* and *in-*, and with the addition of *dis-*, students can cover about 58% of prefixed words they will encounter. By focusing on the most frequent and common affixes, the researcher aimed to compensate for the limited duration of the intervention.

Only Latin bases were taught. Support for this choice comes from multiple sources (Henry, 1988; Moats, 2004; Newton et al., 2011). Latinate words are more common than Greek words in English, and Latin words often comprise tier-two vocabulary, which are words that carry meaning across multiple disciplines and content areas (Beck et al., 2002; Henry, 1988).

Ninety percent of English words with more than one syllable are Latin-based, and much of the remaining 10% are Greek-based (Newton et al., 2011). However, Greek-based words are often categorized as tier three vocabulary words, which are more specialized and, therefore, less beneficial for this study, as they are less common (Beck et al., 2002; Henry, 1988). Latin bases for instruction and their placement in the scope and sequence of the intervention were justified based on transparency and frequency. Various studies identified transparency as a barrier to access, while many studies similarly identified frequency as a factor in predicting reading performance.

Therefore, early lessons included bases with only one meaning and spelling (e.g., *tract*, *form*, *port*). In contrast, later lessons included bases with multiple potential meanings and/or spelling iterations (e.g., *script/scribe*, *mov/mot/mob*). Bases chosen for targeted instruction were compiled from multiple sources (e.g., Henry, 1988; Marzano,

2010; Moats, 2004; Newton et al., 2011). Intervention that targets common affixes along with bases is promising for middle school students and, therefore, likely to also be helpful for older students reading at a lower skill level (Tyler & Nagy, 1989). Bellomo (2012) identified stability, transparency, and practicality as three keys in morphology instruction. Stability refers to teaching the most common form; transparency allows for a parts-to-whole approach; and practicality relates to the utility of the word form. Table 4 displays a complete list of instructional targets, iterant spellings, meaning, lesson number of introduction, and, if applicable, part of speech.

A Parts-to-Whole approach was used when exploring unfamiliar words. Pacheco and Goodwin (2013) found that, when encountering unfamiliar words, most struggling readers preferred this approach (see also, Bellomo, 2012). Analogy, or relating a morpheme within one word to a morpheme within another, will be part of application practice and word building with word parts. This strategy is more effective when "awareness and knowledge are used in tandem," so it was anticipated that this process would become easier as the intervention progressed (Pacheco & Goodwin, 2013, p. 547). While often integrated into vocabulary instruction (Templeton, 2011/2012), analogy has a role in identification as well, as students learn to recognize morphemes as orthographic units (i.e., Ehri, 2005; Ehri & McCormick, 1998; Jenkins, 1987).

While the base of a word inherently carries more meaning than the affixes, because all prefixes and many suffixes are derivational, understanding how the addition of affixes changes words is an imperative part of recognizing and using morphologically complex text (Pacheco & Goodwin, 2013), even from a very young age (Zoski & Erickson, 2016). Using such approaches as peeling and the Word-Part Strategy can aid

Table 4

Instructional Targets, Meaning, Lesson Number, and Sample Words

Instructional Targets	Meaning	Part of Speech	Lesson Introduced	Sample Words
Syllable Types				
Closed	—	—	1	*c**a**t, spl**a**sh, j**u**mp, b**i**g*
Open	—	—	1	*s**o**, m**y**, b**e**, w**e**, m**e***
VCe	—	—	2	*m**a**k**e**, str**i**p**e**, tr**o**p**e**, n**a**m**e**, fl**u**t**e***
VT	—	—	3	*t**ea**m, r**ai**n, b**oa**t, gr**ee**t, j**oi**n*
R-controlled	—	—	4	*f**ur**, b**ir**d, g**ir**l, c**or**n, b**ar**n*
Cle	—	—	5	*peo**ple**, cir**cle**, guz**zle**, spar**kle***
Schwa	—	—	6	***con**nect, **e**lect, pres**i**dent*
Prefixes				
dis-	not, opposite	—	7	***dis**tract*
non-	not	—	9	***non**sense*
de-	not, away, opposite	—	11	***de**struction*
in-/un-	not	—	13	***in**cessant, **un**natural*
pre-	before	—	15	***pre**view*
re-	again, back	—	17	***re**visit, **re**call*
pro-	before, in front		19	***pro**tective, **pro**active*
mis-	bad, wrong	—	21	***mis**spell*
inter-	between, across		23	***inter**ruption*
ad-/af-/al-/ap-/at-	to, toward		25	***at**tract, **ad**mit*
en-/em-/in-/im-	in, within	—	27	***en**velope, **em**body, **in**nate, **im**plant*

Instructional Targets	Meaning	Part of Speech	Lesson Introduced	Sample Words
con-/cor-/col-/com-	with, jointly	—	29	***con****nect,* ***cor****rupt,* ***col****lect,* ***com****mute*
ex-	out, outside; opposite of, not	—	37	***ex****terior;* ***ex-*** *boyfriend*
Suffixes				
-er/-or	one who, more	Noun,	7	*teach****er,*** *profess****or***
-ion/-sion/-tion	state, process, or condition of	Noun	9	*profes****sion,*** *celebra****tion***
-ly	in a specified manner	Adverb	11	*live****ly***
-ness	state of, condition of	Noun	13	*kind****ness***
-able/-ible	able to	Adjective	15	*do****able,*** *invis****ible***
-al/-ial	having characteristics of	Adjective	17	*pivot****al,*** *jov****ial***
-y	characterized by, being or having	Adjective	19	*luck****y***
-ful/-ous	full of	Adjective	21	*joy****ful****, joy****ous***
-(t)ure	act, process, condition	Noun	23	*nat****ure****, nomenclat****ure***
-ate	state or quality of; to put in the state or quality of	Noun/verb	25	*not****ate***
-ist	one who practices	Noun	27	*scient****ist***
-ive	inclined to	Adjective	31	*act****ive***
-ity/-ty	state of	Noun	33	*activ****ity,*** *uni****ty***
Latin Bases				
tract	to pull or drag	—	8	***tract****ion, ex****tract****, dis****tract****ion*
rupt	to break or burst	—	10	***rupt****ure, bank****rupt****, dis****rupt****ive*
port	to carry	—	12	*im****port****, sup****port****ive, de****port***
form	to shape	—	14	*re****form****, trans****form****, in****form****ant*
cred	to believe	—	14	***cred****it, in****cred****ible,* ***cred****ence*
ject	to throw, to lie	—	16	*pro****ject****, con****ject****ure, re****ject****ed*

Instructional Targets	Meaning	Part of Speech	Lesson Introduced	Sample Words
aud	To hear, to listen	—	18	***aud****io, in****aud****ible, **aud****ition*
stru, struct	to build	—	20	***struct****ure, con****true****, in****stru****ment*
scrib, scribe, script	to write	—	22	***scrib****ble, in****script****ion, tran****scribe***
spec, spect	to see	—	24	***spect****acle, per****spect****ive, **spec****ial*
vis/vid	to see	—	24	*ad****vis****e, e****vid****ent, **vis****ual*
dic, dict	to say or tell	—	26	*pre****dict****, e****dict****, in****dic****ate*
flect, flex	to bend	—	28	***flex****ible, genu****flect****, in****flect****ion*
mit, miss	To send	—	30	***mis****sion, re****miss****, com****mit***
ven, vent	To come	—	32	*con****ven****e, pre****vent****able, ad****vent****ure*
duc, duce, duct	To lead	—	34	***duc****ation, pro****duce****, con****duct***
vert, vers	To turn	—	36	*con****vert****, sub****vers****ive, **vers****us*
fac, fact, fec	To make, to do	—	38	*satis****fact****ion, **fac****ility, ef****fec****tive*
pel, puls	To drive, to push	—	39	*com****pel****, com****puls****ive, re****pel****lant*
pend, pens	To hang, to weigh	—	39	***pend****ing, **pens****ive, sus****pens****e*

Note. All Latin bases are infinitives before affixes are added, which can determine the part of speech.

students in identification and connection-making (Lovett et al., 2000; Manyak et al., 2018). Additionally, modeling flexible syllabication processes through think-alouds and class discussion/interaction allows students to practice before working independently.

Drill Cards. Each student created and kept a set of notecards for each instructional target. Prefix cards, suffix cards, and base cards were different colors. On the front of each card, the student wrote the instructional target. On the back of the card, the student wrote the meaning(s) of the instructional target, the syllable type, illustrative words, and, if applicable, the part of speech. See Appendix C for an example of each type of card.

During drill review, students focused on automatically identifying the target (reading the morpheme), spelling, meaning, and/or part of speech. Writing the instructional targets helps reinforce orthographic representations of the morphemes (Birsh & Carreker, 2018), and attending to meaning, spelling, and function improves lexical quality (Perfetti, 2007). This approach is used in structured literacy with morphological components (Birsh & Carreker, 2018; Fallon & Katz, 2020; IMSE, 2016a).

Application Activities. Application activities for new concept lessons include word-building graphic organizers (e.g., word maps, word sums, word trees) and whole group generation activities. The same four graphic organizers were used across the intervention to control for loss of instructional time in teaching completion of new forms.

Graphic organizers were taken or adapted from the Institute for Multisensory Education, which is included in their Advanced Continuum training manual reproducible resources. While the meaning is not an instructional target of this intervention,

morphemes inherently carry meaning, and connecting meaning to orthographic representations can increase the automaticity of recognition (Birsh & Carreker, 2018; Perfetti, 2007). Therefore, some application activities focus on definitions, semantic deconstruction, and/or meaning connections.

Syllabication. The words presented during syllabication practice were taken either from *The Syllable Division Book* (IMSE, 2019) or are researcher-compiled or -adapted using previously taught instructional targets.

Connected Text Passages. Eight researcher-made connected text passages were used across the intervention. Each passage corresponded to the concepts taught the week it was introduced and could have included any concept previously taught. Passages were run through Coh-metrix and analyzed for complexity. However, the skills targeted in each passage were the criteria for inclusion rather than overall text complexity. High-frequency sight words (decodable and non- found on the Fry or Dolch list), predictably patterned syllables (previously taught), words containing explicitly taught morphemes, and a combination of the above were included in passages. New passages were presented approximately every four lessons and used for repeated practice for four lessons, beginning in week two. “The use of rigorous texts allows students to apply morphemic analysis when decoding or figuring out the meaning of morphologically rich words found in many complex nonfiction and fiction books” (Claravall, 2016, p. 197). The texts designed for this study spanned Flesch-Kincaid Grade-Level Readability from 4.11 to 11.88, and included both narrative and expository text. Appendix D includes all connected text passages. Appendix E includes Table 11, which provides the descriptive statistics for the connected text passages.

Measures

A battery of measures was used to determine if students met the criteria for participation (i.e., a deficit in word-reading). Once students were identified, they participated in additional tests of morphological knowledge and morphologically complex word reading. All measures were administered at pretest and posttest.

The Wechsler Individual Achievement Test, 3rd edition (WIAT-III)

The WIAT-III (Psychological Corporation, 2009) is an individually administered achievement test normed for ages 4:00 to 50:11 years. The subtests administered from this assessment ensure that students with decoding deficits are identified for the study. The tests and subtests have test-retest reliability ranging from .90 to .94 for students in grades 6 through 12 (Psychological Corporation, 2009).

This test was used pre- and post-intervention. The pretest provided baseline reading data and criteria for inclusion in the study. The following subtests were administrated: Word Reading and Pseudoword Decoding. Students who scored at or below the 30th percentile were eligible for participation in the experiment. The Word Reading subtest was used as a proximal measure for word reading of more complex words. The WIAT-III Word Reading subtest consists of 75 items, with a discontinue rule of four consecutive incorrect responses. Words start simpler and become more complex. Forty-five of the 75 words contain more than one syllable, and over 25% of the total words are derived. Students performing more than one standard deviation below the mean on this test are less likely to encounter as many multisyllabic derived words. However, the measure is still an appropriate proximal measure of intervention outcomes

based on the opportunities provided to read multisyllabic derived words during administration.

Test of Word Reading Efficiency 2 (TOWRE-2)

The TOWRE-2 (Torgesen et al., 2012) is often used for early identification and diagnosis of reading disabilities and is designed to assess individuals between 6 to 25 years of age. The TOWRE-2 consists of two subtests—Sight Word Efficiency (SWE) and Phonemic Decoding Efficiency (PDE)—with four equivalent forms available for each subtest. Its correlations to additional comparable word reading and phonemic decoding measures range from .89 to .96. Its administration identified participants with the desired reading deficit profile for participation in the study, and its administration is only 45 seconds. Students who scored at or below the 30th percentile on this *and* the WIAT-III were eligible for participation in the study.

Test of Morphological Knowledge

The compiled test of morphological knowledge consists of 150 items that were analyzed. All analyzed parts of the test were read aloud to the participants. Each subcomponent of the test is connected to one or more teachable skills (Goodwin et al., 2019). The skills are as follows:

Skill 1: Students can identify units of meaning.

Skill 2: Students can use suffixes for syntactic information.

Skill 3: Students can use morphology for meaning.

Skill 4: Students can read and spell morphologically complex words.

Cooper (2017) modification of Carlisle (2000). Cooper's (2017) modification of Carlisle's (2000) morphology survey comprises the first 30 items of the test. Part one of

this section asks students to derive a word by adding affixes to a provided base word to complete a sentence (i.e., *expand* to *expansion*). Part two of this section asks students to decompose a derived word by removing affixes from a provided base word to complete a sentence (i.e., *reliance* to *rely*). Cooper's (2017) modification connects to all four skills. This section also relates to a combination of morphemic analysis and morphemic processing tasks from Goodwin et al. (2017). This section of the morphological test has an internal reliability of .82 based on the sample for this study.

Base Word Knowledge and Meaning Knowledge. This section has 100 items and assesses various areas of morphological knowledge. Because the items in these sections are not necessarily directly taught during the intervention instruction, these sections are treated as distal measures of intervention outcomes.

Base Word Knowledge presents 50 words and asks participants to identify the simplest base word the target word was derived from three choices. This section of the test corresponds to Skill 1. This relates to an analysis task that Goodwin et al. (2017) used, which asked participants to determine whether pairs of words were morphologically related.

Meaning Knowledge presents the same 50 words and asks participants to select the most appropriate definition for the word from three choices (Skills 1 and 3). This measure corresponds to morphological processing skills related to meaning (Goodwin et al., 2017). The internal reliability of these sections together for this study was .91.

Latin Base Knowledge and Affix Knowledge. Twenty items comprise this section. The first 10 items ask students to match ten Latin bases to their morphological meaning, and the second 10 items ask them to match ten affixes to their morphological

meaning (Skills 1 and 3). This section was specific to this study's instructional targets and was designed to gauge explicit knowledge gained on morpheme meaning and serves as a proximal measure of intervention outcomes. All 20 items together had an internal validity for this study of .79. Latin Base Knowledge's 10 items had internal validity of .73, while the Affix Knowledge section's internal validity was .59.

This test is not normed, but it is based on various domains of morphological knowledge and morphological skills (Goodwin et al., 2017; 2019). See Table 5 for summarization of test and corresponding skills.

Multisyllabic Derived Word List

Consisting of 32 multisyllabic, derived words, this researcher-made list of morphologically complex words served as a proximal measure of intervention outcomes. The words on the list were created from the instructional targets of the intervention, but the words were not necessarily directly taught during the intervention. This is not a normed measure but assessed the accuracy of word reading of multisyllabic derived words by participants at pretest and posttest. Internal reliability for this sample is .91. Across the literature, effects were larger for researcher-designed measures than standardized measures (Goodwin & Ahn, 2013), which is another reason this study will use the WIAT-III Word Reading subtest as an additional proximal measure for comparing the outcomes of the experimental and control groups of participants. The researcher-designed test is available in Appendix F.

Procedure

Participants were recruited from two subsets of 9th and 10th graders with an Individualized Education Plan (IEP). Participants for the experiment group were recruited

Table 5

Researcher-Designed Test of Morphological Knowledge Domains and Examples

Section	Skill[a]	Sample Item
Cooper (2017) modification Carlisle (2000) morphology survey	1, 2, 3, 4	Perform. Tonight is the last _____. (performance)
Base Word Knowledge	1	Malformed a. med b. form c. mal
Meaning Knowledge	1, 3	Malformed a. evilly made b. shaped bad or wrong c. made well
Latin Base and Affix Knowledge	1, 3	struct = to build

[a] Skill 1: Students can identify units of meaning. Skill 2: Students can use suffixes for syntactic information. Skill 3: Students can use morphology for meaning. Skill 4: Students can read and spell morphologically complex words (Goodwin et al., 2019).

from reading intervention classes provided in the resource classroom for students served under special education. Participants for the control group were recruited from 9th and 10th-grade students with an IEP who scored below the 30th percentile on their most recent (within a year) Measures of Academic Progress (MAP) screener in reading (Thum & Kuhfeld, 2020). Informed consent and assent for pretest and posttest was obtained from parents and participants. All qualifying participants were tested with the researcher-designed Test of Morphological Knowledge and Multisyllabic Derived Word List before the ten-week intervention began.

Once all pretesting was complete, the experimental group began receiving the intervention. The intervention was designed to be 40 lessons of approximately 30 minutes each. During implementation, each lesson averaged 47 minutes, making the projected total instructional time of the intervention approximately 30 hours. Twenty-eight lessons were completed during the experiment for a total of approximately 22 hours. Class periods were 55 minutes long three days a week and 90 minutes two days a week. On the 90-minute block days, students split their schedule, so each participant was in intervention four days a week. The intervention took place across 10 weeks of school in the spring semester of the 2021-2022 school year.

The control group did not participate in a targeted reading intervention class and continued their academic classes and electives as scheduled. The researcher and building-level administrators performed fidelity checks. Due to observing different lessons, interrater reliability could not be calculated.

Design

This study is a pretest-posttest quasi-experimental design that aimed to measure morphological knowledge and the ability to read multisyllabic derived words accurate between a group that received no targeted morphological intervention and a group that received explicit instruction in morphological components and strategies. The independent variable is the administration of the intervention, or group. The dependent variables were morphological knowledge, as measured by the Test of Morphological Knowledge. and word reading accuracy of multisyllabic derived words, as measured by the Multisyllabic Derived Word List and the Word Reading subtest of the WIAT-III.

General word reading and decoding skills were assessed at both pretest and posttest. These measures (WIAT-III, TOWRE-2) determined inclusion criteria by identifying students with a word reading-related deficit if they scored below the 30th percentile on both measures. While performance on the TOWRE-2 may improve, due to its design, it is unlikely to provide information on participant performance in reading multisyllabic words with at least one affix. The WIAT-III Word Reading subtest was used as a secondary proximal measure.

The Test of Morphological Knowledge presents a variety of tasks that relate to one or more of four skills identified by Goodwin et al., 2019: identifying units of meaning, using suffixes for syntactic information, using morphology for meaning, and reading and spelling morphologically complex words. Scores from different sections were analyzed to address research question 1.

Analytic Approach

While several comparable studies have used a variety of analytic approaches to answer their specific research questions, the analyses proposed here are consistent with the literature and informed by the current study's design. A t-test was used to compare the two groups on the WIAT-III assessment to confirm equivalence before the intervention. The TOWRE-2 was used as a qualifying criterion but was not analyzed due to its administrative rules and the unlikelihood of participants engaging with complex words. Descriptive statistics, including sex, age, and grade, were also reported to characterize participants in the experimental and control groups.

To compare the two groups' growth from the pretest to posttest, a series of ANCOVAs compared performance at posttest between the experimental and control groups on the Multisyllabic Derived Word List, the WIAT-III Word Reading Subtest, and on each section of the Test of Morphological Knowledge as dependent variables, while controlling for performance on these measures at pretest. The use of ANOVAs, ANCOVAs, or t-tests is consistent in the intervention literature to compare the two groups from pretest to posttest.

Effect sizes for Hedge's *g* were calculated to determine practical efficacy regardless of statistical significance. Hedge's *g* was chosen over Cohen's *d* due to the differences in group size. Much of the reviewed literature reported Cohen's *d* values. Because the calculated *g* and *d* values for the results of this study were always within two one-hundredths of one another, original values are reported in this section with clear designation of whether it is a Hedge's *g* value or a Cohen's *d* value.

In addition, while the researcher hoped to see significant differences between the growth of the experiment and control groups, limitations in statistical power may result in practical effects that do not meet the criteria to be labeled as statistically reliable.

Research Question 1 explored the effect of the morphological-based intervention on students' morphological knowledge. It was predicted that the morphological knowledge of the experimental group would improve to a greater degree than the control group. Research question 1 was addressed by comparing performance on the Test of Morphological Knowledge at posttest between the experimental and control groups while controlling for performance on the Test of Morphological Knowledge administered at pretest.

Research question 2 addressed the impact of an intervention explicitly teaching structural word analysis and Latin roots and derivational affixes on students' abilities to read multisyllabic and morphologically complex words. It was predicted that the experimental group would experience greater gains in reading multisyllabic derived words accurately than the control group. Research question 2 was addressed by comparing performance at the posttest on the Multisyllabic Derived Word List and the WIAT-III Word Reading subtest while controlling for performance on these measures at pretest.

The Multisyllabic List of Derived Words served as a more proximal measure than the WIAT-III Word Reading subtest. It was created to contain morphologically complex, multisyllabic words. These words were designed based on the instructional targets (morphemes) taught during the intervention but were not necessarily words explicitly taught during the study. By looking at posttest performance while controlling for

performance at the pretest, the analysis can confirm whether the experiment group grew in their accuracy and ability to read multisyllabic derived words more than the control group, who did not receive explicit instruction in morphological concepts during the 10-week intervention period.

CHAPTER FOUR

RESULTS

Data from this study were analyzed using ANCOVAs to answer the two research questions proposed. Levene's test for equality of variance was run on all ANCOVAs. All analyses met the assumption of equal variance.

Research Questions

Research Question 1

What effect does the morphological-based intervention have on students' morphological knowledge?

To address research question 1, performance on a researcher-compiled test of morphological knowledge was analyzed. Latin Base and Affix Knowledge comprise the proximal measures within this larger test. In contrast, the other sections (Cooper, Base Word Knowledge, and Meaning Knowledge) serve as distal measures of morphological knowledge. The items in these sections were not explicitly taught in the intervention scope and sequence. The entire test can be found in Appendix G. Refer back to Table 5 for information on each section, its corresponding skill(s), and a sample item. A full description of the measure is found in Chapter 3.

Performance at post-test served as the dependent variable while controlling for performance at pretest. Tables 6 and 7 present non-adjusted mean scores at pre and posttest, as well as mean difference. Table 7 also includes the range of scores. See Table 8 for full results of ANCOVA on performance at posttest while controlling for performance at pretest.

Table 6

Researcher-Designed Test of Morphological Knowledge from Pre to Post Test

Test section	Experiment Group						Control					
	Pre		Post		Diff		Pre		Post		Diff	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cooper												
Derivation[a]	2.94	1.80	3.11	2.30	0.17	1.58	1.80	1.30	2.00	2.35	0.20	2.05
Decomposition[b]	5.28	1.73	6.28	2.47	1.00	2.57	3.20	3.11	3.60	3.36	0.40	0.55
Total[c]	8.22	3.96	9.39	3.99	1.17	3.05	5.00	4.30	5.60	4.83	0.60	2.51
Dainty												
Base Word Knowledge[d]	33.39	6.53	31.06	8.97	-2.33	8.25	29.00	10.07	35.20	7.66	6.20	5.58
Meaning Knowledge[e]	34.17	5.90	36.11	5.63	1.94	3.57	24.80	10.03	28.60	11.28	3.80	1.92
Part 4												
Latin Base Knowledge[f]	4.50	2.96	6.39	2.20	1.89	2.85	3.40	0.89	4.40	2.30	1.00	2.24
Affix Knowledge[g]	3.39	2.09	4.50	2.38	1.11	2.30	1.20	0.84	1.80	1.30	0.60	1.82
Total[h]	7.89	4.51	10.89	3.38	3.00	4.34	4.60	1.14	6.20	2.95	1.60	3.58

Note. Scoring on the Cooper (2017) modification of Carlisle (2000)'s morphology survey is reported according to lax spelling rules. Credit was awarded as a correct answer if the word was morphologically correct, even if spelled incorrectly within two errors. For example, if a student was supposed to write *expansion* and wrote *expandtion*, the participant was marked correct. While orthography and spelling is part of morphological knowledge, this analysis decision is appropriate as it allows the change in morphological knowledge to be better measured rather than orthographic memory. Reported values based on non-adjusted means. Diff = difference

[a] 15 possible items

[b] 15 possible items

[c] 30 possible items

[d] 50 possible items

[e] 50 possible items

[f] 10 possible items

[g]10 possible items

[h] 20 possible items

Table 7

Multisyllabic Derived Word List from Pre to Post Test

Measure	Experiment Group							Control Group						
	Pre		Post		Diff		Range	Pre		Post		Diff		Range
	M	*SD*	*M*	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	*M*	*SD*	
MDWL[a]	16.00	6.81	19.72	6.80	3.72	3.02	1-26	8.60	7.57	10.80	8.96	2.20	2.68	1-19
WIAT-III WR[b]	69.67	12.48	77.50	16.80	7.83	10.67	-11-32	61.60	16.09	63.00	18.28	1.40	3.51	-2-7

Note. MDWL = Multisyllabic Derived Word List; WIAT-III-WR = Wechsler Individual Achievement Test (3rd ed.) Word Reading Subtest.

[a] 32 possible items

[b] Standard Score (*M* = 100, *SD* = 15)

Table 8

Performance at Posttest on The Test of Morphological Knowledge: ANCOVA

Test section	Experiment Group		Control Group		F^a	g^b
	M_{adj}	*SE*	M_{adj}	*SE*		
Cooper						
Derivation[c]	2.87	0.41	2.85	0.80	0.000	0.01
Decomposition[d]	6.00	0.51	4.61	1.00	1.479	0.64
Total[e]	8.85	0.68	7.52	1.32	0.750	0.45
Researcher-Designed						
BWK, MK[f]	64.90	1.85	71.95	3.69	2.741	-0.89[j]
Latin bases[g]	6.31	0.50	4.68	0.95	2.312	0.78
Affixes[h]	4.26	0.49	2.66	1.00	1.924	0.75
LB, AK[i]	10.61	0.82	7.19	1.62	3.429	0.97

Note. Scoring on the Cooper (2017) modification of Carlisle (2000)'s morphology survey is reported according to lax spelling rules. Credit was awarded as a correct answer if the word was morphologically correct, even if misspelled within two errors.

BWK = Base Word Knowledge; MK = Meaning Knowledge, LB = Latin base; AK = Affix Knowledge

[a] *F*-value indicates the effect of group at posttest while controlling for performance at pretest

[b] *g* indicates Hedge's *g* value's calculated from adjusted mean values

[c] 15 possible items

[d] 15 possible items

[e] 30 possible items

[f] 100 possible items

[g] 10 possible items

[h] 10 possible items

[i] 20 possible items

[j] Effect in favor of the control group

Proximal Measures. Knowledge of Latin bases and affixes was addressed in the final section of the Test of Morphological Knowledge. These two subtests consist of items directly taught in the intervention material and therefore served as a proximal measure of morphological knowledge. When comparing performance across the summed total score of items from both subtests, the experimental group (M = 10.61, SE = 0.82) correctly answered more items than the control group (M = 7.19, SE = 1.62) after controlling for performance on the test before the start of the intervention. However, group was not a statistically significant factor when controlling for performance at pretest, $F_{(1, 20)} = 3.429$, $p = .08$, $g = 0.97$. Observed power on this analysis was .42.

Both outcomes favored the experimental group when Latin bases and affix knowledge were analyzed separately. For the section consisting of Latin bases and their meanings, the experimental group (M = 6.31, SE = 0.50) correctly answered 1.64 more items on average than the experiment group (M = 4.68, SE = 0.95) on this 10-item test. However, this was not a statistically reliable difference. Group was not a significant factor when controlling for performance at pretest, $F_{(1, 20)} = 2.312$, $p = .14$, $g = 0.78$. Observed power was .30. When tested on affixes and their meanings, on average the experiment group (M = 4.26, SE = 0.49) correctly answered 1.60 items more questions than the control group (M = 2.66, SE = 1.00). Again, group was not a significant factor after controlling for performance at pretest, $F_{(1, 20)} = 1.924$, $p = .18$, $g = 0.75$. Observed power was .26.

Distal Measures. The Cooper (2017) modification of Carlisle's (2000) morphology survey and researcher-designed Base Word Knowledge and Meaning Knowledge sections of this test served as distal measures of morphological knowledge.

Cooper (2017) modification of Carlisle (2000). This measure asks students to either derive words from provided base to complete a sample sentence or decompose words from provided derived words to complete a sample sentence. Correct responses were based on lax spelling expectations. The word was counted as correct if a student was within two errors. For example, if the expected correct response was *expansion* and the participant wrote *expandtion*, it was counted as correct under lax spelling rules. While orthography and spelling are part of morphological knowledge, this analysis decision is appropriate as it allows the change in morphological knowledge to be better measured rather than orthographic memory or spelling.

Estimated group marginal means for the two groups at posttest while controlling for performance at pretest show that the experiment group correctly answered more items on average (M = 8.85, SE = 0.68) than the control group (M = 7.52, SE = 1.34). However, this difference was not statistically reliable after controlling for performance on the measure at pretest, $F_{(1, 20)} = 0.750$, $p = .40$, $g = 0.45$. Observed power was .13.

The two subsections were also analyzed separately. The experiment group (M = 2.87, SE = 0.41) and control groups (M = 2.85, SE = 0.80) had equivalent performance on the 15 item derivation task, $F_{(1, 20)} = 0.000$, $p = .98$, $g = 0.01$. Observed power on this analysis was .05. In contrast, on the decomposition task, the experiment group (M = 6.00, SE = 0.51) correctly answered more items on average than the control group (M = 4.61, SE = 1.00). However, the differences was not statistically reliable, $F_{(1, 20)} = 1.479$, $p = .24$, $g = 0.64$. Observed power was .21.

Researcher-designed Sections. Base Word Knowledge and Meaning sections comprise two sections of the researcher-designed portion of the Test of Morphological Knowledge.

When the sum of the correct items answered on the Base Word Knowledge and Meaning Knowledge tests were analyzed, the control group (M = 71.95, SE = 3.69) outperformed the experiment group (M = 64.90, SE = 1.85). After controlling for performance at pretest, group was not a significant factor, $F_{(1, 20)} = 2.741$, $p = .11$, $g = 0.89$. Observed power was .35.

Research Question 2

What impact did the intervention explicitly teaching structural word analysis, Latin roots, and derivational affixes have on students' abilities to read multisyllabic and morphologically complex words?

To address this question, performance at the posttest on the Multisyllabic Derived Word List was analyzed, as well as performance at the posttest on the WIAT-III Word Reading Subtest, while controlling for performance at the pretest. Estimated marginal means are reported, and all analysis met the assumption for equal variance.

The Multisyllabic Derived Word List consisted of 32 multisyllabic derived words constructed from instructional targets from the intervention treatment group materials and serves as a proximal measure. These words contained morphemes that were explicitly taught along with syllabication rules, but the items themselves were not explicitly taught. At posttest, the experimental group (M = 18.19, SE = 0.73) correctly read an average of 1.87 more words than the control group (M = 16.32, SE = 1.46. However, this difference was not statistically reliable after controlling for performance at pretest, $F_{(1, 20)} = 1.239$, $p = .28$, $g = 0.60$. Observed power was .18.

On the WIAT-III Word Reading subtest, which served as a secondary proximal measure of complex word reading, the experiment group (M = 74.95, SE = 2.03)

outperformed the control group (M = 69.17, SE = 3.93). After controlling for performance at pretest, group was not a significant factor at posttest, $F_{(1, 20)} = 1.668$, p = .21, g = 0.67. Observed power was .23. Full results for group are reported in Table 9.

The comparison of effect sizes between reviewed literature and the current study is warranted, especially due to the low observed power of the analyses. While the WIAT-III Word Reading subtest was analyzed as a proximal measure in research question 2, it is used here as a standardized measure of basic word reading to allow for more direct comparisons to other standardized word reading and word identification assessments. Table 10 shows the effect sizes of the current study, reported earlier in this chapter, compared to the reported effect sizes from the studies reviewed in Chapter 2.

Table 9

Performance at Posttest on The Multisyllabic Word List and WIAT-III Word Reading: ANCOVA

Test	Experiment Group		Control Group		F^a	g^b
	M_{adj}	*SE*	M_{adj}	*SE*		
MDWL[c]	18.19	0.73	16.32	1.46	1.239	0.60
WIAT-III WR[d]	74.95	2.03	69.17	3.93	1.668	0.67

Note. MDWL = Multisyllabic Derived Word List; WIAT-III WR = Wechsler's Individual Achievement Test, (3rd ed.), Word Reading subtest

[a] *F*-value indicates the effect of the group at posttest while controlling for performance at the pretest

[b] *g* indicates the effect of the estimated mean difference between groups at posttest while controlling for performance at pretest

[c] 32 possible items; scores reflect the number of correct

[d] Standard score ($M = 100$, $SD = 15$)

Table 10

Comparison of Effect Sizes in Current Study and Reviewed Literature

Study	Outcome Measure and Effect Sizes		
	Basic Word Reading	Morphologically Complex Word Reading	Morphological Knowledge
Dainty (2022)	0.67	0.60	0.53-0.97
Apel et al. (2013)	0.50-0.87^{+}	—	0.74-2.96^{+}
Georgiou et al. (2021)	0.98^{+}	—	0.71^{+}
Gray (2019)*	0.12^{+}	2.47^{+}	2.60^{+}
Kim et al. (2016)*	0.20^{+}	—	0.18^{+}
Lovett et al. (2017)*	0.45^{+}	0.57^{+}	—
Moats (2010)*	0.39^{+}	—	—
Toste et al. (2017a)	0.31	—	—

Notes. No superscript + = Hedge's *g*, Superscript + = Cohen's *d*

— No reported effect sizes within the study

* Studies focused on secondary grade participant

CHAPTER FIVE

DISCUSSION

Research on the use of morphology as a component of intervention in remediating reading deficits has increased over the past twenty years. As a result, it has been learned that morphological awareness contributes uniquely to multiple areas of reading, surpassing phonological awareness after the fifth grade (Kuo &Anderson, 2006; Mann & Singson, 2003; Nagy et al., 2006; Nagy et al., 2013). While beneficial for younger students, morphology as an instructional component for older students is of particular interest because of the large number of morphologically complex words in rigorous texts they are expected to read. However, far less is known about how to intervene than whether or not morphology supports reading development. Current intervention research involving morphology shares many common strategies and approaches, as discussed in Chapter 2. To add to the existing research, this study examined the effects of a morphological intervention on the ability of 9th and 10th-grade students with a reading disability to read multisyllabic derived words. The intervention was designed to integrate common strategies and activities to enhance morphological awareness and knowledge.

Participants were eligible for inclusion in the current study if they scored below the 30th percentile on the WIAT-III Word Reading and TOWRE-2 Sight Word Efficiency subtests. Participants assigned to the experimental group were to receive 20+ hours of instruction across 40 lessons spanning 10 weeks. In contrast, the control group did not receive any reading intervention during their school day. The experimental group completed 28 of 40 lessons and received over 20 hours of instructional time, as lesson length averaged 47 minutes.

Research Question 1

What effect does the morphological-based intervention have on students' morphological knowledge? This question sought to highlight the relationship between a direct, systematic morphological intervention, comparable to those found in the current literature, on the levels of morphological knowledge students had before and after instruction. While it was predicted that the participants in the experiment group experience greater gains in their morphological knowledge than participants in the control group, this was only the case for portions of the test containing items directly covered in instructional time.

While some studies used standardized measures of morphological knowledge, many used a series of tasks or activities to capture participants' morphological knowledge and awareness. This study used a researcher-compiled measure. The first section of the test is Cooper's (2017) modification of Carlisle's (2000) morphology survey, in which students have to first derive words from a given word to fit a sentence and then decompose words from a given word to fit a sentence. The other sections of the test were researcher-created and designed to correspond to morphological skills and domains of morphological knowledge identified in the literature (Goodwin et al., 2017; Goodwin et al., 2019).

The estimated marginal means for the Base Word Knowledge and Meaning Knowledge sections favored the control group. At pretest on the Meaning Knowledge section of the test, the experimental group scored 9.37 items higher on average (out of 50) than the control group. On the last section, which covered items directly scripted into the intervention material (Latin Bases and Affixes), the experimental group already

performed 3.21 items out of 20 possible correct responses higher at pretest. When controlling for the pretest, the experimental group performed 3.42 items higher at posttest than the control group, accounting for 17% of the possible items.

The results favoring the control group on the distal measure portions of the test of Morphological Knowledge, at a glance, look as though the intervention did not work and perhaps even produced regression in skills. However, when looking at individual item responses, it was observed that the experiment group overgeneralized some explicitly taught skills. For example, participants in the experiment group over-utilized affixes taught during the intervention (e.g., *conveytion* for *conveyance/conveyor*) and selected foils in the multiple choice that mimicked morphemes that appeared during instruction. Overgeneralization occurs when "learners encounter a new rule or pattern in the target language" and then "assume the rule or pattern operates without exception" (Scovel, 2001, as cited in Linguistic Variety, Global Society, n.d., para. 1).

This is part of language development but also occurs as students learn phonics patterns and apply them to reading and spelling (Ehri, 2005; Ehri & McCormick, 1998). It is not out of place for students without strong orthographic memories and weaker word reading skills to overgeneralize skills to unfamiliar words when trying to spell them. The discrepancy in the performance of the experiment group may be a misapplication of the instructional content. Since this cannot be confirmed without further assessment, the question remains whether or not the intervention improved their morphological knowledge.

When looking at the portions of the test that served as proximal measures—Latin Base and Affix knowledge—results favored the experimental group. As these items were

directly taught during the intervention and performance in this section did not require the application of skills, just recall, it was expected that the experimental group would perform better than the control group. At posttest, the range of correct responses on Latin base and affix knowledge for the experiment group was 4-18 out of 20, while for the control group, it was 3-11. Most participants from the experiment group correctly answered at least 10 items on the posttest compared to the control group, who correctly answered at least six items.

The proximal measures most closely relate to Skill 1: Students can identify units of meaning, and Skill 3: Students can use morphology for meaning (Goodwin et al., 2019). The greater performance of the experimental group on the derivation and decomposition tasks on the Cooper's (2017) modification of Carlisle's (2000) morphology survey overlaps with these skills as well as Skill 4: Students can read and spell morphologically complex words. Reading morphologically complex words is the overarching dependent variable of the study, which question 2 looks at more directly.

Research Question 2

What impact did the intervention explicitly teaching structural word analysis, Latin roots, and derivational affixes have on students' abilities to read multisyllabic and morphologically complex words? This question looked at performance on two different word reading measures. One was researcher-designed (Multisyllabic Word List) with no ceiling rule and contained 32 multisyllabic derived words. The other (WIAT-III Word Reading) was standardized with a ceiling rule of four consecutive incorrect responses. While this measure was not composed entirely of multisyllabic derived words, forty-five

of the 75 words contain more than one syllable, and over 25% of the total words are derived.

Performance at the posttest on both the Multisyllabic Word List and the WIAT-III Word Reading subtest favored the experiment group as predicted. Controlling for performance at the pretest resulted in an estimated mean difference on the Multisyllabic Word List of 1.87 items. When looking at simple descriptive statistics, the experiment group's correct responses ranged from 3-28 compared to the control group's range of 2-25. Forty percent of the control group got at least 13 words correct on the post-test compared to 83% of the experiment group. In the experiment group, one student read only three multisyllabic derived words correctly (compared to one word at the pretest), but the next lowest performing student read 11 words correctly. Fifty percent of the experimental group read at least 21 words correctly at posttest, compared to only one student in the control group reading more than 13 words correctly.

On the WIAT-III Word Reading subtest, the experimental group performed better than the control group by an average of 5.79 standard score points when controlling for pretest performance. The average participant was 15.93 years old at the posttest. The difference between a standard score of 69 and 75 is the difference between reading 34 words correctly and 40 words correctly before hitting the discontinue rule. Improving performance by six items on a word reading measure with complex words has practical implications despite, in this case, having no statistical significance.

However, all of this must be interpreted with the differences in group numbers in mind. The control group only had five participants ($n = 5$) compared to the experiment group's larger sample ($n = 18$). Small samples are subject to minor changes influencing

results, and small sample size must be considered in interpreting the performance, especially that of the control group.

Effect Sizes

In analyzing the current study's effect sizes in comparison to the current literature, the effect size from the WIAT-III Word Reading subtest, while used as a proximal measure in other discussion, is used here as a measure of basic word reading. This allows more direct comparison to the current literature which utilized other standardized measures of word reading as outcome measures. The Multisyllabic Derived Word List is used as a measure of complex word reading, and the effect sizes from the Test of Morphological Knowledge are used to compare to other studies with reported effects on morphological knowledge and/or awareness. Refer back to Table 10 for comparison of the effect sizes of the current study to the reported effects from the reviewed literature.

Basic Word Reading

When looking at how morphological interventions affected basic word reading, the current study's effect of $g = 0.60$ is higher than all studies except Georgiou et al. (2021; $d = 0.98$) and the upper range of Apel et al. (2013; $d = 0.50$-0.87). Apel et al. (2013) found a range of effects ($d = 0.50$ to 0.87) on measures of word reading. These two studies looked at primary and elementary age students, though, and Apel et al. (2013) focused their instruction only on inflectional morphemes. When comparing the current study to the reviewed literature that focused on secondary students, the current study had larger effects than all of them. In fact, compared to the next largest effect size, reported by Moats (2010; $d = 0.45$), the current study's effect size is more than two-tenths higher,

which is indicative of practical implications (See Table 10). Therefore, the effects on word reading found in this study is promising for secondary students receiving a morphological-based intervention and that instruction's effects on basic word reading skills.

Complex Word Reading

Because many of these studies utilized measures that do not necessarily include multisyllabic derived words and therefore are not an appropriate or accurate proximal measure of complex word reading, it is important to look at the proximal measure of complex word reading next. The effect size for the experiment group in the current study on complex word reading, as measure by the 32-item Multisyllabic Derived Word List, was $g = 0.60$.

Only two other studies that reported effect sizes looked at complex word reading through a proximal measure. Gray (2019) reported an effect of $d = 2.47$ on their complex word reading task. However, Gray only tested their participants on target words directly taught during the intervention. This is different than the complex word reading measure of the current study, which included words derived from instructional targets but not whole complex words explicitly taught as instructional targets. This makes direct comparison difficult between the two studies.

Lovett et al. (2017), on the other hand, did utilize a complex word reading test, the Challenge Words Test, that was composed of multisyllabic words that were not part of instruction. They found an effect of $d = 057$. The closeness of these effects suggests promise for future research in this area. If the WIAT-III Word Reading measure is viewed as a secondary proximal measure ($d = 0.67$), the current study produced an effect

one-tenth higher than the reviewed literature, which is further indication of the need for more research in how morphological interventions can be leveraged to improve secondary student complex word reading skills.

Morphological Knowledge

Regarding the effect sizes from analyses on performance on The Test of Morphological Knowledge, *g* ranged from 0.53-0.97. Apel et al. (2013) found a range of effect sizes for all grades (though primary) on the morphological awareness tasks (d = 0.74-2.96). The current study produced an effect larger than Kim et al.'s (2016; d = 0.18) study, which focused on secondary students. Georgiou et al. (2021) had an effect at delayed posttest on morphological relatedness of d = 0.71. However, the effect size produced by Gray (2019; d = 2.60), which also involved secondary level students, was more than twice as large as the one produced by the proximal measures of the current study.

The effects of researcher-designed measures of morphological knowledge produced larger effects, which makes sense since researcher-designed measures tend to be more closely aligned to the instructional targets of the intervention. Even when looking only at studies involving secondary students, proximal measures, and their effect sizes, the current study produced a larger effect than Kim et al. (2016), but was more than 2.5 times smaller than the effect produced by Gray (2019). If the intervention had finished all lessons and intended hours of instruction, students in the experiment group might have improved their application of these skills as assessed through both distal and proximal measures, touching on all four skills outlined in Goodwin et al. (2019).

Currently, however, it is difficult to say that the intervention had the predicted effect on morphological knowledge.

Limitations

An obvious limitation of the study was its sample size ($N = 23$) and the small control group ($n = 5$). Even minor changes from pre to posttest can influence results in smaller samples. The results might have been more reliable if the study were repeated with an equally sized experiment and control group.

Another limitation is the use of existing population pools to create study groupings. Randomized groupings would have helped control for inequalities at the pretest. While participants had to qualify for the study by having word reading difficulties confirmed by performance on pretest measures, the experiment was limited by the school's pre-existing schedule. Repeating the study with a larger sample and random assignment of participants to the experiment and control groups would strengthen the experiment.

Group did not produce a significant effect in any of the analyses, despite the overall models indicating significance. The performance at the pretest was a significant predictor of performance at the posttest in all measures except Latin Base Knowledge. The experimental group performed higher than the control group on all measures at the pretest. Performance on the Multisyllabic Word list at the pretest was statistically different between the groups ($t = -2.10$, $p = 0.05$). While the researcher controlled for performance at the pretest by using it as a covariate in the ANCOVA analysis, the fact that the groups were unbalanced in skill and size was a limitation. Completing the study with randomized, more equally varied groups at the pretest would be ideal.

Connections to skills outlined in Goodwin et al. (2019) were made to each section of the Test of Morphological Knowledge. It is a limitation of this study that formal validation of the measure and relationship to these skills were not established. This is further discussed in the next section.

Another limitation related to scheduling. Due to scheduling and end-of-year testing, the experiment group completed 28 of 40 lessons but received 21.93 hours of instructional time, as lesson length averaged 47 minutes. Two prefixes, two suffixes, and seven Latin bases were not covered that were initially scripted to be taught as part of the intervention provided to the experimental group. The twelve missed lessons included review lessons and extended practice with previously taught concepts, which may have affected performance on outcome measures. While this could have influenced the results, only one instructional target explicitly appeared on posttests that only appeared in lessons not included in the current study. The students lacked approximately nine hours of instruction and practice due to the shortened instructional period.

Summary and Next Steps

Direct, explicit instruction in morphology and word analysis strategies has research support. Traditional phonics instruction can be effective for older students with word reading deficits but may not address the types of words encountered in grade-level complex texts. Most multisyllabic, complex words are derived, so improving morphological awareness and knowledge and explicit attention to word parts has merit as an instructional strategy for middle and high school students with word reading struggles.

This study screened convenience samples for individuals with word reading deficits and then provided intervention to students scheduled for reading intervention

services. In contrast, the control group students received no specialized instruction in reading during their school day. The ratio of the experiment group to the control group was 3.6:1, with only 23 total participants. This resulted in an underpowered experiment without random assignment, which limited the variables that could be controlled during the analysis of results. Additionally, the experiment group scored higher at the pretest on all assessments, though these differences were not always statically significant. Ensuring equal variance through randomization would be an essential element of future research or iterations of this study.

In addition to the limitations it placed on grouping, scheduling also impacted the instructional time of the experiment. Due to daily schedule changes resulting from the end-of-year high stakes testing, benchmarking, universal screening windows, and final exams, the intended intervention was cut short by twelve lessons, equivalent to over nine hours of instructional and practice time and eleven instructional targets.

Despite these limitations, effect sizes suggested practical efficacy for the instructional model in reading multisyllabic derived words. Across most analyzed measures, both groups grew from pre to post-test. Even when the control group "outperformed" the experiment group at the posttest when controlling for the pretest, the control group's scores were often lower than that of the experiment group.

Some next steps would be conducting a validation study of the Test of Morphological Knowledge and the Multisyllabic Derived Word List. Validating these measures would provide weight to the results of future studies utilizing them. This would also allow for the relationships between subsections and skills outlined in Goodwin et al. (2019) to be analyzed differently. Does improvement in a particular domain or skill

related to morphological knowledge predict an improved reading of multisyllabic derived words?

Additionally, conducting the same or similar study at the start of the school year before state testing windows and end-of-year schedule conflicts, as well as randomizing the groupings, would control for more variables. The inequity of group performance at pretest as well as group size discrepancy are the two most problematic factors in the current study that should be remedied in future research. Since word reading deficits are prevalent in students not served under IDEA, pulling participants from special and, general education populations could provide statistically relevant and practically useful information as well.

The intervention included repeated practice with aligned, connected text passages. These were utilized as a part of the application activities but not as an assessment piece. Fluency was measured and tracked but not analyzed. Analyzing fluency gains on these passages in future implementations of the intervention could provide insight into the generalizability of the instructional efficacy of the intervention.

Lastly, while this study did not analyze a qualitative component, students completed surveys on the perceived effectiveness of the instruction on their reading abilities, their awareness of language, and their confidence levels about literacy. Around 52% of the responses were greater than neutral, affirming that the experiment group participants felt more equipped after the intervention. About 46% of participants in the experiment group thought they had improved for questions regarding word reading and decoding. Fidelity checks performed throughout implementation commented on the student engagement and responsiveness during lessons. Kim et al. (2016) and Toste et al.

(2017a) looked at student engagement and motivation. This may be essential to add to a future study on using morphological interventions to improve word reading skills in secondary-level learners.

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APPENDICES

APPENDIX A

Fidelity Check Form

Date of Observation: _____ Class Period Observed: _____
Observer: _____ Time Observed: From_____ to _____

Fidelity Check
Morphological Intervention

Structure and Pacing

Are materials readily available?	Yes	No	Not observed (partial class check)	Notes:
Did the lesson start in a timely manner?	Yes	No	Not observed (partial class check)	Notes:
Was the lesson finished within the allotted class time?	Yes	No	Not observed (partial class check)	Notes:

Instruction

Did the teacher teach all parts of the lesson?	Review Yes No Not observed (partial class check)	New Concept Yes No Not observed (partial class check)	Syllabication Yes No Not observed (partial class check)	Spelling Yes No Not observed (partial class check)	Reading Yes No Not observed (partial class check)
Were the students engaged, as visible through use of materials and participation through response to teacher?	Yes	No	Not observed (partial class check)	Notes:	
Did the teacher use PPT slides while teaching?	Yes	No	Not observed (partial class check)	Notes:	
Did students use their student workbooks interactively?	Yes	No	Not observed (partial class check)	Notes:	

Quality

Was there questioning and student response?	Yes	No	Not observed (partial class check)	Notes:
Did the students complete tasks that indicated student mastery or progress toward building knowledge?	Yes	No	Not observed (partial class check)	Notes:
Did the lesson include review, new content, application, and practice?	Yes	No	Not observed (partial class check)	Notes:

Additional Notes:

APPENDIX B

Sample Lesson Scripts

Lesson 11 Script
30 minutes Slide 279

1. Present morpheme pack with the following morphemes:

Dis-, non-, -er/-or, -ion/-tion/-sion, tract, rupt (Slides 280-285)

Have students spell the morpheme aloud and then say the morpheme. For example d-i-s, dis-
After each has been spelled and read, present -er/-or and tract separately and call on student to tell everything they know about the morpheme, including meaning, syllable type, part of speech, etc. Use slides 286-289 to confirm answers.

Slide 290: New Concepts.

Instruct students to get out a blue and yellow notecard.
Use slides 291-294 to complete cards for "de-" and "-ly." Draw attention that -ly is an adverb, which answers the question "how, when, or to what degree."

Direct students to put two cards on keyring and attach inside binder.

Slide 295: Graphic Organizer
T: Turn to graphic organizer in your binder. The top half is already populated with some of our previously taught concepts. Using the affixes and bases, create as many new words as you can at the bottom. You may work with a partner. Take 3 minutes to come up with as many words as you can and do your best to spell them correctly thinking about what you know about the word parts. Then we will share some.
After 3 minutes, ask for students to share some words and put them up on the board. If something is not a word, discuss.
T: Now choose one of the words we brainstormed and use it in a sentence. Let's review the expectations for sentences. (Present slide 296.)

Give them 2 minutes to come up with and write a sentence using one of the words they've written. Ask 2 students to share their sentences. Use slide 297 to determine if it meets expectation of the sentences.

3. Flexible Syllabication Practice

Use slides 298-303 to walk through a modeled example of flexible syllabication. Draw attention to circling familiar parts of the word and only syllabicating what is left.
Ask students what they think the word means. Then use Slide 304 to walk through literal meaning and compare it to everyday definition.

Slide 305: Independent Practice
Give students 4 minutes to independently syllabicate additional words. After four minutes, have students get with a partner and read the words to each other. Prompt them to discuss meaning as well. (306-309)
After time, put up "painstakingly" on slide 310 and walk through it.
T: I see -ly, so I am going to pull it off. (Slide 311). I also see 'ing' so I'm going to pull that off too. (Slide 312.) Then I am going to find the vowels that are left. (Slide 313.) I see 'ai' which is a vowel team that says long a. Now I have the syllable "stak" left. It looks closed. If I read it that way, painstackingly, it does not sound like a word I know. Let's look at it again. I know that when I add ing to a word that ends with a vowel, I drop the vowel to add the suffix. This word was likely "stake" and the silent e was dropped to add 'ing.' Let's add that in and read it then.(slide 314). "Painstakingly." That sounds like a word I know that means to be done with much care, effort, and thoroughness.

4. Encoding (315)

T: Put syllabication sheets away and turn to spelling dictation sheet.

Dictate the following words or word parts for spelling practice.

1. -ly, meaning in a specified manner. Spell the suffix -ly.
2. De-, meaning not, away, or opposite. Spell the prefix de-
3. Swiftly. Swift -ly. Spell the two syllable word Swiftly
4. Detraction. De – trac(t) – tion. Spell the word detraction. I hear the suffix de-, the base tract, and the suffix /shun/. Detraction
5. Ornately. Or -nate -ly. Spell ornately. The middle syllable nate is a vowel-consonate-e syllable.

T: Now we are going to write a short sentence. Pencils down and listen first.
He left abruptly the after the altercation.
Listen again: He left abruptly the after the altercation.
Let's say the sentence together: He left abruptly the after the altercation.
Let's count the words: He (1) left (2) abruptly (3) after (4) the (5) altercation (6).
Let's point to the paper as we say the sentence. He abruptly left the after the altercation.

Pick up your pencil and write the sentence. Sound out the words you aren't sure about and think about what you know about the syllables and sounds you hear. When you go spell altercation, know that 'al' spells /all/.

After 1 minute, prompt students to check for capital letter and period. Put up slide 316 for students to check their sentence.

5.Connected Text (Slide 317)

T: Take out connected text passage #1 that we've been reading. I am going to model the passage again, and then you are going to practice silently at your desk for two minutes

before getting with a partner to read aloud for one minute. You will not count your errors or total words read today. Just read.
After silent practice, put up 2 one minute timers. Have partners alternate turns.
After time:
T: Put this passage back into your folder.

Lesson 12
30 minutes, Slide 318

Step 1:

T: I am going to present the morphemes we've learned so far. You all will read them as quickly as you can. Present morpheme pack with the following morphemes:
Dis-, non-, -er/-or, -ion/-tion/-sion, tract, rupt, de-, -ly (Slides 319-326).

T: Now let's review some of our syllable types. Who can tell me the difference between open and closed syllables (call on someone). Someone give me an example of a vowel team. (Call on someone.) What is an r-controlled vowel and who can tell me the 5 main RC vowels? (Call on someone).

Slide 327: New Concepts.

Instruct students to get out a green notecard.
Use slides 328-329. Present the new base PORT. Have students suggest additional words that could be added to the examples on the back of the card.

Direct students to put card on keyring and attach inside binder.

Step 2. Slide 330: Graphic Organizer
T: Turn to graphic organizer in your binder. Remember another word for base is root. Write PORT at the bottom of the tree and the meaning "to carry" on the left. Work with a partner to populate your leaves with additional words containing "port."
After 3-4 minutes:
T: Now take one of the words and create a sentence with it. Remember the expectations for your sentences. (Present slide 331.)

3. Flexible Syllabication Practice

Use slides 332-337 to walk through a modeled example of flexible syllabication. Draw attention to circling familiar parts of the word and only syllabicating what is left.
Present slide 338. Ask a student to translate the word using the literally meaning of the morphemes. Then present slide 339-340 to confirm. Ask someone to give a current example or application for the word.

Slide 341: Independent Practice

Give students 4 minutes to independently syllabicate additional words. After four minutes, have students get with a partner and read the words to each other. Prompt them to discuss meaning as well.
Present slide 342-346 and have students read words together as a class.

4. Encoding

T: Put syllabication sheets away and turn to spelling dictation sheet.

Dictate the following words or word parts for spelling practice (Slide 347).

1. Port, base that means to carry. It has an r controlled verb. Spell port
2. Rupt, meaning to break or burst. Spell rupt
3. Tract, meaning to pull or drag. Spell tract.
4. Detract, meaning to pull or drag away. Spell detract
5. Disrupt, meaning to break apart. Spell disrupt.

T: Here is a challenge word for you with some word parts we've learned and some we are not. You will try to spell it on your own and then when I say so, you can check your work with a partner. Your challenge word is cotransportation. How many syllables does cotransportation have? (Take an answer from class. Model counting/division of syllables if needed.)
T: Spell cotransportation. I will tell you when you can get with a partner to check your work.

After 30-40 seconds, prompt students to partner up and check work.
T: Who thinks they spelled the word correctly? (Ask student to write word on the board for everyone. Walk through corrections as needed. Have students correct their work.)

5.Connected Text

T: Take out connected text passage #1 that we've been reading with the blanks for recording your words correct per minute. You are going to count your words correct per minute again and see if you reached your goal. Remember, an error is a word skipped, replaced with a different word, or read wrong. Get with your partner, decide who is going to go first, and get ready to read. (Set timer. After timer, remind students how to find WCPM). Subtract errors from total words read. Record your total. Did you meet your goal? (Repeat for other student.)

T: If you didn't reach your goal, that is okay. Raise your hand if you improved your wcpm, even if you did not reach your goal. Raise your hand if you did better than your goal. (Offer praise and feedback.)

T: Put the passage back in your folder and turn to Connected Text Passage #2. Follow along as I model the new passage. We will use this passage over the next four lessons. (Model passage. Discuss any words you feel are especially difficult. Direct students to close binder and put away.)

Appendix C

Drill Card Examples

Examples of notecard formatting, including syllable, type, definition, and example words.

prefix	open syllable
pre-	before Examples: preview, preheat, premonition

suffix	noun	schwa
-ion -tion -sion	act, state, process, or condition of Examples: election, vision, union	

base	closed
tract	to pull or drag Examples: tractor, subtraction, attract

APPENDIX D

Connected Text Passages

Eight connected text passages featuring derived words with instructional components were integrated into the intervention. The eight passages follow.

Connected Text Passage #1

Mister Parker knew a disaster was coming. He looked out the window and saw a dark cloud looming on the horizon. He went to his closet and took out his warmest coat. He had to be the protector of those weaker than he was. Outside, the distress on the faces of those all around him was clear, but he could not let that distract him. He started his car. His tires struggled to find traction on the slick streets, but he drove slowly toward his destination.

When he got to the headquarters, he saw that he was the last to arrive. All the other caped crusaders were already present. They were local residents who had committed themselves to fighting crime. The group was a misfit gathering of all sorts of people. Miss Slagle was a preschool teacher with a mohawk. Johnny Sloan was an ex-convict who had pledged to turn his life around. Sally Mathers was a body builder with biceps like large rocks. Mr. Parker may have been the most out-of-place looking one in the bunch. There was nothing special about his appearance, and he was immediately insecure.

When the meeting began, he sat off to the side biting his nails. A man in a hockey mask laid out the plan. There was a spree of crimes at the mall the weekend before. They would go to the mall in shifts and keep lookout. After their assigned time, they'd report back. Mr. Parker's hands were quaking as he took his first job from the supervisor. He wasn't sure about this, but he was ready to battle dangerous forces in the community.

Connected Text Passage #2

The disruption came in the form of a loud clanging sound that rebounded off the walls and echoed in her ears. She woke up with a startle and careened around, trying to find the source of the noise. Allison noticed a portion of her window was smashed, a jagged, sharp mouth of teeth glinting at her from across the room. She rushed to the broken glass and peered out. A blur of stomping feet cascaded down the fire escape. Allison grabbed a sweater and slowly opened the threatening window. She departed with care, being sure not to contact the sharp edges.

Once outside, she tried to see where the perpetrator had vanished to. There was nothing in any direction, as far as she could see. She descended the steel steps, the clanging noise exactly what had woken her minutes earlier. On the ground, public transportation hummed down the slick city streets, and the crowds of people confused her. Had the form been wearing a blue hoodie? Were the sneakers green? Or yellow? She squeezed her eyes shut and shook her head, trying to clear her thoughts.

The image of ring flashed in her brain. She'd recognized that gold, gaudy thing with ruby stones. It had been her sister. The nerve she had showing up after all these years. If she could deport her out of her life, she would. But now, Allison's past was rushing back to punch her in the face. She turned toward home.

Allison knew Sam would come to her. All she had to do was wait.

Connected Text Passage #3

The rules of a courtroom are important to understand before entering. Lawyer teams are comprised of the prosecution and the defense. The prosecutors are trying to prove that someone is guilty, beyond a reasonable doubt. The defense is trying to show that there is reasonable doubt to believe the defendant (person accused of a crime) is not guilty. The defenders must present a credible argument to convince the jury.

A jury is a collection of the defendant's peers who will judge whether to convict the person on trial of the crime they have been accused of. As the lawyer's argue their sides, the other team can interrupt with an objection. This means they have some issue with what the other team just stated and want it stricken from the record. If an objection is overruled, the team whose turn it is can keep going with what they have said. If the objection is sustained, the arguing lawyer must rephrase what he or she has said, or reform the way they present the evidence so that it can be properly admitted.

After both sides have said all they want to say, the jury has to deliberate. This means they get time to discuss, argue, and talk through all the evidence and make a decision concerning whether the defendant is guilty or innocent. If found guilty, the defendant will be sentenced by the court. If found innocent, he or she will be let dismissed to return to their normal lives.

Connected Text Passage #4

Construction zones can be dangerous areas. The equipment used can be so loud that conversation, including warnings, may be inaudible. If the workers cannot hear that there is a threat, they cannot be proactive in a reasonable amount of time to avoid risk. Even though workers are trained professionals, it is hard to detract a swinging wrecking ball or reel in an active crane. Audio-enhancing tools, such as headsets and megaphones can help, but they do not negate all possible problems.

Moreover, the structures teams work on can be incredibly high off the ground, producing additional danger. If an item, even a small one, is projected from such heights, construction workers on the ground could be in trouble. If the scaffolds are rickety or shoddy, anyone utilizing them may be subject to an accident. Regular safety checks are crucial to ensure crew protection. These should be done frequently and by an accredited inspector. Crew leaders may also be responsible for daily reports.

Before recent times, construction crews may have been considered nonessential workers, but they contribute to almost all elements of infrastructure in our country. From roads and highways to bridges, buildings, and power systems, construction teams prove to be productive members of society every day.

Connected Text Passage #5

Car maintenance is a crucial part of upkeeping one of your most valuable investments. Things like keeping your washer fluid filled and gas tank above empty are only part of car care. Changing your oil, rotating your tires, and performing general engine checks are especially important to ensure your car continues to run smoothly. Flat tires and air filters are easy fixes. If you don't run regular checks on the other systems in your car, you may be in for more expensive fixes.

Your car's transmission, for example, is what changes the gears. When you accelerate or decrease your speed, your car shifts through gears. In automatic transmissions, your car does this for you automatically. In manual transmissions, you use a gear shift and clutch to speed up or slow down. A wonky transmission can affect the overall health of your car and can be a very expensive fix. If your car is older and not worth as much, fixing a transmission can sometimes be more expensive than the car itself.

Having a qualified mechanic inspect your vehicle on a regular basis should be part of your routine, just like changing batteries in smoke detectors or the air filters in your house. Car problems are not always visible or audible, though, so preventative maintenance is key.

Connected Text Passage #6

Live concerts can be an adventure. Seeing a favorite band for the first time is an experience unlike listening to studio recordings. The energy in a concert venue is palpable. Everyone is brimming with anticipation for the band or solo performer to amble onto the stage. Live music can be a transformative event. Even positioned far from the stage, the auditory difference can't be replicated, even with the most expensive headphones or earbuds.

Of course, there are pros and cons to everything. Live concerts can be exceptionally pricey. Some bands, especially if it is a reunion tour or final concert series, charge hundreds, maybe thousands, for even mediocre seats. General admission areas can attract patrons with shallower wallets, but there may be no option to sit or visual access to the stage may be partly obstructed by something in the auditorium, like a column or balcony protrusion. Purchasing a cd or digital album is affordable and convenient. Music lovers do not have to fret about travel, parking, or crowds when they listen from the comfort of their own homes.

Yet, there is something incomparable about seeing a favorite group live in the accompaniment of fellow fans. Lit phone screens may have replaced flickering lighters held high in the air, but the connection with both fellow concert-goers and the performers on stage remains unchanged.

Connected Text Passage #7

Research historians have a much more insurmountable task than they did as little as 100 years ago. Even in American history alone, so much has happened since the early 20th century in various aspects of the human experience. From the women's suffrage movement to civil rights to technological progress, reflecting on evolution through a historical lens is an ambitious feat.

Historians do not just look at events. They must look at the context in which the event transpires. Providing commentary on the assassination of Martin Luther King, Jr. outside of the wider perspective of the racial climate of the United States since its inception would be a disservice. Similarly, discussing 9/11 without including discourse on foreign diplomacy and relations in the Middle East would paint an incomplete picture.

History does not happen in a vacuum. Events are like a river, flowing constantly, but also forever changing the landscape through which it traverses. The water in a river slowly erodes the riverbed, smoothing things in some places, displacing centuries-old formations in others. The future direction of the river is altered because of these retrospective shifts. Where the water flows from will continue to influence where it goes to. History is like a living entity, a structure that the citizens of the world have built together and will never finish. A historian's job is infinite, as unending as humanity itself.

Connected Text Passage #8

Cinematic genres offer much choice for a variety of tastes. People who love suspense can select a horror film, a psychological thriller, or even an action movie. Those with milder preferences who enjoy feel-good viewings can choose a romantic comedy, a family film, or an animated classic. Comedic cinematic options range from slapstick to sophisticated, with everything in between.

With streaming platforms, the options for watching quality television and movies from the comfort of one's own home have skyrocketed. A month of subscription fees is often cheaper than one admission ticket to a theater. Moreover, limited series events that often dramatize books in 6 to 10 movie-length installments proffer an appealing alternative to those who want more than a movie but are without the time commit to a series with multiple seasons. While high-profile series with heavy financial backing often get more advertisement, sleeper hits that gain momentum through word of mouth sometimes take the viewing world by storm.

Whether the audience's preference is fictional flicks or nonfiction productions like documentary films, viewers don't need to look far. Many apps have the additional benefit of being portable. Netflix, Hulu, and AppleTV are streamable on numerous devices and only require Wi-Fi or a hefty data plan. Regardless of your predilections for tv and movies, with so many platforms and quality productions, nobody will dictate your selections except you.

APPENDIX E

Table 11

Readability Characteristics of Connected Text Passages

Passage	Paragraph Length	Sentence Count	Word Count	Sentences per Paragraph		Words per Sentence		Syllables per Word		Flesch-Kincaid GL
				M	*SD*	*M*	*SD*	*M*	*SD*	
1	3	24	275	8	1.00	11.46	4.03	1.36	.65	4.93
2	4	24	262	6	2.71	10.92	5.17	1.31	.60	4.11
3	3	16	250	5.33	1.53	15.62	7.02	1.46	.75	7.68
4	3	13	208	4.33	2.08	16.00	6.10	1.64	.97	9.99
5	3	13	218	4.33	2.08	16.77	6.34	1.51	.84	8.76
6	3	14	224	4.67	2.31	16.00	9.38	1.65	.94	10.08
7	3	15	231	5	1.73	15.40	6.91	1.69	.94	10.39
8	3	13	230	4.33	.58	17.69	8.96	1.74	.96	11.88

Note. GL = Grade Level

APPENDIX F

Multisyllabic Derived Word List
Student Copy

inversion	attraction	predictive	nonimportable
misconstrue	discredit	inaudible	perspective
reflexive	purity	inscription	propulsion
intermission	conductivity	reform	impending
dejected	misinformation	contractual	bankrupt
evidential	facilitate	suspenseful	advisory
enmity	recollection	adventurist	inadmissible
noncommittal	incredulous	corruptness	adversarial

APPENDIX G

Researcher-designed Test of Morphological Knowledge

Cooper (2017) modification Carlisle (2000) morphology survey. Bernstein Instructions.

Part 1: Derivation

Instructions: Suffix the word task. Add a suffix to these words to make them fit the sentences. There will be 2 practice items followed by 15 items. If you do not know the answer, leave the item blank. If you are unsure of the spelling, give it your best try. Please write your answer in the blank provided. Each item will be read aloud to you, please follow along on your own paper.

Practice:

a. Assist. The teacher will give you _____. You would answer "assistance."

b. Absorb. She chose the sponge for its _____. You would answer "absorption."

1. Perform. Tonight is the last _____.
2. Expand. The company planned an _____.
3. Revise. The paper is his second _____.
4. Major. He won the vote by a _____.
5. Mystery. The dark glasses made the man look _____.
6. Climate. Under certain _____ conditions, hummingbirds migrate south for the winter.
7. Convey. The hikers built a _____ from fallen branches when Isaac twisted his ankle on the trail.
8. Cause. The researcher was studying the role of nitrates in the _____ of cancer.
9. Admonish. When the rain began, Mary wished she had listened to her mother's _____ to bring an umbrella.
10. Subsist. When the crop failed, the family was unable to produce enough rice for their .
11. Suffice. John wasn't aware his debit card was missing until he received the notice of funds from his bank.
12. Demonstrate. Despite his sadness over the situation, Terry remained _____ at his father's funeral.
13. Found. The prophet's message was one of great simplicity as well as _____.
14. Function. Until Sarah was placed with her new foster family, she was unaware of how her natural family was.
15. Apt. Malcolm was surprised at his own _____ when he realized how poorly he had performed on the task.

Total Correct: _____ Proportion Correct (total correct / 15): _____

Part 2: Decomposition

Instructions: Strip the suffix from the word task. Delete a suffix from these words to make them fit the sentences. There will be 2 practice items followed by 15 items. For example, if you see the item "Driver. Children are too young to ____." You would answer "drive." If you do not know the answer, leave the item blank. If you are unsure of the spelling, give it your best try. Please write your answer in the blank provided. Each item will be read aloud to you, please follow along on your own paper.

Practice:

a. Discussion. The friends have a lot to _____ . You would enter "discuss."

b. Description. The picture is hard to _____ . You would enter "describe."

1. Reduction. The overweight man was trying to _____
2. Reliable. On his friend he could always _____.
3. Continuous. How long will the storm _____?
4. Admission. How many people will they _____?
5. Variable. The Time of his arrival did not _____.
6. Compilation. Zach selected his favorite songs to _____.
7. Bewilderment. Anna's sleight of hand at card tricks was enough to _____ Jack.
8. Popularization. The widespread _____ appeal of Twitter caused a decline in the use of Facebook.
9. Charismatic. The leader of the political movement gained his position in large part due to his __.
10. Elimination. Leigh's plan to win the contest was to _____ the other contestants in the obstacle course.
11. Indelibly. Aaron meant to _____ the email, but he accidentally forwarded it to his entire contact list.
12. Miscalculated. The missing bill caused David to incorrectly _____ the amount of money he owed the cable company.
13. Decomposition. Charlotte chose her words carefully to _____ her letter of resignation.
14. Evaporation. The heating of the liquid in the beaker caused the _____ to rise into the tube and collect in the flask.
15. Proportional. Evan used fractions to _____ the cake into even slices.

Total Correct: _____ Proportion Correct (total correct / 15): _____

Part 1: Look at each word in the list below. Check *yes* if you know the word. Check *no* if you do not know the word. (If you are unsure, check *yes* if you could use the word in a sentence.

1. malformed	___Yes _No	26. children	___Yes ___No
2. mistreating	___Yes __No	27. psychologist	___Yes ___No
3. angelic	___Yes __No	28. incomparable	___Yes ___No
4. believable	___Yes __No	29. apparently	___Yes ___No
5. discredited	___Yes __No	30. fundamental	___Yes ___No
6. unmitigated	___Yes __No	31. liberation	___Yes ___No
7. tractor	___Yes __No	32. autobiographical	___Yes ___No
8. distraction	___Yes __No	33. improvisational	___Yes ___No
9. hypothetically	___Yes __No	34. contender	___Yes ___No
10. unplayful	___Yes __No	35. semiaudible	___Yes ___No
11. impiety	___Yes __No	36. operationalize	___Yes ___No
12. presumptuous	___Yes __No	37. kindness	___Yes ___No
13. readmission	___Yes __No	38. bravery	___Yes ___No
14. subtraction	___Yes _No	39. indecision	___Yes ___No
15. imported	___Yes __No	40. reclusiveness	___Yes ___No
16. diversification	___Yes __No	41. reconstruct	___Yes ___No
17. adventuring	___Yes __No	42. demotion	___Yes ___No
18. detestable	___Yes __No	43. indivisible	___Yes ___No
19. reciprocity	___Yes __No	44. dependable	___Yes ___No
20. commendable	___Yes __No	45. incessant	___Yes ___No
21. irreverent	___Yes __No	46. addressing	___Yes ___No
22. provocation	___Yes __No	47. propelled	___Yes ___No
23. misadvise	___Yes __No	48. descriptively	___Yes ___No
24. transcontinental	___Yes __No	49. abruptly	___Yes ___No
25. undemocratic	___Yes __No	50. nationality	___Yes ___No

Part 2: In each line, the word in **bold** font was formed from one of the words on the right. Select the letter of the word on the right which is the basis for the **bold** word.

Examples:

c	**teacher**	a. tea	b. each	c. teach
a	**undamaged**	a. damage	b. dam	c. aged

___1. **malformed**	a. med	b. form	c. mal
___2. **mistreating**	a. mist	b. eating	c. treat
___3. **angelic**	a. gel	b. an	c. angel
___4. **believable**	a. believe	b. belie	c. able
___5. **discredited**	a. disc	b. credit	c. edited
___6. **unmitigated**	a. gate	b. mitigate	c. mit
___7. **tractor**	a. actor	b. track	c. tractor
___8. **distraction**	a. distract	b. action	c. traction
___9. **hypothetically**	a. hypothecary	b. thesis	c. the
___10. **unplayful**	a. play	b. lay	c. full
___11. **impiety**	a. imp	b. pious	c. pie
___12. **presumptuous**	a. presume	b. sump	c. sumptuous
___13. **readmission**	a. read	b. admit	c. mission
___14. **subtraction**	a. sub	b. traction	c. subtract
___15. **imported**	a. import	b. imp	c. ported
___16. **diversification**	a. diverse	b. versify	c. diver
___17. **adventuring**	a. advent	b. venture	c. ring
___18. **detestable**	a. table	b. able	c. detest
___19. **reciprocity**	a. recipe	b. reciprocal	c. receipt
___20. **commendable**	a. commend	b. mend	c. mendable

___21. **irreverent**	a. reverse	b. revere	c. rent
___22. **provocation**	a. prove	b. provoke	c. vocation
___23. **misadvise**	a. sad	b. is	c. advise
___24. **transcontinental**	a. tin	b. continent	c. con
___25. **undemocratic**	a. demo	b. tic	c. democrat
___26. **children**	a. chil	b. child	c. ren
___27. **psychologist**	a. psycho	b. logo	c. psychology
___28. **incomparable**	a. income	b. parable	c. compare
___**29. apparently**	a. parent	b. rent	c. appear
___30. **fundamental**	a. fun	b. mental	c. fundament
___31. **liberation**	a. beration	b. liberate	c. ration
___32. **autobiographical**	a. graph	b. biography	c. auto
___33. **improvisational**	a. improve	b. provide	c. improvise
___34. **contender**	a. ender	b. contend	c. tend
___35. **semiaudible**	a. semi	b. Audi	c. audible
___36. **operationalize**	a. rationalize	b. opera	c. operate
___37. **kindness**	a. kind	b. kin	c. ness
___38. **bravery**	a. raver	b. very	c. brave
___39. **indecision**	a. incision	b. decide	c. indecent
___40. **reclusiveness**	a. clue	b. recluse	c. rec
___41. **reconstruct**	a. construct	b. recon	c. con
___42. **demotion**	a. demo	b. motion	c. demote
___43. **indivisible**	a. divide	b. visible	c. dive

____44. **dependable**	a. depend	b. deepen	c. endable
____45.**incessant**	a. cess	b. ant	c. cease
____46. **addressing**	a. dress	b. address	c. dressing
_____47. **propelled**	a. propel	b. rope	c. prop
____48. **descriptively**	a. rip	b. script	c. describe
____49. **abruptly**	a. ab	b. up	c. abrupt
___50. **nationality**	a. lit	b. nation	c. national

Part 3: Select the best definition for each word.

___1. malformed
a. evilly made
b. shaped bad or wrong
c. made well

___2. mistreating
a. behaving badly toward
b. clearing of foggy weather
c. unrecognizable food

___3. angelic
a. demonic
b. having the qualities of an angel
c. naughty

___4. believable
a. in the realm of possibility
b. an unlikely story
c. able to survive a tragedy

___5. discredited
a. forced to pay with cash
b. a charge that is removed
c. proven false or worthless

___6. unmitigated
a. without a lawsuit
b. with one's bare hands
c. not toned down

___7. tractor
a. someone who performs on
b. a path for running
c. something that pulls

___8. distraction
a. something that causes lack of focus
b. action of skidding on icy roads
c. the opposite of being active

___9. hypothetically
a. with a needle
b. using supposition
c. written in ink

___10. unplayful
a. full of energy and whimsy
b. lacking playful energy
c. full of the desire to not play

___11. impiety
a. elf-like, fairy tale character
b. lack of respect
c. baked in a round pan

___12. presumptuous
a. overly bold or confident
b. overly ornate
c. asking over and over

___13. readmission
a. place of refuge
b. tutoring in reading
c. entering again

___14. subtraction
a. an underwater vehicle
b. the ability to grip
c. the process of taking away

___15. imported
a. brought or carried in
b. elf-like, fairy tale character
c. docked, like a boat

___16. diversification
a. branching out
b. making into song
c. turning into poetry

___17. adventuring
a. celebrating the season before Christmas
b. a band worn on a finger
c. going out/exploring

___18. detestable
a. causing hatred or dislike
b. cannot be measured
c. a horse out of the barn

___19. reciprocity
a. sharing cooking instructions
b. exchanging or sharing privileges
c. the part left over in division

___20. commendable
a. something that can be fixed
b. worthy of praise
c. something that can be sold

___21. irreverent
a. cannot be undone
b. going forward
c. lacking respect

___22. provocation
a. a first job
b. causing a response
c. a mathematical proof

___23. misadvise
a. a down mood
b. state of being
c. to give bad advice

___24. transcontinental
a. spanning continents
b. a type of metal
c. a felon or criminal

___25. undemocratic
a. not for the people
b. a repetitive body movement
c. a trial run

___26. children
a. a small child
b. more than one child
c. to make cold

___27. psychologist
a. a serial killer
b. one who studies the mind
c. an image representing a company

___28. incomparable
a. receiving little pay
b. able to afford
c. without equal

___29. apparently
a. easily
b. caring for one's children
c. seemingly

___30. fundamental
a. at the base of
b. an enjoyable puzzle
c. interruption of a pattern

___31. liberation
a. setting free
b. sharing books
c. drinking too much

___32. autobiographical
a. about one's own life
b. self-made
c. represented in graphs

___33. improvisational
a. making stronger
b. gaining better insight
c. on the spur of the moment

___34. contender
a. shopper or customer
b. someone who takes charge
c. competitor

___35. semiaudible
a. a type of large carrier truck
b. a type of car brand
c. partially hearable

___36. operationalize
a. to sing in Latin
b. to put into action
c. to perform surgery

___37. kindness
a. quality of being kind
b. being related to someone
c. a Scottish sea monster

___38. bravery
a. acting with courage
b. cheering loudly
c. shameful behavior

___39. indecision
a. unable to choose
b. inappropriate
c. inaccurate

___40. reclusiveness
a. highly selective
b. keeping to oneself
c. a poisonous spider

___41. reconstruct
a. to destroy
b. to build again
c. to look into

___42. demotion
a. lowering of rank
b. fluttering
c. without moving

___43. indivisible
a. unable to be split
b. barely visible
c. in the future

___44. dependable
a. contingent upon
b. able to be counted on
c. stoppable

___45. incessant
a. a small insect
b. to stop
c. not stopping

___46. addressing
a. a girl's piece of clothing
b. speaking to or pointing out
c. turkey stuffing

___47. propelled
a. an object used on stage
b. an expert in their field
c. pushed forward

___48. descriptively
a. in a vivid manner
b. to tear up
c. lines an actor memorizes

___49. abruptly
a. suddenly
b. stomach muscles
c. above

___50. nationality
a. a person's country of origin or identification
b. to illuminate
c. to be reasonable

Part 4: Some of these words can be broken down to bound Latin or Greek roots that carry meaning but do not make sense as standalone English words. Match each root with its correct meaning.

Latin Base Knowledge

____1. struct	A. To carry
____2. script/scrib(e)	B. To pull or drag
___3. tract	C. To write
___4. port	D. To shape
___5. form	E. To hear
___6. cred	F. To believe
___7. rupt	G. Self
___8. aud	H. People
___9. auto	I. To build
___10. demo	J. To break or burst

Affix Knowledge

Prefixes and suffixes also have meaning. Match each prefix or suffix to its meaning.

1. mis-	A. again; back
2. –ous	B. bad or wrong
3. re-	C. under
4. sub-	D. past tense
5. dis-	E. act, state, process, or condition of
6. –ion; -sion; -tion	F. full of
7. –ed	G. across
8. –er/-or	H. before; earlier
9. trans-	I. one who; that which
10. pre-	J. not; opposite; away

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129
FWA: 00005331/IRB Regn. 0003571

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Friday, January 28, 2022

Protocol Title	***Effects of a Morphological Intervention on the Ability of 9th and 10th Graders with Disabilities to Read Multisyllabic Dervised Words***
Protocol ID	**22-2076 7im**
Principal Investigator	**Jessica Dainty** (Student) *Faculty Advisor:* Timothy Odegard
Co-Investigators	NONE
Investigator Email(s)	*jj5d@mtmail.mtsu.edu; timothy.odegard@mtsu.edu*
Department	Literacy Studies (PI) and Dyslexia Services (FA)
Funding	NONE

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU IRB through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category *(7) Research on individual or group characteristics or behavior*. A summary of the IRB action is tabulated below:

Date of Expiration	**12/31/2022**	*Date of Approval*: 12/21/21	*Recent Amendment*: 1/28/22
Sample Size	SEVENTY (70)		
Participant Pool	*Target Population:* Primary Classification: **Minors (Age group 13-17)** Specific Classification: **Students of Cookeville High School (Putnam County)**		
Type of Interaction	☐ Non-interventional or Data Analysis ☐ Virtual/Remote/Online interaction ☒ **In person or physical interaction – Mandatory COVID-19 Management**		
Exceptions	1. Combined parental consent/child assent template is allowed but the processes must be completed independently. 2. COVID-19 tracking is waived; the research conducted during regular school hours.		
Restrictions	**1. Mandatory SIGNED Parental Consent followed by indepdent Child Assent.** **2. Other than the exceptions above, identifiable data/artifacts, such as, audio/video data, photographs, handwriting samples, personal address, driving records, social security number, and etc., MUST NOT be collected. Recorded identifiable information must be deidentified as described in the protocol.** **3. Mandatory Final report (refer last page).** **4. CDC guidelines and MTSU safe practice must be followed**		
Approved Templates	*IRB Templates:* Combined Parental Consent/Child Assent Template *Non-MTSU Templates:* Recruitment Script		
Research Inducement	NONE		
Comments	NONE		

Post-approval Requirements

The PI and FA must read and abide by the post-approval conditions (Refer "*Quick Links*" in the bottom):

- ***Reporting Adverse Events:*** The PI must report research-related adversities suffered by the participants, deviations from the protocol, misconduct, and etc., within 48 hours from when they were discovered.
- ***Final Report:*** The FA is responsible for submitting a final report to close-out this protocol before **12/31/2022 (Refer to the Continuing Review section below)**; REMINDERS WILLNOT BE SENT. **Failure to close-out or request for a continuing review may result in penalties** including cancellation of the data collected using this protocol and/or withholding student diploma.
- ***Protocol Amendments***: An IRB approval must be obtained for all types of amendments, such as: addition/removal of subject population or investigating team; sample size increases; changes to the research sites (appropriate permission letter(s) may be needed); alternation to funding; and etc. The proposed amendments must be requested by the FA in an addendum request form. The proposed changes must be consistent with the approval category and they must comply with expedited review requirements
- ***Research Participant Compensation:*** Compensation for research participation must be awarded as proposed in Chapter 6 of the Expedited protocol. The documentation of the monetary compensation must Appendix J and MUST NOT include protocol details when reporting to the MTSU Business Office.
- ***COVID-19:*** Regardless whether this study poses a threat to the participants or not, refer to the COVID-19 Management section for important information for the FA.

Continuing Review (The PI has requested early termination)

Although this protocol can be continued for up to THREE years, The PI has opted to end the study by **12/31/2022** **The PI must close-out this protocol by submitting a final report before 12/31/2022 Failure to close-out may result in penalties that include cancellation of the data collected using this protocol and delays in graduation of the student PI.**

Post-approval Protocol Amendments:

The current MTSU IRB policies allow the investigators to implement minor and significant amendments that would fit within this approval category. ***Only TWO procedural amendments will be entertained per year*** *(changes like addition/removal of research personnel are not restricted by this rule).*

Date	Amendment(s)	IRB Comments
01/06/2022	Non-MTSU recruitment script approved.	IRBA2022-317
01/28/2022	The previously approved standard measure is replaced with a compilation by the PI. Parental consent form and other scripts referencing the original measure are also revised. .	IRBA2022-324S

Other Post-approval Actions:

The following actions are done subsequent to the approval of this protocol on request by the PI/FA or on recommendation by the IRB or by both.

Date	IRB Action(s)	IRB Comments
NONE	NONE	NONE

COVID-19 Management:

The PI must follow social distancing guidelines and other practices to avoid viral exposure to the participants and other workers when physical contact with the subjects is made during the study.

- The study must be stopped if a participant or an investigator should test positive for COVID-19 within 14 days of the research interaction. This must be reported to the IRB as an "adverse event."
- The MTSU's "Return-to-work" questionnaire found in Pipeline must be filled by the investigators on the day of the research interaction prior to physical contact.
- PPE must be worn if the participant would be within 6 feet from the each other or with an investigator.
- Physical surfaces that will come in contact with the participants must be sanitized between use
- **FA's Responsibility:** The FA is given the administrative authority to make emergency changes to protect the wellbeing of the participants and student researchers during the COVID-19 pandemic. However, the FA must notify the IRB after such changes have been made. The IRB will audit the changes at a later date and the FA will be instructed to carryout remedial measures if needed.

Data Management & Storage:
All research-related records (signed consent forms, investigator training and etc.) must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data must be stored for at least three (3) years after the study is closed. Additional Tennessee State data retention requirement may apply (*refer "Quick Links" for MTSU policy 129 below*). The data may be destroyed in a manner that maintains confidentiality and anonymity of the research subjects.

The MTSU IRB reserves the right to modify/update the approval criteria or change/cancel the terms listed in this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

- Post-approval Responsibilities: http://www.mtsu.edu/irb/FAQ/PostApprovalResponsibilities.php
- Expedited Procedures: https://mtsu.edu/irb/ExpeditedProcedures.php
- MTSU Policy 129: Records retention & Disposal: https://www.mtsu.edu/policies/general/129.php