

Fluency as a Bridge to Comprehension: An Efficacy Study of the RAVE-O Literacy Program

by

Maxine Katarina Schmidt
Bachelor of Arts, University of Guelph, 2014

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Supervisory Committee

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Abstract

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The purpose of this study was to investigate the effectiveness of a theoretically-grounded reading intervention in children with reading difficulties. Participants were between the ages of 8 to 10 years from a community-based program for children with learning disabilities and a single-case research (SCR) design was employed. An adapted version of the RAVE-O intervention was delivered which focused on instruction in phonology, orthography, semantics, syntax, and morphology in building children's word-level fluency skills. Norm-referenced word-level reading, decoding, and reading comprehension measures were collected at pre- and post-test, and progress monitoring data via curriculum-based measures were also collected. Overall results based on percentage of non-overlapping data (PND) analyses indicated moderate effects for decoding fluency and reading comprehension and small effects for decoding accuracy and reading fluency. Implications for educators and professionals working with elementary school students identified with reading difficulties are discussed.

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Introduction

“How a child first learns to read is a tale of either magic and fairies or missed chances and unnecessary loss” (Wolf, 2007, p.84). The ability to read and understand text is a complex process requiring the integration of multiple brain mechanisms. This ability is not innate, in fact it is believed by some that human beings were not born to read (Wolf, 2007). However complex and demanding the task of reading is, understanding the reading brain is of utmost importance.

Reading is intertwined throughout everyday life. Involvement in social, economic, academic, and cultural life requires successfully extracting meaningful information from written text. Text is a source of knowledge, which carries within information, ideas, history, values, culture, and emotion. Consequently, the negative effects associated with unsuccessful reading development are not exclusive to the realm of education (Ozernov-Palchik et al., 2017; Paivinen, Eklund, Hirvonen, Ahonen, & Kiuru, 2018; Pfof, Hattie, Dorfler, & Atelt, 2014; Wei, Blackorby, & Schiller, 2011). However, it is within education, specifically during a child’s primary schooling years, that reading skills should be nurtured (Hay, Elias, Fielding-Barnsley, Homel, & Freiberg, 2007; Pfof et al., 2014; Vaughn & Wanzek, 2014).

Assessments of reading acquisition consistently demonstrate an alarming percentage of students reading below basic levels of reading proficiency. In 2017, 32% of fourth-grade students in the United States performed below the basic achievement level in reading, indicating a significant portion of students that have not attained even *partial* mastery of fundamental reading skills (National Center for Educational Statistics, 2018). These statistics are concerning, given what is known about the importance of early reading acquisition and the long-term negative effects associated with poor reading (Denton, Fletcher, Anthony, & Franics, 2006;

Eklund et al., 2014; Ozernov-Palchik et al., 2017; Pfost et al., 2014).

The negative effects of poor reading development are found to be relatively stable and long-lasting, meaning children with reading difficulties are likely to remain poor readers throughout their school years and beyond (Denton et al., 2006; Eklund et al., 2014; Ozernov-Palchik et al., 2017; Pfost et al., 2014). Fortunately, the negative effects of poor reading may decrease when children receive intensive interventions that effectively target reading skills (Denton et al., 2006). Early intervention methods, such as Response to Intervention (RTI) frameworks, help to identify those in need of specialized services, reducing the number of students who would otherwise fall behind if they were to only receive classroom-level instruction (Denton et al., 2006; Hooper et al., 2013). Within the domain of reading, RTI interventions have been found to be effective at improving reading-specific skills (Denton et al., 2006). However, it is important to note that RTI is not a specific program for intervention. Instead, it is a framework oriented towards the identification of students who require specialized services and their learning needs (Hooper et al., 2013). Thus, determining effective instructional methods and intensive interventions that target struggling readers early-on and aid in developing proficient reading skills within an RTI framework is important. Developing and utilizing an effective reading intervention requires a comprehensive understanding of the mechanisms involved during reading.

Understanding the key mechanisms involved in reading and how to successfully target and strengthen these component skills early-on is crucial to eradicating the longitudinal and detrimental impact reading difficulties may have on a child's future.

Review of the Literature

The present study aims to assess the efficacy of a newly developed reading program, the Retrieval, Automaticity, Vocabulary Elaboration, Orthography (RAVE-O) Literacy Program. As an introduction, this review will begin with an exploration of the importance of proficient reading, specifically examining how children with reading difficulties differ from those without and what these disparities mean presently and longitudinally. Understanding the importance of reading proficiency within the classroom and beyond will help readers recognize the importance of remediating difficulties.

The next section will explore the processes underlying successful reading and will review the central reading theories guiding the present study. The two theories discussed within this review include the Simple View of Reading (Gough & Tunmer, 1986) and the Lexical Quality Hypothesis (Perfetti, 2007). These theories stem from a multi-componential framework (Perfetti & Adolf, 2012), indicating that successful reading requires the integration of multiple lower- and higher-level processes. Within a multi-componential framework, the end goal of reading is reading comprehension – the understanding of text. Consequently, this review of the literature will include an examination of reading comprehension, and the processes involved to provide an understanding as to how one can achieve reading success and how one can successfully intervene when reading failure occurs.

A comprehensive understanding of the processes involved in reading - how they operate, and how they contribute to reading success - is important to determine the ways in which reading interventions can be developed to ensure they effectively achieve improved reading. Furthermore, we must continuously evaluate our models of reading. Recently, studies have examined the importance of reading fluency – how it contributes to reading, why it should

belong within a multi-componential view of reading, and how to target fluency to ensure that interventions improve reading. Following a review of the influential processes involved in reading will be a review of commonly employed instructional methods and interventions targeting the acquisition of fluency development. This section will examine the efficacy of these techniques and provide an introduction of the RAVE-O literacy program.

The Importance of Reading Proficiency

Reading is a complex skill in which many children struggle to achieve proficiency. It requires the dynamic interaction of a range of multifaceted cognitive processes (Hay et al., 2007). For those who struggle with reading, related tasks can be trying and taxing. However, strengthening weak reading abilities is fundamental to bringing positive change to many facets of a child's life, and the earlier remediation begins the better (Hay, Elias, Fielding-Barnsley, Homel, & Freiberg, 2007; Pfof et al., 2014; Vaughn & Wanzek, 2014).

Within the classroom. Reading difficulties have been found to be relatively stable and long lasting (Eklund et al., 2014). By the end of primary school, large individual differences in student reading literacy exist (Pfof et al., 2014). If these reading difficulties persist, it is likely that these children will continue to fall behind their classmates in a number of academic areas (Paivinen et al., 2018; Tressoldi, Vio, & Iozzino, 2007). Thus, early identification and remediation of reading difficulties is crucial to close the achievement gap between children with and without reading disabilities. Research shows that earlier treatment results in the highest gains in reading abilities and it is within a child's early elementary years that reading interventions have the greatest impact on a child's education and future (Vaughn & Wanzek, 2014).

Within the classroom, judgements of reading proficiency are often linked to oral reading abilities. Children flagged as poor readers are those who exhibit laboured and disconnected oral

reading (Hudson, Lane, & Pullen, 2005). Poor readers often feel as though reading is effortful and frustrating, which negatively impacts their relationship with text (Meyer & Felton, 1999). Often times, children who display reading difficulties acquire negative attitudes towards reading, resulting in decreased time spent with written text. Reduced print exposure results in restricted vocabularies and poor comprehension strategies (Ozernov-Palchik et al., 2017). Conversely, children without difficulties in reading have been found to have more print exposure, superior automaticity in reading and comprehension skills, larger and more advanced vocabularies and display superior cross-domain knowledge in comparison to their peers who struggle with reading (Ozernov-Palchik et al., 2017).

Furthermore, students with reading difficulties lack confidence in their abilities and develop a fear of failure, which has been found to contribute to low levels of effort in, and avoidance of, reading-related tasks – a harmful cycle that contributes to the widening gap between students with and without reading difficulties (Paivinen et al., 2018).

Beyond the classroom. An individual exiting the educational world does not leave behind their reading difficulties. Neglected reading difficulties in the elementary and high school years are impactful. For children with reading difficulties, reading growth rates were found to decline with age. Studies have found reading difficulties to be associated with negative outcomes, such as secondary school non-completion and a greater likelihood of employment in a low-status occupation (Smart et al., 2017).

It is important to prevent these achievement gaps from widening to ensure that all children are provided with the opportunity to strengthen their reading skills. As demonstrated in this section, developing proficiency in reading is important to ensure children receive the opportunity reach their fullest potential during their school years and beyond. In order to

recognize how to effectively assist children in developing reading proficiency, an understanding of the component skills is required. The goal of reading is to understand and comprehend what has been read. Thus, by reviewing reading comprehension first, a top-down approach to understanding the mechanisms and component skills that contribute to successfully comprehending text can be achieved.

Reading Comprehension

Reading comprehension has been defined as the process through which readers derive and construct meaning during text interaction and effectively build mental representations of the messages contained within the text (Pardo, 2004; Perfetti & Adolf, 2012). It is the “intentional thinking during which meaning is constructed through interactions between the text and the reader” (Durkin, 1993, p.76). Thus, the key elements of reading comprehension can be stated as grasping meaning and understanding of the presented text (Trapman, van Gelderen, van Steensel, van Schooten & Hulstijn, 2014). It is described as the end, and ultimate, goal of reading (Cutting, Materke, Cole, Levine & Mahone, 2009; Silverman, Speece, Haring & Ritchey, 2013; Veenendaal, Groen & Verhoeven, 2015), and, consequently, it is fundamentally important to understand the influential components that impact and account for proficiency in reading comprehension.

Reading comprehension has been described as a complex task, requiring the integration of multiple skills (Perfetti & Adolf, 2012). Identifying which skills act as component skills for reading comprehension is therefore essential. This section will describe the central theories of reading comprehension within a multi-componential framework (Perfetti & Adolf, 2012), highlighting the theorized key elements and processes of comprehension. These influential theories include the Simple View of Reading (Gough & Tunmer, 1986) and the Lexical Quality

Hypothesis (Perfetti, 2007) The goal of this section is to bring attention to the various component skills interacting in conjunction with one another when text comprehension is occurring, while additionally emphasizing the foundational role of fluency.

The most prevalent view of reading comprehension describes comprehension not as a single process, but instead as multiple components interacting with one another (Perfetti & Adolf, 2012). As mentioned previously, it is important to identify the skills contributing to successful comprehension; however, it is even more important to understand that no component is sufficient in isolation (Perfetti & Adolf, 2012). What is required of the reader involves the identification of words, the retrieval of word meanings, the connecting of meanings to prior knowledge, and the sufficient retention of information so that understanding can be attained. This multi-componential view of reading comprehension also holds that comprehension requires mental representations of the text, influenced by different levels of these component skills (Perfetti & Adolf, 2012). Thus, mental representations are influenced and developed at the word-level, sentence-level, and text-level, requiring the integration of lower-level and higher-level processes.

Of the lower-level processes that feed into reading comprehension, a critical component skill is word identification. If the reader fails to identify the word, comprehension will be impaired (Adolf & Perfetti, 2012). Vocabulary is a second influential component skill, strongly linked to reading comprehension, so much so that for comprehension to occur, readers are required to know approximately 90% of the words embedded within the text (Adolf & Perfetti, 2012). If readers can identify words, but not define them, comprehension suffers. A third component skill is lexical knowledge. High lexical knowledge, or quality, results in well-specified and flexible representations of word forms and meanings (Perfetti, 2007). Well-

constructed representations allow for the efficient retrieval of word meanings. Following this is word-to-text integration. The reader is required to connect and relate the meanings of previously read words to words under current scrutiny to create a coherent representation of what the text is conveying (Adolf & Perfetti, 2012). Lexical knowledge and word-to-text integration is also influenced by prior knowledge. Flexibility in word meaning is influenced by a reader's experience with the word. That is, readers are required to understand how multiple words are synonymous to one another for coherent understanding to occur (Adolf & Perfetti, 2012). Additionally, prior knowledge helps readers connect what is being read to their existing knowledge (Wendling & Mather, 2009).

Higher-level component skills of reading comprehension rely on the effective functioning of the lower-level component skills. Higher-order skills allow for appropriate meanings to be extracted from the text. Inferencing, defined as forming a conclusion from facts or premises (Merriam-Webster's Dictionary, 2017), is a higher-level component skill that allows readers to maintain coherence within the text, essential to comprehension (Adolf & Perfetti, 2012). Comprehension monitoring is another required skill that allows readers to confer their understanding of the text and make alternations to any inconsistencies (Adolf & Perfetti, 2012). In other words, the attainment of comprehension monitoring allows readers to be cognizant of any reading errors that interfere with text understanding and maintains coherence within the text. In order to detect these errors, lower-level skills are called upon. Comprehension monitoring requires readers to have formed accurate representations of text sentences (Adolf & Perfetti, 2012), achieved in the lower-level processes such as lexical knowledge and word-to-text integration, which in turn is influenced by additional skills such as word identification, vocabulary, and prior knowledge.

As illustrated, the process of comprehending text requires the simultaneous integration of multiple skills. Due to many skills working in concert with one another, an impediment in one skill can have grave consequences for the understanding of connected text. Within the multi-componential view of reading comprehension, specific theories, such as the Simple View of Reading (Gough & Tunmer, 1986) and the Lexical Quality Hypothesis (Perfetti, 2007), provide a greater examination into specific componential skills and how they work in conjunction with one another to achieve reading comprehension.

The Simple View of Reading (SVR), is an influential model of reading comprehension and has been used to understand and explain the core components contributing to the comprehension of text. The SVR model proposes that reading comprehension is the product of decoding accuracy and linguistic (or language) comprehension (Gough & Tunmer, 1986; Kendeou, McMaster & Christ, 2016; Silverman, Speece, Harring & Ritchy, 2013; Tilstra, McMaster, van den Broek, Kendeou & Rapp, 2009). In this theory, decoding is defined as the ability to apply one's knowledge of letter-sound correspondences accurately and with efficiency (Silverman et al., 2013). Thus, it is the component skill enabling readers to decipher written text at the word-level. Language comprehension, the second element of reading comprehension as proposed by the SVR model, has been defined as the ability to understand language and is required to construct coherent representations of the material being read (Kendeou et al., 2016; Silverman et al., 2013).

The second theory of reading comprehension to be discussed is the Lexical Quality Hypothesis, as proposed by Perfetti (2007). In his hypothesis, Perfetti (2007) defines quality as the precise and flexible way mental representations can specify both the form and meaning components of a word. In this theory, it is essential for mental representations to be a) precise

because words can look and sound similar; and b) flexible because meanings of different words can be the same. Furthermore, mental representations should be simultaneously precise and flexible because identical spellings can be pronounced differently due to the sentence in which they are embedded and the meaning they are intended to have (Perfetti, 2007). It is the variation in the quality of these representations that are consequential for reading and comprehension. Thus, to have high lexical quality is to have well-constructed and flexible representations of the forms and meanings of words, that allow the reader to efficiently derive meaning from the text, and thus comprehend it (Perfetti, 2007).

Considering the various components of reading comprehension, it is evident that the skills involved are intertwined and dependent on one another. By highlighting the component skills in relation to one another, one can identify how they become foundational to one another and, ultimately, to the successful comprehension of text. However, what is currently understood about reading comprehension is not complete or definitive. As research continues to examine the processes involved, including *how* they are involved and *why* they are interrelated, questions arise as to whether additional skills are contributing to reading comprehension. By examining the predictors of reading comprehension and the factors contributing to the variance found in reading comprehension abilities, the component skills contributing to this complex ability continue to expand. In particular, the contribution of fluency and whether it belongs within the multi-componential view of reading comprehension has been debated (Adolf, Catts & Little, 2006; Silverman et al., 2013).

Fluency, further discussed in the following section, is defined as the ability to read with automaticity (Wendling & Mather, 2009), requiring text reading to be rapid, smooth, and effortless (Meyer & Felton, 1999). Much of the research on reading fluency has found it to have

a significant impact on overall reading proficiency and comprehension abilities (Fuchs et al., 2001; Hudson et al., 2005; Mule et al., 2018; Tilstra, McMaster, Van den Broek, Kendeou & Rapp, 2009; Tressoldi et al., 2007). These findings suggest a place for fluency within reading comprehension (LaBerge & Samuels, 1974; Perfetti, 2013; Silvermann et al., 2013).

Additionally, it has been debated as to whether the inclusion of reading fluency would make reading comprehension models more complete (Tilstra et al., 2009). In the following section, a more comprehensive definition of fluency will be provided to further demonstrate how fluency contributes to reading comprehension, and where - within a multi-componential view of reading comprehension - it fits.

This analysis provides a rich understanding of the complexity of reading comprehension and, consequently, why children struggle to achieve reading proficiency. Reading success requires reading comprehension. Thus, in order to develop proficiency in reading, children are required to utilize multiple lower and higher-order skills simultaneously. Although many influential theories of reading exist that have shaped the way in which reading is understood and how we remediate reading failure, there remains a significant proportion of children who continue to struggle with reading. This leaves room to debate whether or not the current understanding of reading is complete. The following section will provide an in-depth analysis of the current literature available for reading fluency and identify the reasons why fluency may be the missing piece to understanding the reading brain.

Reading Fluency

To understand reading fluency and its fundamental influence on reading comprehension, one must understand it as more than reading with automaticity. Early definitions of reading fluency described it in much this way; as the smooth and effortless process of reading with

automatic understanding (Carver, 1997; LaBerge & Samuels, 1974; Schreiber, 1980). Following these early conceptualizations of reading fluency, a similar definition of reading fluency was presented by researchers Meyer and Felton (1999), who stated that fluency is the “ability to read connected text rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding” (p. 284). The latter half of this definition touches on an important aspect suggesting that for fluency to be obtained the lower-level processes of reading need to be achieved, a concept incorporated into present definitions of reading fluency.

Researchers Wolf and Katzir-Cohen (2001) reviewed both historical and current definitions of what it means to be a fluent reader. In doing so, they outlined the many definitions presented over the years, highlighting the differences due to frameworks and models, and stated how differing perspectives impact the prevention, intervention, and the selection of assessment methods (Wolf & Katzir-Cohen, 2001). Wolf and Katzir-Cohen (2001) argue for a complex view of fluency that presents both developmental and component-based definitions that encompass rate and speed as subskills, and accuracy and automaticity as outcomes. These researchers stress that fluency is not only a matter of speed, instead, “it is a matter of being able to utilize all the special knowledge a child has about a word – its letters, letter patterns, meanings, grammatical functions, roots, and endings- fast enough to think and comprehend” (as cited in Wolf, 2007), a view similar to the previously discussed Lexical Quality Hypothesis (Perfetti, 2007) used to describe the mechanisms of reading comprehension.

Similar conceptualizations exist between early and present definitions of fluency, though some subtle differences do exist. For the purpose of this paper, the definition of fluency will be established from the most prevalent criteria found within the literature. Both past and present definitions of fluency not only encompass the rate and speed of a reader, but also reading

accuracy (Cutting et al., 2009; Veenendaal, Groen & Verhoeven, 2015). Thus, readers are deemed fluent when words are automatically and effortlessly read by sight. Current debates are taking place as to whether to include prosody within fluency's working definition (e.g. Hudson, Pullen, Lane & Togen, 2009; Schwanenflugel, Hamilton, Kuhn, Wisenbaker & Stahl, 2004). Prosody, defined as the ability to apply the appropriate intonations and stresses when orally reading text, has been argued to be an important element of fluency as it makes the sound of reading aloud analogous to natural speech (Veenendaal, Groen & Verhoeven, 2015). However, the inclusion of prosody requires researchers to capture and measure a reader's expression and intonation, thus altering the way in which fluency is assessed. Additionally, little is still known about the exact function of prosody (Veenendaal, Groen & Verhoeven, 2015), and thus defining fluency as the ability to read rapidly, automatically, and effortlessly remains the most prevalent and functional definition at present. It is this definition of reading fluency that will be utilized throughout the present study.

It is this reading of words by sight that has been deemed crucial to skilled reading (Meyer & Felton, 1999). When readers are successful at reading words by sight, their attentional resources are freed from the lower-level processes involved in reading words. Alternatively, dysfluent readers must focus their attentional resources first on the accuracy of reading, displayed by word-by-word reading, lack of prosody, and difficulty segmenting sentences into meaningful phrases (Meyer & Felton, 1999). When readers must consciously tackle word recognition, little attentional focus is left to derive meaning from the text. When word recognition becomes an unconscious effort, readers are able to allocate the appropriate amount of attentional resources to the higher-order processes of reading that allow for comprehension (Meyer & Felton, 1999; Perfetti, 1997). Thus, oral reading fluency is conceptualized as a

“performance indicator for overall reading competence, including comprehension” (Fuchs, Fuchs, Hosp & Jenkins, 2001, p. 241).

Two perspectives that support the notion that fluency is an indicator of reading competence and a fundamental component skill of comprehension are the Automaticity Model of Reading, presented by LaBerge and Samuels (1974), and the Verbal Efficiency Theory presented by Perfetti (1985). Both theories posit that reading fluency facilitates reading comprehension (LaBerge & Samuels, 1974; Perfetti, 1985). LaBerge and Samuels’ (1974) automaticity model proposes that if each component of reading required attention, an individual’s attentional capacity would be exceeded, leaving little to no room for comprehension. Consequently, fluency allows for comprehension by reducing the attentional demands of reading via the automaticity of the lower-level components of reading (Fuchs, Fuchs, Hosp & Jenkins, 2001). Similarly, Perfetti (1985) attempts to explain comprehension through his theory of verbal efficiency. This theory suggests that there is limited capacity within the cognitive system to simultaneously decode words and find meaning within text (Silveran et al., 2013). As readers obtain fluency, their decoding skills become automatic and space within the cognitive system is freed, allowing the reader to focus on obtaining meaning from text. Perfetti (1985) proposes that comprehension will develop as readers obtain fluency (Conrad, 1986).

In order to understand how fluency contributes to successful comprehension, one must think back to the point made about higher and lower-level component skills working in conjunction with one another. Fluency in the involved lower-level processes, such as decoding, allows for readers to allocate their attentional resources and dedicate their cognitive resources to higher-level text processing, such as building mental representations of what is being read. When less attentional focus is required for lower-level processes, the reader is able to designate more

attention to linking text to prior knowledge and the building of mental representations, which are foundational to comprehension (Tilstra et al., 2009; Trapman, et al., 2014).

The importance of reading fluency in relation to reading comprehension. Dysfluency was found to be a reliable predictor of reading comprehension problems (Fuchs et al., 2001; Hudson et al., 2005). Fluency, as defined above, requires automaticity. Fluent readers were found to be better at recognizing a word in a single eye fixation. This quick recognition was associated with improved scores on both measures of reading rate and comprehension (Hudson et al., 2018). Children who are not able to quickly recognize words often exhibit laborious reading, as each word required analysis, and thus greater attention (Hudson et al., 2018). Furthermore, skilled readers fluently use their linguistic knowledge to build mental representations of the text, allowing for an increased capacity for text comprehension (Tilstra et al., 2009; Trapman, et al., 2014). Consequently, slow word identification was seen to have a limiting effect on comprehension (Perfetti, 2013). These findings align with the Automaticity Model of Reading (LaBerge & Samuels, 1974) and the Verbal Efficiency Theory (Perfetti, 1985) mentioned above, suggesting that this increased attention allocated to deciphering each individual word results in a decreased amount of attention available for comprehension. Additionally, a study looking at monolingual teens found that poor fluency explained low reading comprehension levels, further supporting the notion that efficient and fast word recognition allows for the reallocation of resources onto higher-order reading processes (Trapman et al., 2014).

In specific relation to the SVR, fluency was identified as a mediator between decoding and comprehension. When decoding was automatic, attentional resources were free to focus on the meaning of the text (Silverman et al., 2013). Alternatively, it was found that students who had higher decoding abilities, but insufficient levels of fluency, had lower comprehension skills

than students with high abilities in both (Silverman et al., 2013). When fluency was entered as a final predictor of reading comprehension, it explained the additional variance found in comprehension scores (Cutting et al., 2009).

These findings suggest the importance of fluent reading in relation to strong reading comprehension skills. However, reading fluency does not always develop naturally. Children struggling to develop reading fluency often require direct instruction and opportunities for intense interventions explicitly targeting fluency (Hudson et al., 2005). The following section will describe the common instructional methods applied to improve reading fluency, and the popular commercially developed programs and interventions designed to improve both fluency and comprehension. The purpose of the following section is to provide a review of the instructional techniques successful at improving fluency skills, and how these techniques influenced the development of reading interventions. Additionally, this section is included to provide a foundational understanding of fluency instruction and the appearance of such methods. This will support the later understanding of the functions of the various tasks and activities utilized within the RAVE-O intervention.

Summary. At present, theories of reading and the processes involved are guided by a multi-componential framework. Thus, reading is understood as an ability requiring the integration of multiple lower- and higher-level processes (Perfetti & Adolf, 2012). The ultimate goal of reading is to comprehend text so that from it meaning can be derived. To achieve comprehension, many component skills and mechanisms must be integrated and function in concert with one another. The consequences of comprehension difficulties are grave and have been found to be relatively stable and long-lasting. Therefore, awareness of the critical processes required to achieve proficiency in comprehension is essential. Recent research suggests that of

these component skills, reading fluency has been found to be a strong predictor of comprehension, suggesting the influential role fluency has in overall reading abilities. Fluency in lower-level processes allows attentional resources to be allocated to understanding and comprehending text. These findings within the literature and recent studies is critical to developing a comprehensive and complete understanding of reading and what mechanisms are required to achieve reading proficiency. Reading research suggests that fluency has a place as a critical component skill required for proficiency in reading.

These findings are relevant to the present study, as the aim of the study is to examine the efficacy of the RAVE-O reading intervention that was designed to target reading fluency in order to positively impact children's reading comprehension skills. RAVE-O design is rooted in the belief that reading fluency is essential to comprehension, thus an in-depth understanding of reading fluency and how it contributes to comprehension was necessary. The following section will identify effective instructional methods and interventions that explicitly target reading fluency. This will provide an understanding of instructional methods utilized within RAVE-O to ensure the intervention targets the development of reading fluency as a means of improving children's overall reading abilities.

Fluency Instruction and Interventions

Understanding *which* processes are involved, examining *how* they are involved, and understanding *why* they are interrelated is important when determining a) the predictors of reading comprehension; b) how to measure comprehension; and c) how to effectively intervene when children are failing to comprehend text.

As described in the first section of this proposal, reading comprehension involves many higher- and lower-order componential skills working in conjunction with one another to relieve

the necessary processes that allow for text comprehension to occur. Particularly, when the lower-order processes have reached optimal levels of fluency, attentional resources are reallocated to focus on deriving meaning from the text, building mental representations of the text, and linking prior knowledge to what has been read - all of which pave the way for reading comprehension. Due to the association between reading fluency and reading comprehension, interventions targeting reading fluency are essential. The focus of this section will be on effective fluency instruction and interventions, specifically examining the successful instructional methods and the prospective outcomes of effective interventions.

As previously mentioned, a significant proportion of 4th graders in the United States are performing below the basic achievement level of reading, identifying a large proportion of students who have yet to develop even partial mastery of the fundamental skills. When these fundamental skills are not developed, the individual's cognitive load is occupied at the expense of understanding the written text (Stevens, Walker & Vaughn, 2017). Though the average reading score of 4th graders has increased over the years, the percentage of students performing below basic levels of achievement is alarming. In 2000, the National Reading Panel in the U.S. released a statement classifying fluency as a critical requirement for successful comprehension, suggesting that struggling readers require effective instruction and interventions directly targeting reading fluency to make gains in not only fluency, but also in overall reading abilities.

Response to Intervention framework. As highlighted throughout this paper, a number of children continue to struggle with reading and slip between the cracks in general education settings, suggesting that current instructional methods may not be adequate at meeting the needs of all children (Solis et al., 2014). Response to Intervention (RTI) models are one way to ensure that the learning needs of all children are met. RTI models are multi-tiered instructional systems

designed as a preventative effort to reduce the number of children identified with specific learning disabilities (Millburn, Lonigan, & Phillips, 2017). RTI is based on the concept that when provided with effective instruction, children will either respond adequately or inadequately (Fuchs & Fuchs, 2006; VanDerHeyden, Witt, & Gilberston, 2007).

The first tier of an RTI model is the general education classroom, where children's responsiveness is measured when provided with effective instruction (Fuchs & Fuchs, 2006; Milburn et al., 2017). Children deemed "unresponsive", based on predetermined criterion, will receive more intensive instruction at the second tier (Fuchs & Fuchs, 2006; VanDerHeyden et al., 2007). At the second tier, children receive supplemental, small-group interventions targeted at developing specific skills (Milburn, et al., 2017). It is believed that after tier two interventions, between 2 and 5 percent of children with reading difficulties would remain (Denton et al., 2006). These children would be classified as "unresponsive" and identified as having pervasive deficits and move on to instruction provided at the third tier. Tier three instruction occurs in a smaller, more homogenous group of children or a one-to-one setting (Hopper, 2013). Children in tier three interventions receive more intensive and individualized interventions for longer periods of time (Denton et al., 2006; Fuchs & Fuchs, 2006).

RTI frameworks have been found to be effective at improving reading outcomes over time. For instance, students with low comprehension skills receiving RTI outperformed students who did not receive RTI interventions when reading comprehension was measured at a later time (Robert, Vaugh, Fletcher, Stuebing, and Barth, 2013). Additionally, RTI interventions were found to significantly improve children's decoding, fluency, and comprehension skills (Denton et al., 2006).

An overview of RTI models is included in this section to highlight the ways in which

educators can effectively identify and assist those at-risk of developing reading disabilities. Through this problem-solving approach, educators are encouraged to be more cognizant of the students who are not receiving adequate support from instruction provided in general education classroom settings. Additionally, this review was provided to assist readers in understanding the rationale behind the design of the RAVE-O intervention utilized in the present study.

The following section provides readers with a description of the instructional methods commonly utilized to improve reading fluency. The efficacy of each technique and program is discussed to provide readers with an understanding of the effective ways to target reading fluency and ultimately improve reading comprehension skills. RTI provides educators with the opportunity to determine the extent of a problem and design an intervention that targets the specific learning needs of the student (Fuchs & Fuchs, 2006). In order to ensure these interventions are effective, an understanding of the efficacy of the instructional techniques and the commercially available programs is essential.

Fluency instruction. Common instructional methods used to improve reading fluency include speed drills, choral readings, repeated readings, previewing, taped books, assistive technology, and commercial programs.

Speed drills. Speed drills require the sequenced reading of a given list of words within a one-minute timed trial. As the student reads, an instructor pays attention to the number of words read correctly. During the trial, the instructor records both the correctly and incorrectly read words on a replicated word list. To calculate the rate at which the student reads, the total number of errors is subtracted from the total items attempted to produce the total number of words read correct per minute. Accuracy is calculated by dividing the total number of words read correctly by the total words attempted to produce a percentage of words read correctly. Typically, word

lists consist of phonetically regular words, sight words, or those that the student is required to master throughout the school year. In addition, speed drills are commonly administered by educators conducting early reading curriculum-based measures (CBM) to assess a student's reading abilities and to detect the mastery of foundational skills by measuring automaticity (Hosp, Hosp & Howell, 2016). The goal is for the student to develop automatic recognition of words, an important skill underlying both reading fluency and comprehension. Studies examining speed drills have found it to be an effective method for increasing word recognition. Students receiving interventions incorporating speed drills showed improvements in their ability to accurately and automatically read words (Mule et al., 2018).

The Neurological Impress Method. An effective method of choral, or concert, reading used to increase reading fluency is the neurological impress method (Heckelman, 1966). This method emphasizes fluent reading and requires the student and the instructor to share a copy of the text and read along together. While doing so the instructor models fluent reading by following the words with his or her finger and reading at a slightly quicker pace than the student. Though use of this method has declined over the past years, recent research conducted by Flood, Lapp & Fisher (2005) has shown it to be effective at improving oral reading fluency, silent reading fluency, and comprehension.

Repeated reading. Repeated reading, a more commonly used method, involves students repeatedly reading a passage aloud. Unlike the neurological impress method, repeated reading emphasizes not only fluency, but comprehension as well. This method has proven to increase fluency and comprehension through improvements in reading rate, accuracy, and understanding (Stevens, Walker & Vaughn, 2017). Repeated readings were most effective at improving fluency when combined with modeling, corrective feedback, and performance feedback in the form of

words correct per minute (Stevens, Walker & Vaughn, 2017).

Previewing. Previewing is another method for improving reading fluency. This method allows the student to access and review the text prior to formal reading, either by reading it alone silently or aloud, or by having the text read by the instructor. Research on previewing text, no matter the form, has shown it to be an effective means to improving reading fluency. In addition to improvements in fluency, previewing text was found to be an effective strategy leading to increases in reading comprehension (Hawkins, Hale, Sheeley & Ling, 2010)

Assistive Technology. Much of the assistive technology (AT) designed to support reading abilities are equipped with features that are common in effective fluency interventions. For instance, Kurzweil 3000 is an AT program that allows students to digitally access and manipulate text. Once the text is integrated into the computer program, it can be read aloud and highlighted so that students can access features such as previewing prior to activities and formal readings, immediate feedback when words are read incorrectly, and modelling of fluent reading rate. Students utilizing Kurzweil 3000 have shown increases in their reading speed and acquisition of sight words (Cullen, Keesey, Alber-Morgan & Wheaton, 2013). Comparable to Kurzweil 3000 is The Soliloquy Reading Assistant. This electronic reading assistant increases fluency, vocabulary development, and comprehension through immediate feedback, modeling, previewing, repeated reading, and built-in comprehension activities (“Soliloquy Reading Assistant”, 2002).

Fluency interventions. Fluency interventions include any mediation practice that addresses and attempts to produce gains in the students reading speed and accuracy (Stevens, Walker & Vaughn, 2017). Research indicates that the most effective fluency interventions are complex and multi-componential (Solis et al., 2014), complementing the way reading

comprehension is defined as a construct. In addition, interventions are found to be the most effective when they are intensive, when they were implemented in a child's early school years and when they are provided within a small-group setting (Hay, Elias, Fielding-Barnsley, Homel, & Freiberg, 2007; Pfoost et al., 2014; Vaughn & Wanzeck, 2014). As a result, fluency interventions need to incorporate multiple components that simultaneously target fluency and comprehension, and the lower and higher-level processes involved, to a small number of children at one time.

For children with learning difficulties, interventions should be intensive, in that they provide instruction to a small, homogenous group of children at one time. Small groups of three to four children are associated with higher effects than larger groups of about eight to ten children (Lou et al., 1996). When specifically looking at children with reading difficulties, those receiving small group interventions show greater improvements than those provided interventions in larger groups (Vaughn & Wanzeck, 2014; Wanzeck & Vaughn, 2007). Additionally, Vaughn and Wanzeck (2014) found that early elementary students with reading difficulties who were provided with intensive reading interventions showed the highest gains in word reading and comprehension in comparison to upper elementary and secondary school students with reading difficulties who received similar interventions.

A study conducted by Chard, Vaughn & Tyler (2002) synthesizing the research on fluency interventions, produced the most common features of effective interventions. Their research indicated that students with reading disabilities benefitted most from interventions that incorporated a model demonstrating fluent reading, multiple readings of a passage or text, corrective feedback, and instruction and practice recognizing larger orthographic units (Chard, Vaughn & Tyler, 2002). In addition, interventions focusing on the alphabetic principle (i.e.,

letter-sound correspondences), practicing skills, and repeatedly reading in various contexts and in combination with comprehension activities, were found to successfully improve both reading fluency and comprehension abilities. Their findings provide support for interventions that incorporate multiple components.

In addition to being multi-componential, interventions for children with reading difficulties must be targeted at developing specific reading skills and processes. The risk of chronic reading difficulties can be decreased when children are provided with intensive interventions that are targeted (Al Otaiba, Gillespie Rouse & Baker, 2018; Denton et al., 2006). An understanding of the effective instructional methods, such as those outlined above, can help educators and practitioners determine which interventions are likely to improve the reading abilities of children who are struggling, and assist educators and practitioners design individualized interventions based on a specific child's learning needs. Ensuring that multiple elements of effective interventions are incorporated within an intervention is essential to warranting the positive impact an intervention has on a child. Choosing empirically sound interventions and providing them to children at the appropriate level (i.e., tier two versus tier three) is of utmost importance.

The following is a description of the commonly employed commercial programs implemented to improve reading fluency. Those commonly utilized include the Great Leaps Reading Program (Campbell, 1998), Read Naturally (Hasbrouck, Ihnot & Rogers, 1999), QuickReads (Hiebert, 2006), and the recently developed RAVE-O (Wolf, 2011) literacy program.

Great Leaps Reading Program. Widely-used, the Great Leaps K-8 reading program (Campbell, 1998), has been developed with the intent to supplement students' core reading

program and improve many components of reading, including reading fluency (Begeny et al., 2010; Hudson, Lane, & Pullen, 2005). The positive response received by Great Leaps has been attributed to the easy implementation of the program and the incorporation of effective instructional procedures. These include modelling, repeated readings, practice, and performance feedback (Begeny et al., 2010). However, despite the program's popularity, few studies have examined the effectiveness of Great Leaps as a reading intervention. Of those studies that have been conducted, mixed results have been reported. For instance, in one study in which Great Leaps was implemented, an increase in participant's decoding automaticity and quicker recognition of high-frequency words was found (Mercer, Campbell, Miller, Mercer, & Lane, 2000). Whereas contradictory evidence was found in a study conducted by Begeny and colleagues (2000), who reported that students receiving Great Leaps did not perform significantly better than the control group on any measures of reading achievement. The limited and inconsistent research available makes the widespread use of this program problematic. Further evaluation and evidence of the efficacy of the Great Leaps reading program is required before it is adopted into educational settings and deemed an effective intervention.

Read Naturally. Read Naturally is an intervention specifically designed to improve reading fluency. Throughout the program, Read Naturally incorporates the effective instructional methods used for improving fluency skills. These include reading alongside a fluent model, repeated readings, and progress monitoring (Erikson, Derby, McLaughlin & Fuebrer, 2015). In this program, students read the developed passages up to five times. These passages are then re-read while student performance is tracked and monitored. Students also have the option to practice reading these passages alongside an audio-tape. Due to the repeated readings of the passages, students are exposed to the same words, multiple times, increasing their ability to

recognize them with accuracy and automaticity (Erikson et al., 2015). Recent research provides evidence to support the use of Read Naturally as a fluency intervention due to significant gains in measures of both the participant's reading fluency and confidence (Erikson et al., 2015).

QuickReads. QuickReads (Hiebert, 2006) consists of condensed science and social studies texts developed for building reading fluency, vocabulary, and comprehension (Trainin, Hayden, Wilson & Erikson, 2016; Wendling & Mather, 2009), through the “gradual release of responsibility” (Trainin et al., 2016, p. 94). The program begins with the instructor modeling fluency by reading quickly and expressively. Students then move onto reading the passage silently alongside the instructor. This stage allows for guided practice, as students have the opportunity to track the model's word-reading. The final stage involves the students reading the passage independently during a timed trial (Hiebert, 2006; Trainin et al., 2016). This program incorporates many of the effective instructional methods mentioned previously, such as modelling, previewing, repeated reading, and choral reading. QuickReads has been shown to improve reading rate, vocabulary, and comprehension for students in grades two through five (Trainin et al., 2016).

As previously stated, it is essential for practitioners and educators to understand which instructional methods are effective and why. Adopting a pre-designed reading program or intervention without examining its efficacy is problematic. In addition, it is precarious to design an intervention without considering both effective and ineffective instructional methods. To ensure that the employed and developed interventions are targeted, practitioners and educators must evaluate which methods target the specific reading difficulties a child is exhibiting. Likewise, when selecting an intervention to implement, a look into the different instructional methods incorporated throughout the program is necessary to ensure that the program

appropriately targets reading. Just because a program is made commercially available does not mean it guarantees improvements in reading abilities, as is the case for Great Leaps - whose claims are unsubstantiated.

RAVE-O. The Retrieval, Automaticity, Vocabulary Elaboration, Orthography (*RAVE-O*) literacy program (Wolf, 1994) was designed to improve the reading skills of children identified with reading difficulties. This particular intervention was chosen for the present study for the following reasons: (1) *RAVE-O* incorporates multi-componential and multi-layered instructional methods to improve reading skills (Wolf et al., 2009), aligning with the multi-componential framework used to understand reading as suggested by Perfetti and Adolf (2012); (2) *RAVE-O* emphasizes the importance of enriching a child's knowledge about a word, by focusing on a number of word elements, such as orthography, aligning with the ideas presented in Perfetti's (1986) Lexical Quality Hypothesis; and (3) *RAVE-O* conceptualizes reading fluency as a bridge to comprehension, focusing on strengthening fluency skills through proven instructional methods, such as modelling (Wolf et al., 2009). These key pieces highlight the ways in which *RAVE-O* incorporates current understandings of reading, including the importance of fluency. Due to its emphasis on fluency, *RAVE-O* was chosen for this present study to examine whether or not a fluency-focused intervention improves not only the fluency skills of struggling readers, but also comprehension skills. However, due to its recent release, the *RAVE-O* literacy program has not been extensively studied. Additionally, *RAVE-O*, designed to be implemented in a large group setting, has not been extensively researched as an intensive tier two intervention for children achieving at below average levels in reading. Thus, the central purpose of this study is to examine the efficacy of this program and the impact it has on improving children's fluency and comprehension skills when used as an intensive intervention. The following section provides

a comprehensive description and discussion of the RAVE-O program.

The RAVE-O Program

Referred to as a new and “promising approach” (Wendling & Mather, 2009, p. 74) is the Retrieval, Automaticity, Vocabulary Elaboration, Orthography (RAVE-O), established by Dr. Maryanne Wolf (1994). The central purpose of RAVE-O is the development of reading fluency and automaticity (Wolf et al., 2000) by explicitly targeting fluency in word attack, word identification, and comprehension. Emphasis is also placed on developing automaticity in the underlying componential processes of reading (Wolf et al., 2000). In introducing the RAVE-O program, Wolf (2011) asks readers, researchers, and instructors to indulge in the notion that “human beings were never born to read” (p. 2). Consequently, many children struggle with the task of reading. In their work, researchers Wolf & Katzir-Cohen (2001), discuss the need to reconstruct beliefs about reading difficulties due to the high number of children failing to respond to general classroom instruction and remediation methods. What they uncovered was students’ failure to respond to interventions that focused on a single process. Specifically, they discovered a number of interventions were focused on phonological-based treatments and implemented due to the belief that phonological impairments were the sole source of students’ reading difficulties. However, as demonstrated in the previous sections, reading is not dependent on a single mechanism or process. Reading is complex, requiring the integration of multiple mechanisms, as suggested by Perfetti & Aolf (2012) who view reading within a multi-componential framework. Models such as the Simple View of Reading (Gough & Tunmer, 1986) and the Automaticity Model (1974) support this notion, explaining reading as a process involving multiple levels of processing. These central theories provide some explanation as to why Wolf & Katzir (2001) discovered interventions to be ineffective when they focused only one

component of reading. Utilizing findings from reading research, Wolf (1994) understood the need for more robust interventions and set out to design a literacy intervention that targeted reading comprehension by focusing on first strengthening a child's reading fluency skills.

Current evidence about the relation between fluency and comprehension highlights the need for the development of fluency in reading to achieve success in comprehension and overall reading abilities. In particular, deficits in the lower-level skills required for fluent word recognition negatively affect reading comprehension abilities (Wolf et al., 2000). However, as described by Wolf and colleagues (2000), fluency is under-addressed in many of the reading interventions and programs available. Due to this, Wolf designed the RAVE-O intervention to address this gap in treatment.

Intervention Goals. The purpose RAVE-O is to provide an intensive small group intervention to assist students at-risk for reading failure (Wolf et al., 2000). "At-risk" students are defined in the program as students between the second and fifth grade who have phoneme awareness-related decoding difficulties, fluency deficits, and/or rapid naming deficits. Additionally, these students may have been identified for tier two or tier three interventions in an RTI program (Wolf, 2011; Wolf et al., 2000). The first, and "ultimate" (Wolf et al., 2000, p. 377) goal of RAVE-O is to develop fluency in word identification, word attack, and comprehension. To achieve this, effective instructional methods, such as choral reading, repeated readings, and modelling in conjunction with immediate and explicit emphasis on understanding words based on their orthography, semantics, syntax, and morphology, are utilized (Wolf, 2011; Wolf et al., 2000). These strategies align with the central theories of reading. Within the Simple View of Reading (Gough & Tunmer, 1986), reading comprehension is thought to rely heavily on decoding and linguistic comprehension. Decoding, the ability to read words quickly and

accurately, requires the deciphering of written code (Kendeou et al., 2016). By building on decoding skills, one's ability to develop fluency in word identification and word attack can be achieved, which has been found to have a positive effect on comprehension (Silverman et al., 2013). Similarly, creating a rich understanding of words based on their orthography, semantics, syntax, and morphology aligns with the Lexical Quality Hypothesis proposed by Perfetti (2007). Perfetti (2007) suggests that high lexical quality, that is flexible and precise mental representations of a word that specifies its form and meaning components, improves reading comprehension as this rich lexicon allows for rapid retrieval of words and meaning (Perfetti & Adolf, 2012).

The second goal of the program is to connect lexical with sub-lexical processes to allow for the achievement of fluency (Wolf et al., 2000). At the sub-lexical level, RAVE-O activities are focused on increasing the processing speed of underlying component skills, such as vision-related processes (i.e., scanning) and auditory processes (i.e., onset and rime identification). At the lexical level, RAVE-O activities consist of repeatedly exposing students to letter sequences and common sub-lexical units in English, while also explicitly teaching multiple meanings of words. Students are taught to attach meaningful and comprehensive associations to each of the words and their meanings, the rationale being "rapid word retrieval is facilitated by the child's familiarity with and the amount of knowledge about the word" (Wolf et al., 2000, p. 378). This once again compliments the Lexical Quality Hypothesis (Perfetti, 2007) used to conceptualize the processes involved in comprehension.

The third goal of RAVE-O is to challenge the way students' view themselves as readers and to engage them in reading by establishing achievable successes (Wolf, 2011; Wolf et al., 2000). Alongside explicit instruction, the greatest aid to fluent comprehension is the child's

intrinsic desire to read (as cited in Wolf, 2007). By utilizing materials designed as platforms of success, this program allows students to overcome their expectation of reading failure and create more positive perceptions of their abilities (Wolf et al., 2000).

Intervention Efficacy. To date, few studies have examined the efficacy of the RAVE-O literacy intervention. A search of the literature produces few efficacy studies, many of which have been conducted or overseen by the developer, Maryanne Wolf. Although limited, these studies will be discussed to provide some evidence towards the efficacy of the RAVE-O literacy program and emphasize the need for additional efficacy studies to be conducted.

The efficacy of RAVE-O comes from two five-year randomized treatment-control studies funded by the National Institute for Child Health and Human Development (NICHD), and a handful of small intervention studies conducted in varying school contexts. In the studies conducted by the NICHD, RAVE-O was found to significantly improve participants' decoding accuracy, reading fluency, comprehension, and vocabulary knowledge (Wolf, 2011). However, RAVE-O was not implemented in isolation. In these studies, participants received RAVE-O combined with a phonemic awareness and blending program. Therefore, it is hard to draw conclusions about the efficacy of RAVE-O as a solitary intervention. Donnelly Adams (2009) investigated the use of RAVE-O in a summer school setting, and found significant improvements in students listening comprehension, reading comprehension, sight-word reading, and reading fluency. Though some evidence was found to support the efficacy of RAVE-O, what is available is limited. Developer Wolf (2009) and colleagues also state that with feedback and additional studies, the RAVE-O program itself is subject to change.

RAVE-O incorporates many of the current trends and theories found in the scientific reading research literature. Through the review of the relevant literature, the author was able to

establish many connections RAVE-O has to central and current theories of reading. For instance, RAVE-O parallels the multi-componential view by approaching reading difficulties with a complex, word-level intervention. The multi-componential view of reading comprehension is the notion that reading success requires the simultaneous coordination of multiple tasks (Fuchs et al., 2001; Perfetti & Adolf, 2012). Therefore, the implementation of a multi-componential intervention that explicitly targets the development of the many fundamental skills of reading, including fluency is essential when addressing reading difficulties. Due to its emphasis on fluency, comprehension, and on the multi-componential processes of reading, such as phonological, orthographic, semantic, and lexical retrieval skills (Wolf et al., 2000), the RAVE-O intervention was chosen for the present study to examine the relations among fluency, comprehension, and overall reading abilities. Based on the significant association found between fluency and reading success in many studies, and the use of these discoveries in the development of RAVE-O, the central purpose of the present study is to assess the efficacy of the program by specifically examining its effect on measures of participants' fluency, decoding, and comprehension skills. Additionally, this study will examine whether or not the RAVE-O literacy program is effective when used in as a small-group, intensive intervention.

Summary

Reading is a highly influential ability, impacting not only reading related-tasks, but other subject areas as well. Furthermore, reading influences successes and failures beyond the classroom. A child's reading ability has been found to be relatively stable and long-lasting, thus failure in reading can have grave consequences throughout a child's life. Though the focus on the present study is reading within an educational setting, it is important to remember the importance of reading throughout our everyday lives, as it is essential to interacting within our society.

Therefore, it is imperative that professionals and educators continue to develop a more informative and comprehensive understanding of reading and the reading brain. In order to do so, one must understand the many processes involved, how these processes are interrelated, and how to effectively intervene when children are exhibiting reading difficulties.

Central theories in the literature describe the ability to read as not one skill, but multiple skills working simultaneously (Perfetti & Adolf, 2012). The reading brain is similar to a complex machine with many connected working parts. The functioning of a single process in isolation will fail to produce quality in the end result. For reading, this end result is comprehension. Comprehension is the process in which readers construct meaning and grasp understanding from text. In order for accurate comprehension to be achieved, many lower- and higher-level processes must work in unison. However, allocating attention to each process is too demanding for the reading brain. Greater attentional resources allocated to lower-level processes will negatively impact a reader's ability to retrieve context appropriate meanings from the text, and ultimately impact their ability to understand and remember what has been read (Perfetti & Adolf, 2012). Though lower-level processes provide a foundation for reading, less attentional resources must be allocated to make way for higher-level processes to function. In order for these lower-level processes to require less attention, reading fluency must develop. Fluency allows for lower-level processes to function with automaticity and little conscious attention. Thus, more attention can be allocated to higher-level processes that allow comprehension to take place (Meyer & Felton, 1999). Due to the nature of fluency, and the way in which it is involved in the reading process as a whole, it has been deemed as a critical requirement for successful comprehension and overall reading abilities (Cutting et al., 2009; Fuchs et al., 2001). Therefore, it is important for reading interventions to incorporate effective instructional methods that explicitly target

reading fluency.

As presented within the literature review, recently developed and released reading interventions, such as the RAVE-O program, typically have not been studied in-depth resulting in limited efficacy evidence in the literature. However, it is crucial to examine these interventions to determine whether they are appropriately and effectively targeting the fundamental processes involved in reading. The design of RAVE-O was guided by the multi-componential framework and designed to target the reading fluency skills of children identified with reading difficulties. Due to its recent development, limited evidence can be found to support the efficacy of this intervention. The present study hopes to close this gap and add to the literature on reading fluency and fluency interventions.

Rationale. The present study will examine the implementation of RAVE-O within a small-group setting comprised of children in the early elementary years identified with reading difficulties. This demographic is important, as it has been found that without effective remediation these children will continue to face difficulties throughout their lives. It is essential that prior to implementing RAVE-O, there is evidence that supports its use as an effective intervention that targets fluency and comprehension skills and is also effective for this group of children. The present study utilized an adapted version of RAVE-O designed to mimic an intensive tier two intervention within an RTI model, as this would resemble the way in which children identified with reading difficulties would receive a reading intervention in educational settings. The results of this study can inform the design and delivery of the RAVE-O intervention when used as an intensive intervention for students identified with reading difficulties.

Research Questions

The purpose of this study is to determine whether the adapted RAVE-O literacy intervention, utilized within this study, improves reading fluency in struggling readers, and in turn advances reading comprehension skills. An adapted version of RAVE-O was designed to condense the current program into an intervention that explicitly targeted reading fluency and comprehension. The aim was to create an intensive intervention, styled as a tier two intervention utilized in response to intervention (RTI) designs for children identified with reading difficulties.

The study was designed to address the following questions: (1) Does the implementation of the RAVE-O intervention improve the reading skills of children with reading difficulties (along the dimensions of sight-word efficiency, phonemic decoding efficiency, letter-word identification, word attack, oral reading fluency, and passage comprehension), as evidenced by significant, positive changes in fluency and comprehension scores? (2) Is the RAVE-O an effective intervention when condensed and used as a tier two intensive intervention for children identified with reading difficulties, as evidenced by improvements in reading scores?

Significance of the Study. The results of this study can inform the use of RAVE-O as a literacy intervention for children identified with reading difficulties. This study provides evidence towards the efficacy of RAVE-O, specifically when it has been condensed and utilized as an intensive tier two intervention within small-group settings. Due to its recent development, there is a significant lack of evidence found in the literature that examines the efficacy of this particular intervention. It is important for practitioners and educators to select and implement programs proven to be the effective as evidenced through research studies. In addition to examining the effect RAVE-O has on the reading skills of struggling readers, the relationship between fluency development and reading comprehension will also be examined. An improved

understanding of fluency and its effect on reading comprehension skills can inform the selection and use of specific instructional methods when the goal is to address reading difficulties and improve comprehension. Recognizing fluency as a foundational skill for successful reading can help change the way reading difficulties are viewed, and consequently, the ways in which practitioners and educators intervene.

Method

Research Design

To address the research questions, this study employed a single-case research (SCR) design- a common experimental design in the field of special education research (Alnahdi, 2015; Kratochwill & Levin, 2014; Horner, Carr, Halle, McGee, Odom & Wolery, 2005). SCR designs allow researchers to evaluate the effect treatments and interventions have on participants without utilizing a group design. Group research designs prove to be difficult to construct in this field due to the heterogeneous characteristics of subjects, especially true since participants are commonly individuals with disabilities. Consequently, the formation of equivalent groups used to study and make comparisons is rarely feasible. Alternatively, SCRs “allow educators to compare each participant’s performance with his/her other performances across various settings (Alnahdi, 2015, p. 257). Thus, participants act as their own control, eliminating the need to form an equivalent control group. Correlational relationships are inferred when measurable effects occur in the dependent variables following the implementation of an independent variable, in this case the intervention (Horner et al., 2005).

In the present study, an SCR design was employed to allow for the participant’s performance before the implementation of the RAVE-O intervention (baseline scores) to be contrasted with their performance occurring throughout (CBM scores) and after the intervention (treatment scores). In this study, participants acted as their own control. A pre-post design was selected to obtain conclusions about the effectiveness of the RAVE-O reading intervention and to provide evidence-based research to assist educators in selection and implementation decisions.

SCR designs in the field of special education allow for studies to focus on a small, and specific groups of individuals and how they are affected by the implementation of an

intervention (Horner et al., 2005). SCR designs are practical ways of measuring change, as they are easily employed within educational settings. Horner et al. (2005) suggested that this feature eliminates the potential for participant differences in performance and behaviours due to the experimental context, such as lab environments. MacMillan (as referenced in Alnahdi, 2015) summarizes five characteristics of SCR designs that evidence this as a satisfactory design for intervention studies. First, the measures used in intervention studies are typically standardized and administered in similar contexts, under the same conditions, by an individual with appropriate training. Therefore, the instrumentation for data collection is likely reliable. Secondly, these designs commonly employ multiple and repeated measures of the same behaviour or ability. This allows researchers to identify clear patterns of change in participants over the course of the study (Alnahdi, 2015). Thirdly, SCR designs maintain validity by providing comprehensive descriptions of the measures administered and the treatment conditions. The inclusion of baseline and treatment conditions in SCR designs provides yet another reason for the appropriateness in educational psychology studies. Baseline measures allow for behaviours and abilities to be measured prior to the implementation of an intervention or treatment. This provides a point for future performances to be compared, such as the treatment condition. Finally, the introduction of a novel variable, such as an intervention, following the baseline phase allows for the effect of this variable to be studied and examined. Moreover, Horner et al. (2005) argued the value of SCR designs lies in their capacity to examine the efficacy of interventions for exceptional groups, such as children with reading difficulties. Additionally, the results of SCR designs have been effective in improving special education practices by allowing researchers to examine the effect treatments, programs, and interventions have on students' performance (Alnahdi, 2015; Horner et al., 2005).

Participants

One group comprised of four children aged 8 to 10 years old (*Mean* age = 109 months) received the intervention. Participants attended three different elementary schools in the greater Victoria area, with three participants in fourth grade and one participant in third grade. An equal number of males ($n = 2$) and females ($n = 2$) participated in the study. Participants were referred to the study by the director of the Learning Curve (formerly the Learning Disability Association of British Columbia). Eligibility criteria for participation in the study was collected to ensure those referred were between grades two to five, consistent with the RAVE-O program, and were experiencing reading difficulties, as indicated by standard scores below 90 on the measures used to assess reading ability. Table 1 outlines the participant's profiles prior to the implementation of the intervention. Participants' reading difficulties were similar in nature. A homogenous profile of reading difficulties is indicated in participants' scores achieved at pre-test. All participants displayed difficulties in reading fluency, reading accuracy, decoding fluency, and decoding accuracy. To preserve confidentiality, participants are assigned pseudonyms and identified as Lily, Flint, Ivy, and Cliff.

Table 1 *Pre-Test Assessment Scores*

Measure**	Lily		Flint		Ivy		Cliff	
	RS	SS	RS	SS	RS	SS	RS	SS
WJ-IV Letter-Word Identification	42	84	41	78	36	82	44	82
WJ-IV Word Attack*	15	88	14	82	14	89	11	73
WJ-IV Passage Comprehension	25	85	23	76	21	82	25	80
TWORE-2 Sight Word Efficiency	43	78	48	77	24	70	45	74
TWORE-2 Phonemic Decoding Efficiency	10	73	3	59	5	68	14	75
Oral Reading Fluency (words read correctly in 60 seconds)	38	n/a	30	n/a	17	n/a	25	n/a
Maze (correct word insertions in 3 minutes)	10	n/a	10	n/a	9	n/a	0	n/a

Note. RS = raw score; SS = standard score

*Age-based norms were utilized.

**WJ-IV and TOWRE-2 measures employed standard scores (mean = 100, SD = 15)

Procedure

Preliminary assessments were conducted individually to confirm reading difficulties. Form A of the Woodcock Johnson – Fourth Edition (WJ-IV) (Woodcock, McGrew & Mather, 2001; 2007) and the Test of Word Reading Efficiency – Second Edition (TOWRE-2) (Torgesen, Wagner & Rashotte, 2011) measures were utilized at pre-test assessment (see Table 2 for the

sequence of the study's assessment procedures). An adapted RAVE-O intervention was implemented to the group during the sessions following the preliminary assessment. The intervention was delivered over 15 sessions with each session lasting approximately 45 minutes. Throughout the intervention, curriculum-based measures (CBMs) were administered. At the end of sessions 3 and 12, the DIEBLS Oral Reading Fluency was administered to participants individually. At the end of sessions 4 and 13 the DIEBLS Maze was administered to participants as a group. The CBMs were administered at pre-testing to obtain a baseline score for each participant, and again at post-test. Post-test measures were administered individually 4 days after the final intervention session. Form B of the WJ-IV and the TOWRE-2 were utilized so that participants received the alternate form of these measures. All aspects of the study were conducted in a quiet study space in the Learning Curve.

Table 2 *Study Assessment Procedures*

Pre-test Measures	Progress-Monitoring Measures	Post-test Measures
WJ-IV Letter-Word Identification subtest (form A)	DIBELS Oral Reading Fluency measure administered at the end of sessions 3 and 12.	WJ-IV Letter-Word Identification subtest (form B)
WJ-IV Word Attack subtest (form A)	DIBELS Maze measure administered at the end of sessions 4 and 13.	WJ-IV Word Attack subtest (form B)
WJ-IV Passage Comprehension subtest (form A)		WJ-IV Passage Comprehension subtest (form B)
TOWRE-2 Sight-Word Efficiency subtest (form A)		TOWRE-2 Sight-Word Efficiency subtest (form B)
TOWRE-2 Phonemic Decoding Efficiency subtest (form A)		TOWRE-2 Phonemic Decoding Efficiency subtest (form B)
DIBELS Oral Reading Fluency measure*		DIBELS Oral Reading Fluency measure*
DIBELS Maze measure*		DIBELS Maze measure*

*3 different tests, of equivalent difficulty, were administered to obtain a median score used for the final baseline score. The baseline score was placed as the first data point on the participant's graph and used to monitor progress throughout the study.

Intervention

The RAVE-O literacy program is a comprehensive intervention consisting of 16 units, which amount to 79 individual lessons and 7 consolidation lessons. For the purpose of this study, an unpublished adapted version of RAVE-O was used (Harrison, Schmidt, Perkins, & Padua, 2018). This version consisted of 15 45-minute scripted sessions. The original lessons that built up each of the 16 units of the RAVE-O were adapted into a single concise lesson, so that one lesson stood in place of an entire unit and included all the essential tasks involved.

The intervention is comprised of a variety of engaging characters and appealing tasks that

systematically connect every aspect of an introduced word. Each lesson begins with the introduction of a group of words, which become the focal point of the lesson. The words used have common English letter patterns and have more than one meaning. After the introduction of the words, participants move through a series of tasks that tap into the words' phonology, orthography, semantics, syntax and morphology (Wolf, 2011). The activities within RAVE-O utilize many instructional methods that effectively target key component skills and processes of reading. These activities can be easily mimicked and incorporated by educators within their daily instructional routines.

The following is a description of the nature of the tasks, separated by central and supplementary activities. This study defines central activities as those that occur in each lesson, while supplementary activities are those occurring in only specific lessons. Provided within the description of the supplementary activities is the lesson in which it occurs.

Central Activities. Following the introduction of the lesson's words, participants were asked to identify the rime patterns of the words, and to identify rhyming and non-rhyming pairs. This task required participants to review the organized units of sounds within the words (phonology). This task was followed by instructing the participants to identify the multiple meanings of the given words. Participants utilized a worksheet displaying image cards. The image cards provided a picture cue of the multiple uses of the given word. With the instructor, participants discussed the words many meanings, and then created the word by printing it on the provided lines (orthography). The objective of this task was to have participants provide more than one meaning for a word (semantics).

Participants were then required to review the sound-symbol correspondences of the words. The participants were instructed to slowly say each of the words so that the sounds within

the words could be easily heard, allowing for the phonemes to be segmented. Wooden blocks displaying onsets and rimes of the words were provided. Participants took turns slamming together the two blocks displaying the word's onset and rime. While doing so, participants were encouraged to produce the word vocally. The instructor then wrote the core words on a board to display the spelling pattern and participants were instructed to name the letters. This task required participants to segment phonemes, identify letters, review sound-symbol correspondences, and blend sounds to word level (phonology).

Participants were then provided with a book that contained short stories that were to be read during each lesson. Each story was unique and increased in difficulty as the intervention progressed. The short stories contained the words taught within the lesson. Stories were first read as a group with the instructor leading. The instructor modeled fluent reading and paid close attention to the participants' reading of irregular words (i.e., words that are not pronounceable using letter-sound relations, such as *breath*). If participants exhibited difficulty reading the irregular words (orthography), assistance was provided by the instructor and a description or definition of the word was given. This task allowed participants to become familiar with the text and allowed for practice prior to a formal reading of it. As a final lesson activity, participants were asked to read the short story again, only this time individually. The instructor recorded the participants' reading time to track their reading speed and accuracy (fluency).

Supplementary Activities. Supplementary activities are those that occur in only the specified lessons. The first supplemental activity, *Ender-Benders*, provided participants with a lesson about suffixes, including the purpose of a suffix and how specific suffixes change words. Participants were given the opportunity to practice attaching suffixes to core words to familiarize themselves with the way it may change the spelling (i.e., doubling of letters when adding *-ing*).

These activities were completed on worksheets. This supplementary activity occurred in lessons 4, 5, 6, 8, 14 and 15. A second supplementary activity introduced participants to a character named *Sam Sleuth*. The objective of Sam Sleuth was to act as a memory aid for metacognitive phonological retrieval. The instructor introduced Sam Sleuth, a word detective, to participants and the many tips he had for word identification. The first tip encouraged participants to think about the word's onset sound. Next the character reminded participants to think about the meaning of the word and what other words it might be similar to, in terms of meaning and sound. The final tip was to consider the length of the word. This task provided participants with the opportunity to practice the use of onset sounds and semantic clue to retrieve core words from memory (phonology and semantics). This supplementary activity occurred in lessons 7 and 9. A third supplementary activity provided a metacognitive strategy for comprehension. This activity, named *Think Thrice*, provided three tips to assist participants when retrieving meaning from text. First, of the importance of inferring what might happen in the story prior to reading; then, of the importance of assessing and monitoring ones understanding of the story after reading; and finally, to make personal connections to the text (fluent comprehension). *Think Thrice* occurred in lessons 7 and 8. Finally, *FatRats* was a supplementary activity that introduced participants to compound words. The objective was to have participants identify the word as a whole, and as two-word parts (orthography). Participants were provided with the definition of the words, and practiced reading and writing them in workbook activities (semantics). This supplementary activity occurred in lesson 6.

Measures

A collection of norm-referenced, standardized measures were administered to assess each participant's reading fluency and comprehension prior to and following the implementation of the RAVE-O intervention. Subtests from the WJ-IV and the TOWRE-2 were administered as pre- and post-measures to evaluate differences in participant's reading after the implementation of the RAVE-O reading intervention. Two curriculum-based measures (CBMs) were administered throughout the study to monitor and evaluate participant's reading growth consistent with RTI approaches. These included the DIBELS Oral Reading Fluency test and the DIBELS Maze task.

Word Reading and Decoding Accuracy. Two subtests from the WJ-IV were administered at pre-and post-test. The first subtest assessed participants' word reading accuracy, by reading words in isolation that gradually became more difficult (Letter-Word Identification), and the second assessed participants' ability to use letter-sound skills to decode nonwords (Word Attack). Starting and stopping points as described in the test manual were followed, and raw scores and standard scores were recorded. Internal consistency estimates for the age range of participants in the current study (i.e., 8 to 10 years) as reported in the manual are 0.96 to 0.94 and 0.92 to 0.94 for Letter-Word Identification and Word Attack, respectively.

Reading and Decoding Fluency. Two subtests from the TOWRE-2 were administered at pre- and post-test. The first subtest assessed participants' word-reading fluency, by requiring participants to read a list of familiar words with speed and accuracy that gradually increased in difficulty (Sight Word Efficiency). The second subtest assessed participants' rate and accuracy when reading pronounceable non-words (Phonemic Decoding Efficiency) Starting and stopping points as described in the test manual were followed, and raw scores and standard scores were

recorded.

Reading Comprehension. The Passage Comprehension from the WJ-IV was administered to assess participants' reading comprehension at pre- and post-test. This task required participants to complete information missing from texts they read in a cloze format that gradually become more difficult. Starting and stopping points as described in the test manual were followed. Internal consistency estimates for the age range of participants are between 0.93 and 0.89. Raw scores and standard scores were used.

Progress Monitoring Measures

DIBELS Oral Reading Fluency. The Oral Reading Fluency CBM was administered to measure participant's accuracy and reading rate when reading connected text (Hosp et al., 2016). As a progress-monitoring measure, it was used to detect any changes in participants' reading accuracy and rate throughout the study as a response to the intervention. Participants were required to read passages aloud for one minute. This allowed for the assessment of participant's decoding processes. The oral reading rate was calculated by totalling the number of words read correctly per minute. Words were scored as incorrect if they were read incorrectly, omitted, or substituted for another word. Additionally, if the participant hesitated for more than three seconds the word was scored as incorrect. However, if the participant made a self-correction, the word was scored as correct (Hosp et al., 2016). Oral Reading Fluency CBM was initially administered 3 times to ensure an accurate score was obtained, and to ensure the student received the appropriate passage level based on ability.

DIBELS Maze. The Maze CBM was administered to assess and participant's overall reading skills and detect any changes in reading ability throughout the duration of the study. Maze was delivered due to its high correlation with comprehension (Hosp et al., 2016). During

this test, participants were presented with a reading passage containing approximately three-hundred words and forty-two deleted words. For each deleted word, participants were offered three replacement words and are required to supply the word most suitable for the given context. Each of the administered Maze tasks were of equivalent difficulty, but novel to the participant. To obtain the participants rate, the total items attempted was subtracted by the total number of errors to attain the total correct words supplied. To obtain a measure of accuracy, the total number of correct words supplied was divided by the total items attempted to attain a percentage of correct responses (Hosp et al., 2016). Maze CBM was initially administered 3 times to ensure an accurate score was obtained, and to ensure the student received the appropriate passage level based on ability.

Results

The following section will review the reading measures for all participants and synthesize the results through percentage of non-overlapping data analyses. The study was designed to answer: (1) Does the implementation of the RAVE-O intervention improve the reading skills of children with reading disabilities (along the dimensions of sight-word efficiency, phonemic decoding efficiency, letter-word identification, word attack, oral reading fluency, rapid automatic naming, and passage comprehension), as evidenced by significant, positive changes in fluency and comprehension scores? (2) Is the RAVE-O an effective intervention when condensed and used as a tier two intensive intervention for children identified with reading difficulties?

Due to the serial dependency of the data points, mean differences and regression-based effect sizes were not computable (Wolery, Busick, Reichow & Barton, 2010). By way of explanation, the data collected was on the performance of the same individual over time, in the same context and under the same conditions. Therefore, to synthesize the data and determine the size of the effect, the percentage of non-overlapping data (PND) was calculated. PND is a widely known and commonly employed overlap method for calculating effect sizes in SCR designs akin to the present study (Wolery et al., 2010). To calculate the effect size, the intended change was determined. The present study hypothesized an increase in scores as a result of the implementation of RAVE-O. Baseline measures were administered, and scores were graphed. It should be noted that raw scores were collected and used throughout the PND analysis, as standard scores are norm-referenced and describe the child's relative standing within a group. Using standard scores would compare participants to a normal population of same-age peers. Since participants were identified with reading difficulties, the use of standard scores would subject participants to a comparison against a population from which they are not represented.

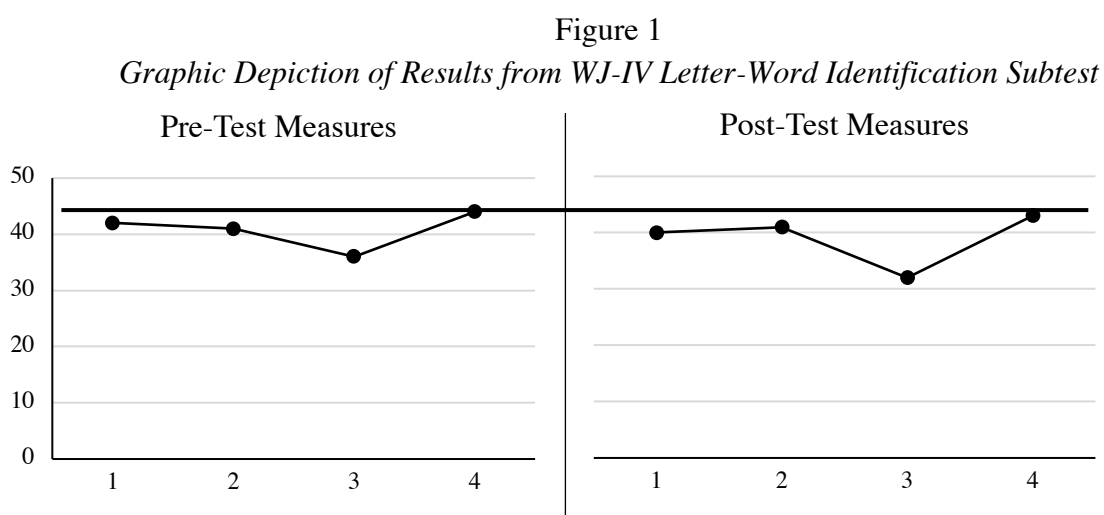
The graphs provided in the following section have been organized so that along the y-axis run the raw scores, while on the x-axis run the participant's identification numbers, with 1 representing the scores of Lily, 2 representing the scores of Flint, 3 representing the scores of Ivy, and 4 representing the scores of Cliff. Because of the intended change, the greatest datum point was identified by drawing a horizontal line through the graph at this point (Scruggs & Mastropieri, 2013). The numbers of data points in post-intervention scores above the line were counted. The sum of these points was divided by the total number of post-intervention scores. This calculation produced the percentage of non-overlapping data. To calculate the effect size, the interpretation guidelines proposed by Scruggs and Mastropieri (2013) were referenced. They suggest a large effect to be one in which 90% of the post-intervention data points do not overlap with the greatest baseline score. A moderate effect is calculated when 70% to 90% of post-intervention data points do not overlap with the greatest baseline score, and when 50% to 70% of the scores do not overlap the effect is considered small. Consequently, an intervention is considered ineffective when fewer than 50% of scores do not overlap with the highest baseline score. The following section will provide answers to the study's research questions by looking at each of the administered measures and determining the effect due the change in scores between pre- and post-test administration.

Reading and Decoding Accuracy: Pre-Post-Test Comparisons

The following section reports on the reading and decoding accuracy measures over the course of pre-test assessments, where baseline data was obtained, and post-test assessments, where data was obtained after the completion of the RAVE-O intervention. Word reading accuracy was measured by the administration of the Word-Identification subtest from the Woodcock-Johnson Test of Achievement- Fourth Edition (WJ-IV) (Woodcock et al., 2001;

2007). The Word Attack subtest from the WJ-IV measured decoding accuracy. From these subtests, raw scores were derived and graphed.

Figure 1 provides a graphic depiction of the results of the Letter-Word Identification subtest from the WJ-IV (Woodcock et al., 2001; 2007). This subtest assessed word reading accuracy, by having participants read isolated letters and whole words of increasing difficulty from a presented list (Woodcock et al., 2001; 2007). As visually represented in the graph, the highest baseline score attained during pre-test assessment measures was a raw score of 44. At post-test, the highest score achieved was a raw score of 43. The PND for this measure was 0%. An intervention with fewer than 50% data points that do not overlap is considered ineffective, according to Scruggs and Mastropieri (2013). Additionally, as represented in Table 3, the participants scores remained relatively stable between baseline and post-intervention measures. These results suggest that the implementation of RAVE-O was not an effective means to improving participants' word reading accuracy.

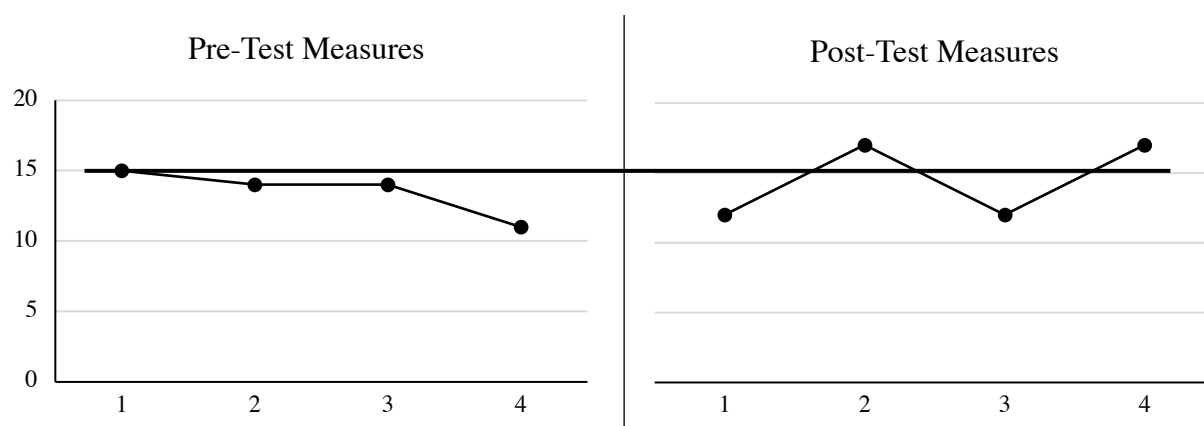


Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Figure 2 provides a graphic depiction of the results of the Word Attack subtest from the WJ-IV (Woodcock et al., 2001; 2007). This subtest assessed participants' decoding accuracy, by reading unfamiliar words, requiring them to utilize their phoneme and decoding skills (Woodcock et al., 2001; 2007). The highest baseline score attained during pre-test measures was a raw score of 15. At post-test, two of the raw scores participants received were higher than the highest baseline score. The PND for this measure was 50%. An intervention with 50-70% of data points that do not overlap with the highest baseline score is considered to have a small effect, according to Scruggs and Mastropieri (2013). The results from the PND analysis suggest that the implementation of RAVE-O was marginally effective at improving participants' decoding accuracy.

By comparing the standard scores of participants at pre- and post-test, in-depth qualitative and clinical information at an individual level can be provided. As seen in Table 3, Flint, who was assessed at a below average level based on the raw score and associated standard score achieved during the pre-test, obtained an improved raw score that resulted in a standard score (SS) of 90 within the average range. Additionally, Cliff, who received a score well below average (SS = 73) during pre-test, scored just below average, attaining a standard score of 89 at post-test. This finding suggests that for Flint and Cliff, the implementation of RAVE-O improved their decoding accuracy skills.

Figure 2
Graphic Depiction of Results from WJ-IV Word Attack Subtest



Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Table 3 Comparisons between Pre-Test and Post-Test Assessment Scores

Measure	Lily				Flint				Ivy				Cliff			
	Pre		Post		Pre		Post		Pre		Post		Pre		Post	
	RS	SS	RS	SS	RS	SS	RS	SS	RS	SS	RS	SS	RS	SS	RS	SS
WJ-IV Letter- Word Identification	42	84	40	81	41	78	41	78	36	82	32	75	44	82	43	80
WJ-Word Attack	15	88	12	79	14	82	17	90	14	89	12	83	11	73	17	89
WJ-Passage Comprehension	25	85	27	90	23	76	29	90	21	82	21	81	25	80	26	83
TWORE-2 Sight Word Efficiency	43	78	42	71	48	77	57	86	24	70	28	73	45	74	60	90
TWORE-2 Phonemic Decoding Efficiency	10	73	17	79	3	59	14	75	5	68	10	76	14	75	17	79
Oral Reading Fluency (words read correctly in 60 seconds)	38	n/a	50	n/a	30	n/a	67	n/a	17	n/a	21	n/a	25	n/a	51	n/a
Maze (correct word insertions in 3 minutes)	10	n/a	10	n/a	10	n/a	14	n/a	9	n/a	13	n/a	0	n/a	6	n/a

Note. RS = raw score; SS = standard score

*Age-based norms were utilized.

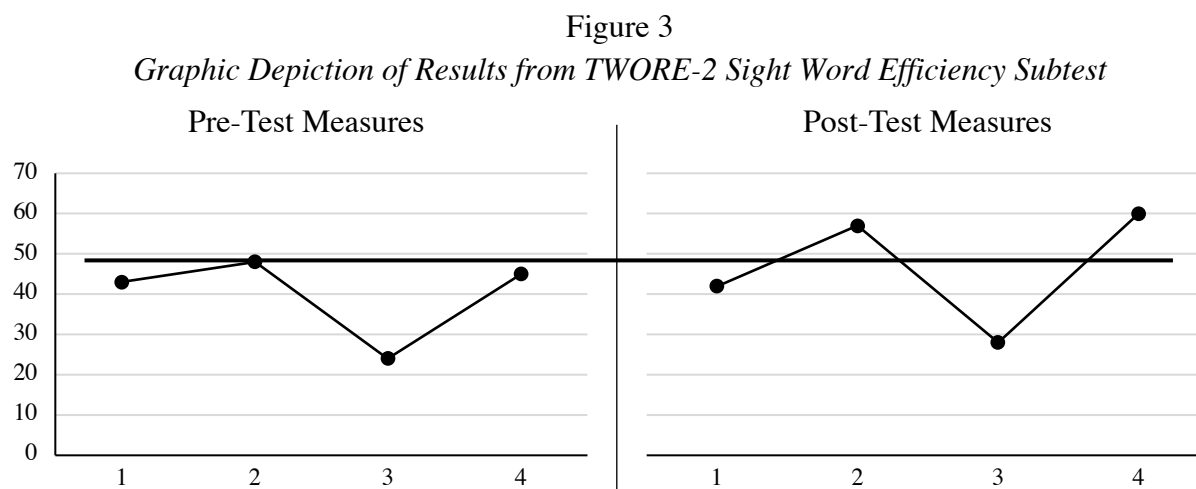
**WJ-IV and TOWRE-2 measures employed standard scores (mean = 100, SD = 15).

Reading and Decoding Fluency: Pre-Post-Test Comparisons

The following section reports on the reading and decoding fluency measures over the course of pre-test assessments, where baseline data was obtained, and post-test assessments, where data was obtained after the completion of the RAVE-O intervention. Word-reading fluency was measured by the Sight-Word Efficiency subtest and decoding fluency was measured by the Phonemic Decoding Efficiency subtest of the Test of Word Reading Efficiency – Second Edition (TOWRE-2) (Torgesen et al., 2011). From these subtests, raw scores were derived and graphed.

Figure 3 provides a graphic depiction of the results of the Sight Word Efficiency subtest from the TOWRE-2 (Torgesen et al., 2011), which assessed participants' reading fluency by assessing rate and speed when reading familiar words. The highest baseline score attained during pre-test measures was a raw score of 48. As represented visually in Figure 3, two participants attained post-test scores that were superior to the highest baseline score. PND for this measure was 50%, suggesting a small effect size (Scruggs & Mastropieri, 2013). The results from PND analysis suggest that the implementation of RAVE-O intervention was marginally effective at improving participants' reading fluency.

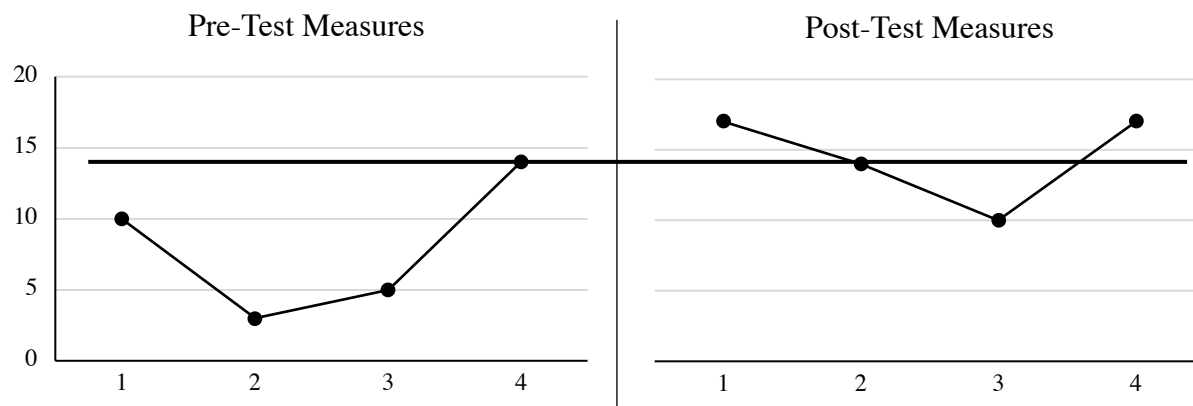
An examination of participant's standard scores at pre- and post-test provides in-depth clinical information at an individual level. Cliff - who scored poorly (SS = 74) on this measure during the pre-test assessment - attained a score within the average range (SS = 90) at post-test, as seen in Table 3. This finding suggests that at the individual level, the implementation of RAVE-O improved Cliff's reading fluency skills.



Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Figure 4 provides a graphic depiction of the results of the Phonemic Decoding Efficiency subtest from the TOWRE-2 (Torgesen et al., 2011). This test measured participants' decoding fluency, by assessing accuracy and speed when reading pronounceable non-words. The highest baseline score attained during pre-test administration was 14. At post-test, three participants attained scores higher than the highest baseline score. The PND for this measure was 50%, suggesting a small effect (Scruggs & Mastropieri, 2013). Although a small effect was found, a visual analysis of the results graphed in Figure 4 provides further explanation. As displayed, all participants improved their scores on this measure, however due to stringent PND analysis and to Cliff scoring a significantly higher baseline score in comparison to the other participants, only a small effect could be found. The results from the PND analysis suggest that the implementation of RAVE-O was marginally effective at improving participants' decoding fluency.

Figure 4
Graphic Depiction of Results from TOWRE-2 Phonemic Decoding Efficiency Subtest



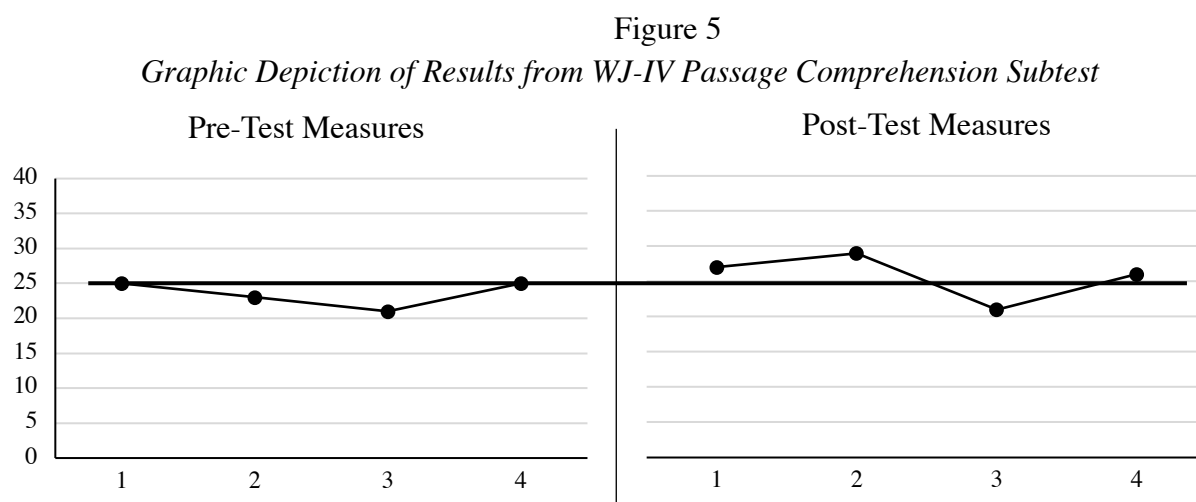
Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Reading Comprehension: Pre-Post-Test Comparisons

The following section reports on the reading comprehension measures over the course of pre-test assessments, where baseline data was obtained, and post-test assessments, where data was obtained after the completion of the RAVE-O intervention. Reading comprehension was measured by the administration of the Passage Comprehension subtest from the WJ-IV (Woodcock et al., 2001; 2007). From this subtest, raw scores were derived and graphed.

Figure 5 provides a graphic depiction of the results of the Passage Comprehension subtest from the WJ-IV, which measured participants' reading comprehension. At pre-test assessment, the highest attained baseline score was a raw score of 25. At post-test assessment, three participants attained scores higher than the highest baseline score, resulting in a PND of 75%. These results suggest a moderate effect. The results from PND analysis suggests that the implementation of RAVE-O had a moderate positive effect on the participants' reading comprehension.

An examination of participant's standard scores at pre- and post-test provides in-depth qualitative and clinical information at an individual level. When examining the results in Table 3, improvements in standard scores can be seen in the scores achieved by Lily and Flint. Respectively, participants scored within the below average range (SS = 85) and poor range (SS = 76) range in comparison to same-age peers at the pre-test. However, at post-test both Lily and Flint scored within the average range (SS = 90, SS = 90). This finding suggests that at the individual level, the implementation of RAVE-O improved Lily and Flint's reading comprehension skills.

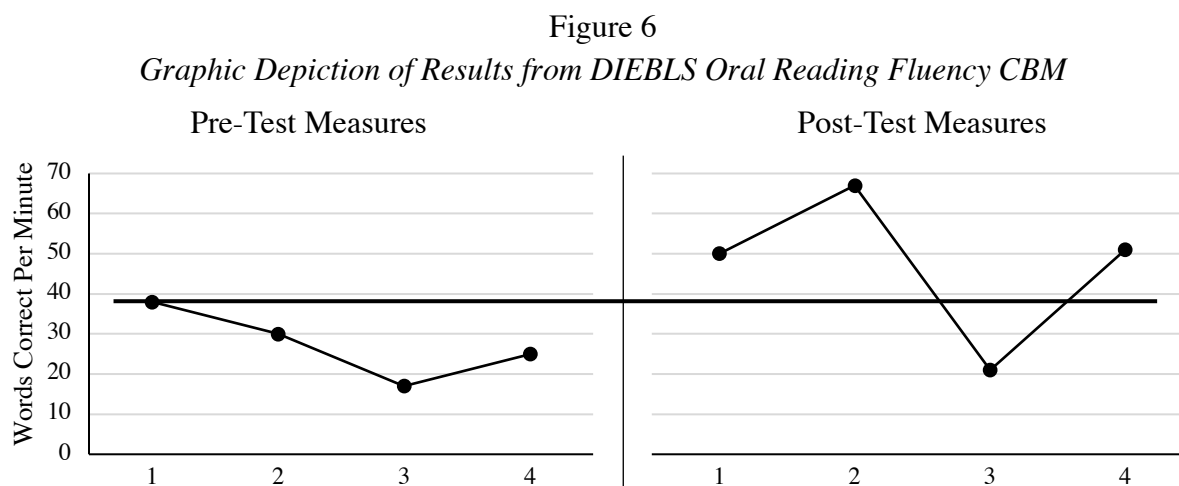


Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Progress Monitoring Measures: Pre-Post-Test Comparisons

The following section reports on the progress monitoring measures over the course of pre-test assessments, where baseline data was obtained, and post-test assessments, where data was obtained after the completion of the RAVE-O intervention. From these tests, raw scores were derived and graphed.

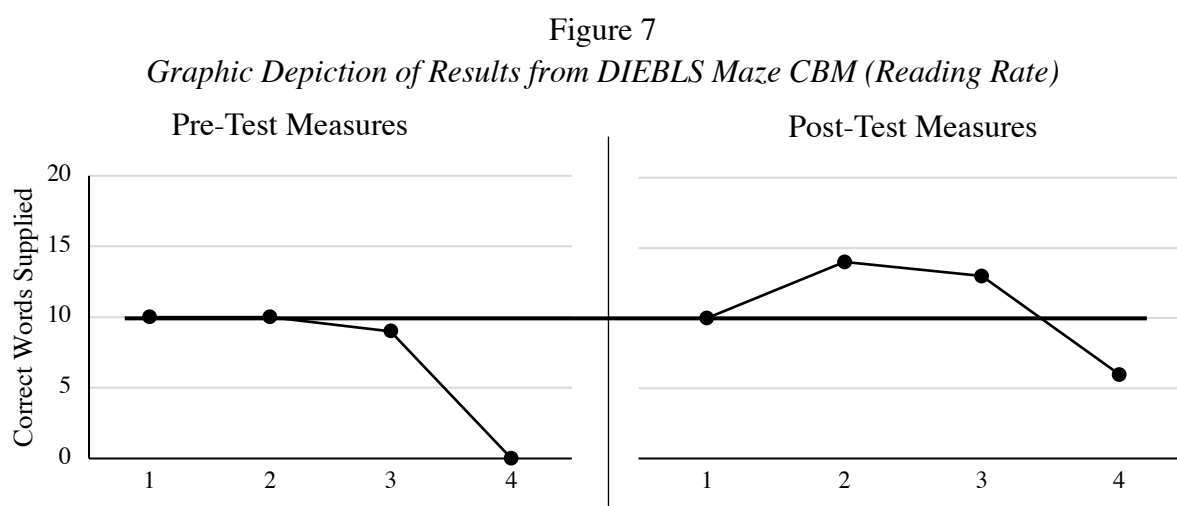
Figure 6 provides a graphic depiction of the pre- and post-test results of the Oral Reading Fluency CBM, which measured participants' reading fluency (Hosp et al., 2016). The highest baseline score attained during the pre-test assessment was a raw score of 38. A raw score represents the number of words read correctly per 60 second timed trials. As seen in Figure 6, three participants attained post-test scores that did not overlap with the highest baseline score. The PND for this measure was 75%, which suggests a moderate effect. Also visible in Figure 6 is the increase in all participants' raw scores at post-test in comparison to the scores they received during pre-test measures. PND analysis suggests that the implementation of RAVE-O had a moderate effect on participant's reading fluency.



Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Figure 7 provides a graphic depiction of pre- and post-test results of the DIEBLS Maze CBM, which assessed participants' reading comprehension. This test required participants to read a passage, in which every 7th word was deleted. For each deleted word, participants were offered three replacement words and were required to supply the word most suitable for the

given context. Therefore, a raw score represents the number of correct words supplied during a timed trial. The highest baseline score received during pre-test measures was a raw score of 10. At post-test, two participants received scores that did not overlap with the highest baseline score achieved. PND for this measure was 50%, suggesting a small effect. All participants, except for Lily, improved their raw scores on this measure. However, although Lily did not have a change in score, it did remain the same between pre- and post-test measures. Results from PND analysis suggests that the implementation of RAVE-O had a small positive effect on reading comprehension.



Note: Within this graph participants are identified along the x-axis as follows: Lily (1), Flint (2), Ivy (3), and Cliff (4).

Progress Monitoring Measures: Individual Response to Intervention

The following section will report on participant's response to the implementation of RAVE-O at an individual level. The CBMs administered were the DIEBLS Oral Reading Fluency, which measured reading fluency, and the DIEBLS Maze CBM, which measured

reading comprehension.

Figure 8 provides a graphic depiction of Lily's gradual response to the implementation of RAVE-O. The graph on the left-hand side displays the effect RAVE-O had on her reading fluency, as measured by the DIEBLS Oral Reading Fluency CBM. As visually represented in the graph, the baseline score attained during pre-test assessment was 38 words read correctly. At post-test, the score achieved was 50. The PND for this measure was 67%, which is considered a small effect. PND analysis suggests that the implementation of RAVE-O had a small effect on Lily's reading fluency. It is also important to note the magnitude of change in Lily's reading fluency scores, as she increased the number of words she read correctly within a 1-minute timed trial from 38 words at pre-test to 50 words at post-test. Though a small effect was found due to stringent PND analyses, Lily did show a general trend in increasing the number of words she read correctly, with the exception of the second data point where she read 37, which was 1 word less than she did at the pre-test. In summation, the implementation of the RAVE-O was found to have a small positive effect on Lily's reading fluency skills, as evidenced by an increase in the number of words she read correctly.

The graph on the right-hand side of Figure 8 displays the effect RAVE-O had on her reading comprehension, as measured by the DIEBLS Maze CBM. As visually represented in the graph, the baseline score attained during pre-test assessment was 10 words correctly supplied in the cloze task. At post-test, the score achieved was also 10 words correctly supplied. The PND for this measure was 0%, indicating no effect. PND analysis suggests that the implementation of RAVE-O had no effect on Lily's reading comprehension. It should be noted, however, that Lily was absent when this measure was administered during the intervention, at Time 1 and 2. It is possible that her absence impacted her performance on this measure.

Figure 8
Graphic Depiction of Results from Lily's Progress Monitoring Measures

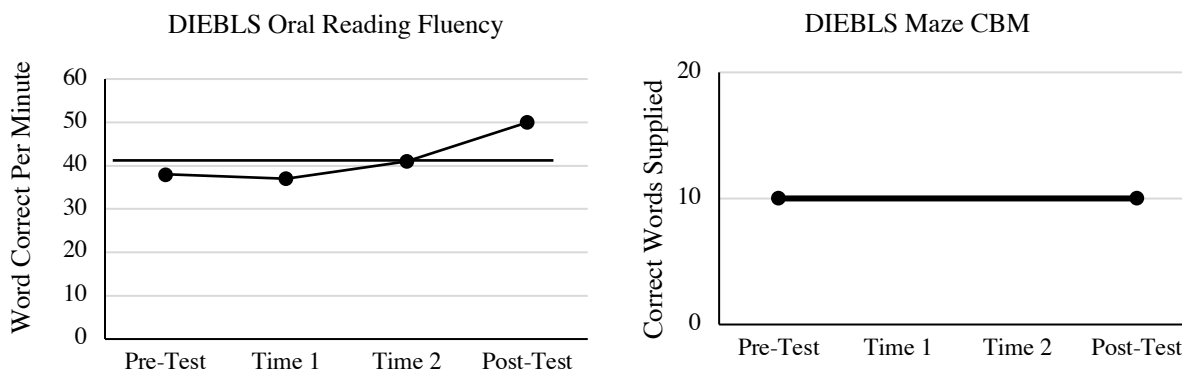


Figure 9 provides a graphic depiction of Flint's gradual response to the implementation of RAVE-O. The graph on the left-hand side displays the effect RAVE-O had on his reading fluency, as measured by the DIEBLS Oral Reading Fluency CBM. As visually represented in the graph, the baseline score attained during pre-test assessment was 30 words read correctly. At post-test, the score achieved was 67. The PND for this measure was 67%, suggesting the implementation of RAVE-O had a small positive effect on Flint's reading fluency. It is also important to note the magnitude of change in Flint's reading fluency scores, as he increased the number of words he read correctly within a 1-minute timed trial from 30 words at pre-test to 67 words at post-test. Though a small effect was found due to stringent PND analyses, Flint did show an increase in the number of words he read correctly, with the exception of the second data point where he read 28, which was 2 words less than he did at the pre-test. In summation, the implementation of the RAVE-O was found to have as small positive effect on Flint's reading fluency skills, as evidenced by an increase in the number of words he read correctly.

The graph on the right-hand side of Figure 9 displays the effect RAVE-O had on his

reading comprehension, as measured by the DIEBLS Maze CBM. As visually represented in the graph, there is variability in Flint's scores, with the number of correct words supplied increasing from a baseline score of 10 at the pre-test, to 16 at Time 1, measured during the intervention. Though this increase suggest an immediate response to RAVE-O, Flint's score decreased back to 10 at Time 2. At post-test, the score once again increased to 14 correct words supplied. The PND for this measure was 67%. which suggests the implementation of RAVE-O had small effect on Flint's reading comprehension.

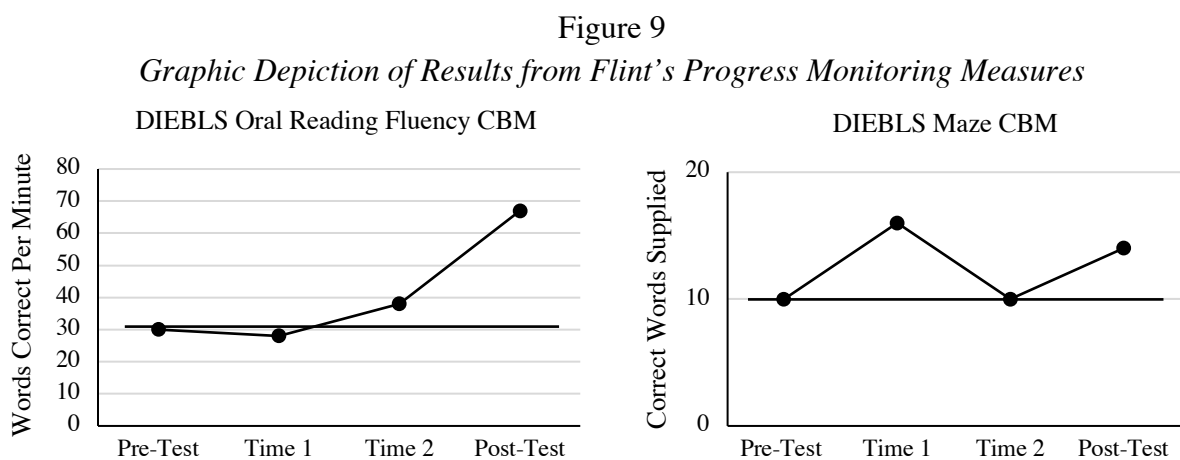


Figure 10 provides a graphic depiction of Ivy's gradual response to the implementation of RAVE-O. The graph on the left-hand side displays the effect RAVE-O had on her reading fluency, as measured by the DIEBLS Oral Reading Fluency CBM. As visually represented in the graph, the baseline score attained during pre-test assessment was 17 words read correctly. At post-test, the score achieved was 21. The PND for this measure was 67%, suggesting the implementation of RAVE-O had a small positive effect on Ivy's reading fluency. Though a small effect was found due to stringent PND analyses, Ivy did show a general trend in increasing the

number of words she read correctly, with the exception of the second data point where she read 15, which was 2 words less than she read at the pre-test. In summation, the implementation of the RAVE-O was found to have a small positive effect on Ivy's reading fluency skills, as evidenced by an increase in the number of words she read correctly.

The graph on the right-hand side of Figure 10 displays the effect RAVE-O had on her reading comprehension, as measured by the DIEBLS Maze CBM. As visually represented in the graph, there is variability in Ivy's scores, with the number of correct words supplied increasing from a baseline score of 9 at the pre-test to 5 at Time 1, measured during the intervention. Though this does not show a positive response to RAVE-O, Ivy's score did increase to 11 at Time 2. At post-test, the score once again increased to 13 correct words supplied. The PND for this measure was 67%, suggesting the implementation of RAVE-O had small effect on Ivy's reading comprehension.

Figure 10
Graphic Depiction of Results from Ivy's Progress Monitoring Measures

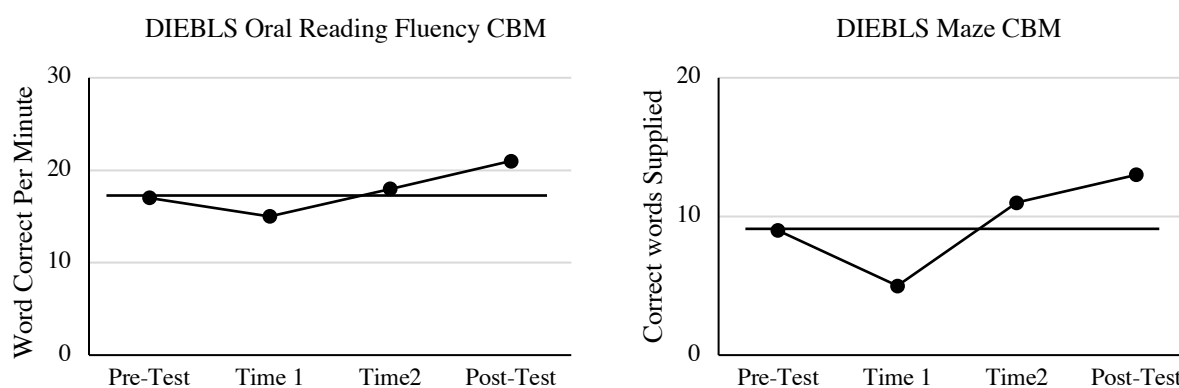
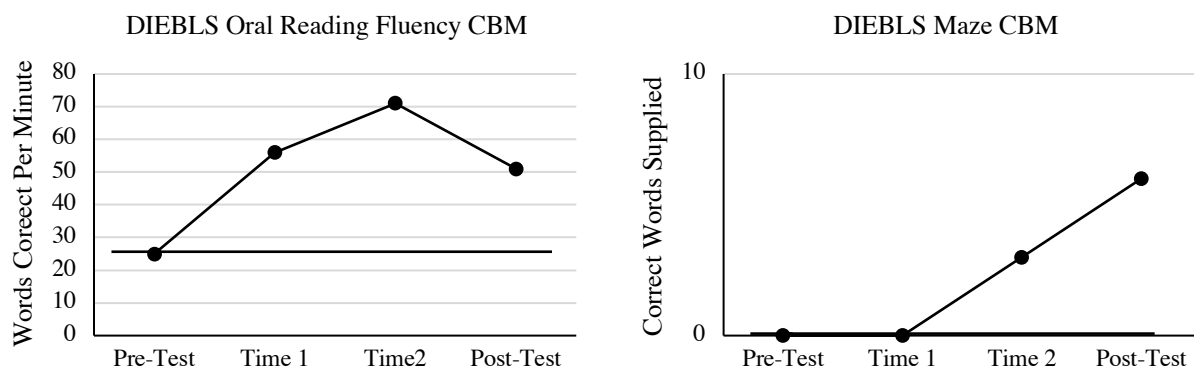


Figure 11 provides a graphic depiction of Cliff's immediate response to the implementation of RAVE-O. The graph on the left-hand side displays the immediate effect

RAVE-O had on his reading fluency, as measured by the DIEBLS Oral Reading Fluency CBM. The PND for this measure was 100%, suggesting the implementation of RAVE-O had a large effect on Cliff's reading fluency. The magnitude of change in Cliff's reading fluency should also be noted. As visually represented in the graph, the baseline score attained during pre-test assessment was 25 words read correctly. In response to RAVE-O, Cliff achieved a score of 56 at Time 1. An increase was again seen in Cliff's score at Time 2, where he read 71 words correctly. Although Cliff's scores did decrease from Time 2 to post-test by 20 words, the score achieved did not overlap with his pre-test score. In summation, the implementation of the RAVE-O was found to have an immediate and large positive effect on Cliff's reading fluency skills, as evidenced by an increase in the number of words he read correctly.

The graph on the right-hand side of Figure 11 displays the gradual effect RAVE-O had on his reading comprehension, as measured by the DIEBLS Maze CBM. As visually represented in the graph, this task proved to be difficult for Cliff, who scored 0 at both pre-test assessment and Time 1. It should be noted that Cliff received the Maze CBM two grade levels below his grade due to his displayed difficulty in completing the task. Cliff did however display a gradual response to the implementation. At Time 2 Cliff increased the number of correct words supplied by 3, and again at post-test to 6. The PND for this measure was 67%, suggesting the implementation of RAVE-O had small effect on Cliff's reading comprehension.

Figure 11
Graphic Depiction of Results from Cliff's Progress Monitoring Measures



Discussion

Overview and Synthesis of Findings

The purpose of the present study was to determine whether the RAVE-O literacy intervention improves reading fluency in struggling readers, and in turn advances reading comprehension skills. The study was designed to address the following questions: (1) Does the implementation of the RAVE-O intervention improve the reading skills of children with reading disabilities (along the dimensions of sight-word efficiency, phonemic decoding efficiency, letter-word identification, word attack, oral reading fluency, and passage comprehension), as evidenced by significant, positive changes in fluency and comprehension scores? (2) Is the RAVE-O an effective intervention when condensed and used as a tier two intensive intervention for children identified with reading difficulties, as evidenced by improvements in reading scores?

To provide answers to these research questions percentage of non-overlapping data (PND) analysis was used to determine the effect the implementation of the RAVE-O literacy program had on participant word reading and decoding accuracy, reading and decoding fluency and reading comprehension. In addition, PND analysis was used to assess whether the RAVE-O intervention was effective when adapted and utilized as a tier two intervention. At the group level, the results of the PND analyses suggest that: (1) The implementation of the adapted RAVE-O intervention had a moderate positive effect on participants' reading fluency and reading comprehension skills; (2) The implementation of the adapted RAVE-O intervention had a small positive effect on participants' decoding accuracy, decoding fluency, and comprehension skills, when measured by the Maze CBM; and (3) The implementation of the adapted RAVE-O intervention had no effect on participants' word reading accuracy. Additionally, progress

monitoring measures provided information on each participants' response to the implementation of the adapted RAVE-O intervention. Once again, PND analyses suggested that at the individual level: (1) The implementation of the adapted RAVE-O had a large effect on Cliff's reading fluency and a small effect Lily, Flint, and Ivy's reading fluency; (2) The implementation of the adapted RAVE-O had a small effect on Flint, Ivy, and Cliff's reading comprehension, but no effect on Lily's. The following will provide an indepth discussion about these findings in relation to the research questions posed above.

The first research question asks whether the implementation of the adapted RAVE-O intervention will improve the reading skills of children with reading difficulties (along the dimensions of sight-word efficiency, phonemic decoding efficiency, letter-word identification, word attack, oral reading fluency, and passage comprehension), as evidenced by significant, positive changes in word reading and decoding accuracy and fluency scores, as well as comprehension scores. To ensure the children selected to participant in this study were identified with reading difficulties, eligibility criterion was established. Participants were selected to partake in the study if the scores they achieved on the measures during pre-test assessment were considered below average range in comparison to same-age peers. In order to study the effect of an adapted RAVE-O utilized as a tier two intervention, the intervention took place within a small-group setting and was implemented to children with identified difficulties to mimic a tier two intervention that would be employed in educational settings. The PND results of the passage comprehension measure suggest that the RAVE-O had a moderate positive effect on participant's reading comprehension skills, a finding that aligns with current trends and theories on reading.

Fluency is considered to be a fundamental component skill of comprehension (LaBerge & Samuel, 1974; Perfetti, 1985). When fluency is developed less attention is required for low-

level processes, such as word-identification and decoding, allowing for more attention to be allocated to comprehension (Meyer & Felton, 1999; Perfetti, 1997). This suggests that greater reading fluency has a positive impact on comprehension. The RAVE-O incorporates many effective instructional methods that improve fluency, such as choral reading, repeated reading, and modelling. Modelling fluent reading, a component of choral reading, has been found to increase fluency and comprehension skills (Flood et al., 2005). Additionally, repeated readings have been found to be effective at increasing fluency and comprehension by improving the reading rate and understanding of text (Steven et al., 2017). Because RAVE-O incorporates these instructional methods, it was presumed that the implementation of the intervention would improve participants' fluency skills. PND analysis did confirm this assumption, suggesting that the adapted RAVE-O intervention was moderately effective at improving reading fluency skills, when oral reading fluency was measured. In addition, the results from this study also suggest that the implementation of the adapted RAVE-O was marginally effective at improving participants' decoding fluency. Decoding is the ability to apply one's knowledge of letter-sound correspondences with efficiency (Gough & Tunmer, 1986). Developing fluency in decoding skills allows for more attentional resources to be allocated to deriving meaning from text, and consequently has a positive impact on reading comprehension skills (Meyer & Felton, 1999; Perfetti, 1997). As suggested in the Verbal Efficiency Theory (Perfetti, 1985), there is limited mental capacity for readers to simultaneously decode and derive meaning, therefore without fluent decoding a large amount of attentional resources are allocated to identifying the word, leaving little to be allocated towards comprehending text. PND analyses indicates the adapted RAVE-O intervention was effective at improving the reading skills of children with reading difficulties along the dimension of reading and decoding fluency.

As indicated in the literature, both reading and decoding fluency are directly related to improvements in reading comprehension (Meyer & Felton, 1999; Perfetti, 1985). Due to the relationship between fluency and comprehension, one could theorize that improvements found in fluency skills would lead to improvements in reading comprehension. Reading comprehension requires the understanding of text to be able to derive meaning from it (Trapman et al., 2014). Reading comprehension has been found to be positively impacted with the improvement of fluency skills (LaBerge & Samuel, 1985; Perfetti, 1997). Due to a focus on fluency development, the implementation of the RAVE-O was presumed to have a positive impact on participant's reading comprehension skills. The findings from this study confirm this presumption and suggest that the implementation of the adapted RAVE-O intervention was moderately effective at improving the reading skills of children identified with reading difficulties along the dimension of reading comprehension. However, the PND analysis of the Maze CBM indicated a small effect, suggesting that when reading comprehension was measured by the Maze task, only marginal improvements on participants' reading comprehension skills could be found.

When reading unfamiliar words, readers are required to utilize phoneme knowledge and decoding skills (Woodcock et al., 2001; 2007). As previously discussed, the adapted RAVE-O intervention was moderately effective at improving the decoding fluency of participants. Similarly, when decoding accuracy was measured, an effect was found. PND analysis suggests that RAVE-O was marginally effective at improving the participants' decoding accuracy skills, suggesting a small positive effect on their ability to utilize decoding skills when reading non-words. Current understandings of reading identify decoding accuracy as a key component of comprehension skills, as suggested in the Simple View of Reading (Gough & Tunmer, 1986). Thus, improvements in both decoding fluency and decoding accuracy are likely to have

contributed to the improvements also found in participants' reading comprehension skills.

The ability to identify words with efficiency is essential to reading. Studies show that if a reader is unable to identify a word, comprehension will be negatively impacted (Adolf & Perfetti, 2012). Word identification makes room for reading comprehension to take place, which in turn allows readers to become aware of any errors in their reading which may interfere with their understanding of the text. Rapid and accurate identification of words allows for more attention to be allocated towards deriving meaning from text, thus positively impacting comprehension skills (Felton, 1999; LaBerge & Samuel, 1985; Perfetti, 1997). Due to the importance of word identification in relation to reading, measures of participants' word reading accuracy and word reading fluency were included. The PND results suggest that the adapted RAVE-O was marginally effective at improving participant's word reading fluency. However, the adapted RAVE-O was not an effective means to improving word reading accuracy. It seems that the RAVE-O was marginally effective at improving participant's fluency skills when reading known words but did not improve their ability to accurately identify known words of increasing difficulty. These findings may suggest why the RAVE-O was found to be only moderately effective at improving participants' comprehension skills. Due to the importance of word reading accuracy, a larger effect on comprehension skills may have been found if the RAVE-O intervention had been more effective at improving accurate word reading of children identified with reading difficulties. In regard to the research question, however, the implementation of the adapted RAVE-O intervention was found to be marginally effective at improving the word reading fluency of children with reading difficulties. Conversely, the implementation of the adapted RAVE-O intervention was found to be ineffective at improving the word reading accuracy skills of children with reading difficulties. These results suggest that

RAVE-O was marginally effective at improving the fluency, but not accuracy, of word reading.

The second research question asked whether the RAVE-O was an effective intervention when condensed and adapted to function as a tier two intensive intervention for children identified with reading difficulties. The results of the PND analysis suggest that: (1) The implementation of the RAVE-O literacy program, when condensed and designed as a tier two intervention, had a moderate positive effect on participants' decoding fluency and reading comprehension; (2) The implementation of the RAVE-O literacy program, when condensed and designed as a tier two intervention, had a small positive effect on participants' word reading fluency, decoding accuracy, and comprehension skills, when maze tasks were utilized. Therefore, as an intensive intervention provided students at-risk of reading failure, the implementation of the RAVE-O literacy program was found to be both moderately and marginally effective at improving reading fluency and comprehension skills.

Evidence of this was gathered again by improvements in reading scores. The present study condensed the RAVE-O literacy program from 72 individual lessons, to 15 lessons provided twice a week, over the course of 8 weeks. The study aimed to provide participants with a version of the RAVE-O that was intensive and targeted, mimicking a tier two intervention. Tier two interventions are typically provided to learners at-risk of reading failure (Hopper, 2013). These interventions are delivered in small group settings, as reductions in group size have been found to intensify the effects of interventions (Vaughn & Wanzeck, 2014). Intensity is further amplified when the frequency of the instruction provided is increased (Fuchs & Fuchs, 2006). Additionally, interventions become more intensive when instruction is more explicit and systematic (Fuchs & Fuchs, 2006). The present study incorporated these components of tier two interventions in hopes of creating a more intensive version of the RAVE-O literacy program. By

providing a targeted and systematic version of the RAVE-O to students identified with reading difficulties within a small homogenous group, twice a week, the intervention provided resembled that of a tier two intervention. Participants were selected for the present study, as they exhibited reading difficulties despite exposure to general classroom reading instruction (i.e., tier one intervention). This suggests that participants were “unresponsive” to the instruction they received, and thus would be a group of children who may benefit from more intensive instruction provided at the second tier of an RTI model (Fuchs & Fuchs, 2006).

The question of whether the RAVE-O literacy program, as it was designed and implemented in the present study, was effective as an intensive, tier two intervention was answered by comparing participant scores on the administered measures at pre-test assessment and post-test assessment.

As aforementioned, children selected for tier two interventions are those who are not responding to general classroom instruction. In order to identify the effect the adapted version of RAVE-O had on children with reading difficulties when used as a tier two intensive intervention, it was important to consider participants’ individual responses to receiving the intervention. The administered progress monitoring measures, administered at two points in time during the intervention captured the response participants had to the implementation of the RAVE-O, as indicated by changes in fluency and comprehension skills. In regards to reading fluency, the implementation of the adapted RAVE-O had a large effect on Cliff, who showed an immediate positive response to the intervention. For Lily, Flint, and Ivy, a small effect was found suggesting that the adapted RAVE-O was marginally effective at improving their individual reading fluency skills. However, for Lily, Flint, and Ivy, a gradual improvement in reading fluency was found, indicating that although the response was not as immediate as Cliff’s, a

positive response to the implementation of the adapted RAVE-O was found for all participants. The improvements that were also found in individual reading comprehension skills confirms the notion that improvements in reading fluency result in improved comprehension skills (Felton, 1999; LaBerge & Samuel, 1985; Perfetti, 1997). In regard to reading comprehension, a small effect was found for Flint, Ivy, and Cliff, suggesting that the adapted RAVE-O was marginally effective at improving their individual comprehension skills. However, for Lily, the RAVE-O was found to be ineffective at improving her reading comprehension skills. Additionally, both Cliff and Ivy displayed a gradual positive response to the intervention as evidenced by improvements in reading comprehension scores, while Flint showed a generally positive yet variable response. Lily did not demonstrate a response to the implementation of RAVE-O.

By utilizing the an intensive version of the RAVE-O to address the reading difficulties of children in teir two intervention settings, small to moderate positive effects can be expected for both reading fluency and reading comprehension skills. Though poisitive effects have been found in the present study through PND analyses, limitations and threats to the design exist. The following section will consider these limitations and address the implications for future research.

Limitations and Threats to the Design

It is important to also consider the limitations of single-subject designs. Threats to external validity is common for single-subject designs due to their focus on individuals rather than groups. External validity examines the generalizability of a causal relationship (Alnahdi, 2015). This threat can be solved through study replication, a suggestion presented when discussing the implications for future research. Another design threat was maturation, impacting accurate data analysis. Because visual interpretations of findings were employed, changes due to the intervention may not be immediately observed and, additionally, the cause for these changes may

be external to the study, as suggested by Alnhadi (2015). The present study spanned over a course of 8 weeks, thus the changes in participant scores on the various measures utilized may have resulted from extraneous variables due to the passage of time. At the time of the study, participants were attending school during the day, and receiving additional reading instruction, which could not be accounted for. Thus, the observed improvements in word reading accuracy and fluency, decoding accuracy and fluency, and reading comprehension may have been influenced by the implementation of RAVE-O in addition to external instruction. However, because students exhibited reading difficulties despite receiving general classroom instruction prior to the study, moderate positive changes in word reading accuracy and fluency, and decoding accuracy and fluency, and comprehension skills succeeding RAVE-O suggests that the intervention was moderately effective as a supplemental intervention, complementing the instruction participant's received at school.

The 8-week duration of the present study may have had additional limiting effects. A lengthier intervention could have produced greater effects, as sustained intensive interventions have been found to be a powerful tool for supporting students with reading difficulties (Vaughn & Wanzeck, 2014). Additionally, the measures administered at post-test marked the end of the study. Therefore, this study did not measure maintenance effects, which could have determined the long-term effectiveness of the intervention (Blyers, Relchle & Symons, 2012). These two points will be further discussed in the following section, where the implications for future research are addressed.

An additional limitation is bias. It is important to note that the author of this paper was both the interventionist and the researcher evaluating the effectiveness of the adapted RAVE-O. These two roles may have biased, either positively or negatively, participants' responses to the

intervention and the assessments run prior to, throughout, and succeeding the implementation of RAVE-O. Treatment integrity should also be considered. Treatment integrity can be defined as the degree to which an intervention was implemented as intended (Frey, 2018). In order to evaluate the effectiveness of an intervention, fidelity must be maintained. If it isn't, the ability to attribute changes in participants' performance to the implementation of the intervention becomes increasingly difficult (Frey, 2018). A strength of RAVE-O is the intervention script. A script was also adapted and developed for the version of RAVE-O utilized in this study, which increased the likelihood of the intervention being delivered as intended, and ultimately increased the integrity. However, treatment integrity could have been improved through the use of checklists and audio or video recording of the sessions. These mediums would have presented additional assurance that interventionist did not deviate from the design of RAVE-O and that the changes in participants' performance was attributed to the implementation of the intervention.

A final limitation to the study was the missing measure of linguistic comprehension. As the Simple View of Reading (Gough & Tunmer, 1986) was an important framework for the present study, administration of a test measuring participants vocabulary would have been beneficial. According to the Simple View of Reading, proficiency in reading requires good decoding accuracy, as well as good linguistic comprehension (Gough & Tunmer, 1986). A measure of decoding accuracy was administered, thus in order to determine whether the implementation of RAVE-O developed reading proficiency as conceptualized within this framework, a measure of vocabulary is required.

Implications for Future Research

This study examined the efficacy of RAVE-O when adapted and utilized as an intensive intervention for children identified with reading difficulties. The aim of the study was to

determine whether or not the intensified version of the program could improve participants reading skills, specifically the fluency and accuracy of both word reading and decoding, as well as comprehension. Although the study found the implementation of RAVE-O to have moderate and marginal positive effects on participants reading (subject to the measures administered), further research is suggested.

As discussed in the previous section, replicating the present study would be beneficial. Replication would reduce threats to external validity and determine the generalizability of the results found (Alnahdi, 2015; Blyers et al., 2012). The intervention designed and applied in the present study should be replicated in additional studies to determine whether the effects found are repeatedly and reliably found across additional settings and participants (Blyers et al., 2012). Additionally, for the effects of this intervention to be considered evidence-based, a minimum of 5 direct replications should be performed, as suggested by Blyers and colleagues (2012).

A second point made in the prior section was the duration of the intervention. Thus, providing a lengthier intervention is suggested. The effects found from the 8-week intervention were moderate or marginal effect sizes. The length of the intervention may have limited the effects. Therefore, it is suggested that a study with a lengthier intervention be implemented to determine whether a longer duration would have produced stronger effect sizes in word-level fluency and reading comprehension measures. Additionally, measuring maintenance effects following post-test measures is suggested. It would be beneficial to determine whether in the absence of the RAVE-O intervention, participants improved word-fluency and comprehension abilities remained. By measuring maintenance effects, the long-term effectiveness of RAVE-O could be determined.

A final suggestion for future research is to replicate the present study within a tier three

intervention design. As a tier two intervention, the RAVE-O literacy program was found to have a moderate positive effect on decoding fluency, when phonemic decoding efficiency and oral reading fluency was measured, and on participant's comprehension skills, when passage comprehension was measured; and a small positive effect on participant's decoding accuracy, when work attack and sight word efficiency was measured, and on participant's comprehension skills, when maze tasks were utilized. At a greater intensity, the RAVE-O literacy program may have had a stronger effect on participants word-level and comprehension skills. Thus, it is suggested that a the RAVE-O designed in the presented study be utilized in tier three intensive intervention setting to determine whether the program is more effective when provided in a one-to-one instructional setting.

Implications for Educators

The results from the present study can help inform educators and professionals supporting children identified with reading difficulties who may not be adequately responding to general classroom instruction. The results above could have implications for intervention recommendations and design for children in elementary school. Through the examination of participants' response to the implementation of RAVE-O, this study provided insights as to whether this intervention was effective at improving the reading abilities of children struggling with reading. Additionally, by adapting RAVE-O to mimic the design of a tier two intervention, this study was able to examine whether RAVE, utilized as an intensive intervention was effective at improving the reading abilities of children identified with reading difficulties. The results indicate that the adapted RAVE-O was moderately effective at improving participants' decoding fluency and reading comprehension skills, and marginally effective at improving participants' decoding accuracy and reading fluency skills. These results could inform future implementation

of RAVE-O as an intervention for children with reading difficulties, and the implementation of RAVE-O as a tier two intervention for children struggling despite receiving general classroom instruction. Additionally, this study addressed the role of reading fluency within overall reading abilities. RAVE-O was selected, as it is theoretically grounded, and incorporates a multi-componential framework that explicitly targets reading fluency. Thus, these results could help to inform the design and evaluation of reading interventions, suggesting the importance of incorporating reading fluency instructional methods to improve overall reading abilities.

Summary

A single-case research (SCR) design provided information about changes at the group and individual level, as well as individual responses to the implementation of RAVE-O. The present study provides insights into the efficacy of RAVE-O when adapted as a tier two intensive intervention for a population of elementary school children identified with reading difficulties. Results indicate that RAVE-O was moderately effective at improving participants' decoding fluency and comprehension skills, while small effects were found for decoding accuracy and reading fluency. Results are not generalizable to children outside of this study, however the results found support the notion that reading interventions rooted in multi-componential frameworks and that include fluency instruction can improve reading comprehension skills (Stevens et al., 2017). Furthermore, results show that RAVE-O implemented as a tier two intervention is moderately effective at improving the reading skills of children identified with reading difficulties, along the dimensions of decoding fluency and comprehension. This finding supports assertions that early intensive interventions provided in small group settings help children make the greatest gains in reading (Solis et al., 2014; Vaugh & Wanzeck, 2014).

Reading is integral to everyday life. It is involved in most aspects of life. Understanding the essential component skills involved in the reading process and identifying the effective ways in which one can intervene when reading failure occurs is essential to ensure an individual's success and opportunity in school and beyond. The present study's results can inform not only researchers studying learning disabilities, but also educators and professionals supporting children identified with reading difficulties.

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