

PROJECT GROW:
A READING FLUENCY INTERVENTION FOR ELEMENTARY STUDENTS

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ABSTRACT

Alison Velchik: Project Grow: A Reading Fluency Intervention for Elementary Students
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Fluency, or the ability to read with speed, accuracy, and proper expression, has been identified as a critical component of literacy attainment and has been consistently linked with reading proficiency. Interventions to promote reading fluency have focused on oral reading by elementary school students to teachers, parents, peers, and even therapy dogs. Although these interventions provide an enriching and effective mechanism to promote literacy attainment, they are inherently resource dependent requiring the presence of others. In order to provide effective literacy intervention that bolsters a student's autonomy and that is less dependent upon other people as mediators, more research should be dedicated to understanding the child's ability to practice oral reading regularly and independently through other engaging and interactive means. A six-week intervention to bolster reading fluency was designed in which third grade students engaged in oral reading to succulent plants. Measures of reading fluency including prosody, comprehension, and attitude towards reading were assessed to compare the intervention and control group on specific performance outcome measures (fluency and comprehension). The intervention group pre and post-test scores were associated with a significant increase in reading fluency as measured by words per minute and reading comprehension. In comparison to the control group of students who engaged in silent reading without a plant, the intervention group also demonstrated a significant increase in reading comprehension. Overall, 88% of the students in the intervention group reported enjoying the intervention. Although the small sample size of the study

is a limiting factor, the findings provide initial support for an innovative intervention to promote reading fluency with elementary school students. Other methodological limitations, implications, and future studies are discussed.

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LIST OF ABBREVIATIONS

APA	American Psychological Association
BOY	Beginning of the Year
DIBELS	Dynamic Indicators of Basic Early Literacy Skills
DORF	DIBELS oral reading fluency
EOY	End of the Year
ERAS	Elementary Reading Attitude Scale
IRR	Inter rater reliability
MOY	Middle of the Year
NAEP	National Assessment of Educational Progress
RAN	Rapid automatic numbering
WMP	Words per minute

CHAPTER ONE: INTRODCUTION

Literacy is a necessary skill for success in society and has been emphasized in recent decades as a priority among elementary students across the world. Fluency, which is defined by the National Reading Panel (2000, p3-1) as reading with speed, accuracy, and proper expression, especially has been realized as a critical component of early literacy attainment, as it is linked with reading comprehension and basic reading proficiency.

Literacy Attainment

The ability to read and write is an integral part of academic development and is necessary for individual success. Literacy attainment is also a mark of achievement and quality for societies and countries. The ability to read serves as a strong predictor of success for children at a young age, when the foundational skills are mastered. Reading scores in elementary school have been reliably shown to be linked with future success academically and vocationally (Lloyd 1978; Hernandez 2011.; Shutay, Plebanksi, & McCafferty, 2010; Evans, Kelley, Sikora, Treiman, 2010; Juel 1998; Payne, A., Whitehurst, G., & Angell, A., 1994). These studies researched the association between early literacy attainment with other marks of success in life. In these studies, lower reading scores in elementary school were strongly associated with high drop-out rates during high school years, while high reading scores in elementary school were linked with higher rates of high school graduation (Hernandez, 2011). Literacy attainment in these elementary years is strongly associated with both the attainment of higher literacy skills and higher language acquisition later in life (Payne, Whitehurst, & Angell, 1994).

The skills mastered in the elementary years of reading set the foundation on which the rest of the academic schooling is built, such as language acquisition. If success is not achieved in these early years, then students will struggle throughout the rest of their education because material is accessed mainly through reading each year, leading to the direct impact on high school drop-out. Without completing high school, individuals are faced with several challenges that will greatly affect their quality of life as many opportunities such as further education, employment, and basic life skills will no longer be available.

Consequences of Illiteracy

Literacy attainment in the early years of elementary school have been studied in relation to other forms of success in society. Research has uncovered that lower reading scores in elementary school were associated with higher likelihood of incarceration in adulthood as well as higher rates of claiming welfare status (Shutay, Plebanski, & McCafferty, 2010). This study revealed that two-thirds of students scoring as 'less than proficient' in reading by the end of 4th grade were either in jail or on welfare in adulthood (Shutay et al, 2010). Reading scores are a clear indicator of future success or failure in a society, as the costs for providing for prison systems and welfare are astronomically devastating for the economy. For example, one prisoner in the United States costs the government over \$30,000 a year, on average, with large variation depending on the state, accumulating to a national cost of over 39 billion dollars per year to taxpayers (Henrickson & Delaney, 2012). The National Institute for Literacy found that seven out of every ten inmates incarcerated in the American prison systems were inadequately literate (National Institute for Literacy, 1998).

Illiteracy is also highly associated with poor health outcomes compared to literate adults, which is problematic and negatively impactful for the individual as well as the greater society.

For example, a study examining managed care enrollees from Medicare found significant associations between individuals who were illiterate and higher rates of admittance to hospitalization, higher healthcare costs, and overall poorer health even when controlling for socio-economic and demographic characteristics (Baker, Gazmararianm Williams, Scott, Parker, Green, Ren, & Peel, 2002). The main author estimated the total cost of illiteracy in America to be in the billions, as illiteracy affects the greater society through increased health care costs, low productivity in the workplace, and significant strains on the welfare system (Baker, Parker, Williams, Clark, & Nurss, 1997). The costs are high, and unfortunately, they typically follow a continuous cyclical pattern across generations, as illiteracy is a notable intergenerational trend (Costa, 1988).

Research has found astounding statistical data relating to future individual success and early reading abilities. For example, one study found that one in every six children that cannot meet reading proficiency standards in third grade does not graduate high school on time, a rate that is four times greater than for children who do meet reading proficiency standards in third grade (Hernandez, 2011). This same study found that about 23% of students with low, below basic reading ability are the more likely to drop-out when compared to students with basic reading skills, or proficient reading skills (Hernandez, 2011). The Bureau of Labor Statistics reported the income and unemployment rate differences based upon education level and reported that individuals who did not obtain a high school diploma were in the highest category for unemployment, with a rate of 7.4% as of 2016, and similarly reported weekly income of \$504 which was the lowest reported compared to the 5.2% unemployment rate and \$692 weekly earnings for a high school graduate (Bureau of Labor Statistics, 2016). The numbers show the actual unemployment and weekly earnings of individuals based upon their educational level,

which this further validates the important role of academic achievement. Kirsch et al, 2001, found that low proficiency readers were more frequently unemployed, typically worked fewer weeks annually, and earned lower wages than individuals with higher literacy skills (Kirsch, Jungeblut, Jenkins, & Kolstad, 2001). Quality of life and access to opportunities are greatly decreased when individuals are not able to read proficiently.

With regard to a more national scale, there are many indexes which assess individual life quality and overall wellbeing of citizens as a marker of a country's success compared to other countries across the globe. These calculated algorithms typically incorporate many aspects of literacy attainment or related academic achievement. For example, the Human Development Index (Human Development Report), the Physical Quality of Life Index (Morris, 1980), and the Starting Well Index (Starting Well, 2017) rank countries on their development and well-being by producing a score based upon calculations which include measures of academic success. Some include measures such as percent of the population that is literate, years of education, or availability of education. These globally recognized markers of well-being and country development underscore the critical importance of academic success and literacy with regards to quantifying the well-being and success of a country. This demonstrates the global perspective of how literacy, and academic achievement, relate to markers of prosperity.

A foundational component of early literacy attainment is reading fluency, which is defined by the National Reading Panel (2000, p3-1) as reading with speed, accuracy, and proper expression. This skill is not only necessary for proficiency but is strongly linked with reading comprehension. Further research is needed to understand the different whole-class and targeted interventions that bolster reading fluency in and outside of the schools.

Roadmap

This study reviews the research on literacy and reading fluency in schools, and oral reading interventions targeting reading fluency as the basis for the development of an innovative reading intervention responsive to the current limitations in the research. Interventions for reading fluency, although effective, are highly resource-intensive and require either a teacher, intervention specialist, peer or parent to be present as the child practices oral reading to increase reading fluency. Drawing on a novel form of intervention that utilizes trained therapy dogs, alternative organisms will be examined in the literature to assess their potential to serve as a component for an autonomous and purposeful third grade intervention. This intervention is designed as a home-school partnership and is introduced to the students as a reading intervention as part of their nightly homework. The procedures, materials, and methods of assessment in the implementation of the study are described in the methods section.

CHAPTER TWO: LITERATURE REVIEW

Literacy in Schools

The National Reading Panel was specifically appointed by Congress to review empirical studies on literacy attainment among children and to report which methods were most effective for learning to read. The National Reading Panel concluded that there were multiple main skills that were imperative to eventual literacy attainment including: phonological awareness, fluency, alphabetic principle, vocabulary, and comprehension (National Reading Panel, 2000). School policy and curriculum focuses heavily on providing elementary students with instruction surrounding these five areas with evidenced-based strategies of instruction provided by the National Reading Panel, and with accountability measures to track progress of each individual student. In continuing research and dedication to shaping policy by using evidenced-based strategies, the National Early Literacy Panel also endeavored to examine strategies and crucial variables for literacy success. It was determined that many variables accounted for future reading proficiency such as alphabet knowledge, phonological awareness, rapid automatic naming, writing in isolation, and phonological memory (National Early Literacy Panel, 2008).

Reading Fluency

Fluent readers are recognized by their ability to read with speed, accuracy, and proper expression, a skill which has been identified as a critical prerequisite for reading comprehension and stressed in its importance for overall reading development (NICHD, 2000). The panel

defined fluency as “the ability to read text quickly, accurately, and with proper expression” (NICHD, 2000, pp 3-5).

Reading fluently is a critical component of basic reading skills and has been notably linked with overall reading proficiency (Rasinski 2000). Multiple studies have consistently found a significant link between reading fluency and reading comprehension (Klauda & Gunthrie, 2008; Cook, 2003; Roberts, Good, & Corcoran, 2005; Roehrig, Petscher, Nettles, Hudson, & Torgesen, 2008; Kim, Petscher, Schatschneider, & Foorman, 2010; Alvarez-Canizo, Suarez-Coalla, & Cuetos, 2015). Reading fluently impacts the reader’s ability to properly understand the text, and to comprehend the significance and meaning not only within a sentence, but across sentences and passages as a whole (Graesser, 2015). Reading comprehension has been identified as a complex process that requires the use of prior general knowledge, ability to make inferences, ability to integrate and synthesize meaning and information, and the ability to construct a mental representation of the text, each of which first requires the reader to have early skills such as decoding, vocabulary, working memory, and fluency (Kendeou, McMaster, & Christ, 2016). Reading comprehension is crucial for later academic success as much of academic performance relies upon students’ ability to read, cognitively digest, and analyze material presented in text format. This relationship between fluency and comprehension is not unidirectional, it has been described and conceptualized as a reciprocal relationship, with each building upon and strengthening the other (Stecker, Roser, & Martinez, 1998).

Reading fluency, as defined and assessed, has evolved over the past decade to encompass far more than an individual’s ability to read words accurately. Based on robust research findings of strong connections between reading fluency and reading comprehension, there has been a marked change in the way educators and researchers conceptualize reading fluency.

The definition of fluency has expanded to incorporate prosody, intonation, appropriate influx, and purposeful pauses to interpret the text fully. These components greatly influence an individual's understanding of the text and their comprehension of the material. A recent study examined the effects of early readers' prosody with oral reading and found that in addition to oral reading fluency predicting comprehension, there was notable additional variance accounted for by prosody with regards to comprehension, even when decoding efficiency and language comprehension were controlled (Veenendaal, Groen, & Verhoeven, 2015). This automaticity between words and sentences, or verbal fluidity, has been found to be linked with greater literacy as it demonstrates the reader's deeper comprehension of early literacy skills such as phonetics (Hawes, 2015). A reader who has the ability to manipulate the text orally achieves better in comprehension measures.

Due to the robust research linking fluency and comprehension, assessments have evolved to reflect this important link by attempting to document student reading fluency and perceived automaticity. Historically, RAN (rapid automatic naming), or similar tests were administered in which a list of words was presented to the child to read aloud in isolation. The number of words read accurately within a certain time frame were tallied to produce a score that would correspond to that child's oral reading fluency. This form of assessment for oral reading fluency has been adapted, and now there are multiple methods of assessing an individual's score. It is stressed that fluency should be assessed with particular attention given to accuracy, rate, quality, and the newer addition of comprehension (Pikulski & Chard, 2005). Many fluency assessments rely upon an entire passage being read while marking hesitation, transposition, substitution, or any other error to produce an accurate tally of words read. Typically, these tests also include a

comprehension question section to fully assess the child's ability to read fluently and absorb the material in real time, as well as a prosody scale.

There has been a notable gap from theory to practice, as many literacy advocates claim there is insufficient attention or instruction given to oral reading fluency. Research and theory have found that there are multiple interventions with strong evidence to support them based upon the National Reading Panels and the National Early Literacy Panel. Practiced reading is consistently recognized in the literature as an important contributor to bolstering fluency (Fountas & Pinnell, 2006). The National Reading Panel emphasized two main instructional strategies that were evidenced-based, with the first being guided repeated oral reading in which students read passages orally with systematic and explicit guidance and feedback from the teacher and the other is independent reading. The National Early Literacy Panel found large outcomes ($ES=0.7$) on oral language for shared-reading interventions, in which various forms of interaction around material occurred, as well as home or parent interventions having a moderate to large effect on oral language outcomes (National Early Literacy Panel, 2008). On average, children who participated in a shared-reading intervention included in this meta-analysis scored more than .7 of a standard deviation higher than children who did not participate in this intervention (National Early Literacy Panel, 2008). The panel has described meta-analyses to identify the most effective instructional and supplemental practices to bolster literacy in elementary students. Their findings have been publicized nationally have been utilized to shape policy and instructional efforts, yet there appears to be a failure to implement from research to practice.

Despite the robust literature highlighting the importance of fluency, it is often neglected in classroom instruction and has been marginalized from curricular efforts, which can have

profoundly negative effects on gaining proficiency (Rasinski, 2014). This affects a substantial number of children, as only about 40% of the nation's 4th graders could read fluently, a statistic that has yet to change over the decade (National Center for Education Statistics, 2017; National Assessment of Educational Progress, 2015; Abadiano & Turner, 2005; Daane, Campbell, Grigg, Goodman, & Oranje, 2005). This failure to translate research to practice has been problematic for gaining reading proficiency across the nation for elementary school students. The current interventions being used must be examined to better understand the gaps in fluency performance among students.

Oral Reading

Reading out-loud has been a well-supported concept providing that is evidence for an increase reading fluency in students (Neumann, Copple, & Bredekamp, 2000; Fountas & Pinnell, 1996). Oral reading has also been shown to increase reading comprehension (Prior, Fenwick, Saunders, Ouellette, O'Quinn, & Harvey, 2011) and oral reading has been linked with further developed critical reading skills in general (Richards 2000; Martinez, Roser, & Strecker, 1999). The intervention in this study, which prioritizes increased oral reading at a critical learning period, addresses a national reading literacy standard (NCTE/IRA Standard No. 4) highlighting the students' ability to adjust their use of spoken, written, and visual language to communicate effectively.

Interventions

The National Reading Panel asserted that fluency is best developed through practice (NICHD, 2000, pp 3-1), and stressed that this can be accomplished specifically through oral reading practice, such as repeated reading, or guided reading, and through encouraging

independent reading as much as possible (NICHD, 2000, pp 3-5). According to Fountas & Pinnell, 2006, there are many types of evidenced based instructional strategies for bolstering reading fluency. Fountas et al., describe three different levels for gaining early literacy skills with fluency within the school setting. The first level is whole-group teaching which utilizes common practices such as interactive read-aloud, shared reading, Readers' Theater, storytelling, poetry share, and interactive vocabulary lessons. The second level is small-group teaching which utilizes guided reading, or literature study (typically in the form of a book club). Lastly, there is an individual level of teaching which includes strategies such as independent reading, buddy reading, and reading conference (Fountas & Pinnell, 2006, pp xxxv). Schools also typically dedicate time for elementary students to read independently, however available data suggests that this alone is not an effective practice and should never be used as the sole instruction for developing fluency (Fountas & Pinnell, 2006).

Reading interventions target whole classrooms and at-risk students in elementary school in order to provide the best possible instruction and increase literacy attainment in these early years. Research indicates that interventions should follow certain guidelines to maximize success. Gaining literacy is most effective through reading in an interactive process (Lonigan, Shanahan, Cunningham, & The National Early Literacy Panel 2008; Wundenber, Wyse, & Chaplain, 2013; Di Santo, Timmons, & Pelletier, 2016). An interactive process signifies engaging interplay with the child which encourages active participation through vocal oral reading. This can be achieved through multiple forums, such as child-teacher reading, peer reading, child-parent reading, and even newer methods such as dog-assisted reading. Each of these methods will be examined based upon the most recent literature while noting any limitations, beginning first with instructional practices within the school setting.

School Based Interventions

School-based fluency interventions have been slowly evolving over time to be more complex and comprehensive than solely having a student practice reading silently. There are a number of strategies that are on the forefront of development, and the research is currently exploring the most effective strategies that are feasible within a classroom setting. Some of these studies reaffirm what literacy panels and experts have suggested, while other studies have delved into new possibilities that are on the cutting edge of developing technology.

Based upon the extant literature, there have been multiple meta-analyses focusing on bolstering reading fluency for elementary aged students. The National Reading Panel, as discussed earlier, reported an overall effect size of .41 for its meta-analysis of 77 studies for repeated reading and guided reading, which has been repeated with similar evidence in the literature (National Reading Panel, 2000). Burns & Wagner found in their meta-analysis that performance feedback, 'listening passage preview', and 'repeated readings' were all statistically significant in bolstering oral reading fluency (Burns & Wagner, 2008). Another meta-analysis of 30 studies involving 107 elementary students with or at risk of learning disabilities found that goal setting plus feedback, or goal setting plus feedback and reinforcement, were most effective with listening and repeated readings, keywords and previewing, and tutoring all producing moderate effects (Morgan & Sideridis, 2006). Suggate (2016) published a meta-analysis which found long-term effects for comprehension and phonemic awareness, though fluency did not maintain its immediate effects long-term. This study did conclude, however, that interventions were significantly more effective when administered in addition to typical instruction rather than in place of instruction (Suggate, 2016). Another meta-analysis (Lee & Yoon Yoon, 2017) examining the effects of repeated reading interventions on reading fluency reported positive

effects of repeated reading on fluency gains, with the largest gains being with elementary students, and with a larger effect being found for reading a passage at least four times. Combining repeated reading and listening passage preview was also highly effective and was noted to reduce student frustration. This meta-analysis, however, did not find support for performance feedback or peer-mediation as a beneficial component (Lee & Yoon Yoon, 2017).

Ross & Begeny (2015) conducted an elementary reading fluency intervention with 2nd grade students in order to compare the effectiveness of small group instruction vs one-on-one instruction, as well as duration of intervention. The strategies utilized throughout the intervention were evidenced-based including modeling, repeated reading, orally retelling the passage (retell), and practicing new or incorrectly read words, known as read and phase-drill error correction (Ross & Begeny, 2015). Although no significant differences were seen between the type of instruction (small group vs one-to-one), there were significant differences for duration of the intervention (14 minutes vs 7 minutes). Many of the strategies utilized in this study have been validated as effective instructional strategies, but it is clear that research is still trying to finalize exactly how long, and in what setting an intervention may be most effective.

Another study also found that multi-component interventions featuring repeated reading and assisted reading with audiobooks contributed to gains in fluency and comprehension, especially among learning disabled students, with repeated reading have the largest effect (Stevens, Walker, & Vaughn, 2016).

Begeny & Silber (2006) examined group-based interventions that utilized a mix of different evidenced-based strategies including repeated reading, listening passage preview, and practicing difficult words in isolation. They reported that each intervention alone did contribute to gains and promoted reading fluency, however the most effective intervention was the

combination of all of the strategies (Begeny & Silber, 2006). It appears that utilizing a combination of evidenced-based strategies has the largest effect on elementary student outcomes with reading fluency. Advances in research have led to new practices being implemented within the school systems to increase reading fluency. Many of these advances have emphasized a multi-component approach which utilizes more than one evidence-based practice or intervention. Along with studies examining the effects of multiple strategies, there are new studies that aim to better understand the ways in which technology can be better harnessed for fluency interventions.

With technology constantly advancing, another intervention for class instruction to improve literacy was recently studied by Redcay & Preston (2016), who found that 2nd grade students' reading fluency and reading comprehension both improved during a study that involved teacher-guided iPad instruction sessions. The students receiving the iPad instruction demonstrated significant growth in fluency and comprehension compared to the control group (Redcay, & Preston, 2016). The use of technology, in this case, was met with astounding praise of acceptance by the students and teachers and demonstrated significant gains in both fluency and comprehension outcomes.

In the school systems, another strategy to increase the amount of time spent reading out-loud includes peer buddy reading. This strategy has been utilized for decades and pairs two children together as one reads a story and the other listens, and then the two children switch being the 'reader' and the 'listener' in order to practice reading out-loud. These interventions have robust literature supporting their effectiveness for increasing fluency (Topping & Bryce, 2004; Morrison, Everton, Rudduck, Cannie, Strommen, 2000; Fuchs, Fuchs, & Burnish, 2000; Koskinen & Blum, 1986)

Despite robust literature finding peer-reading alone to be a highly effective strategy for bolstering oral fluency, there have been a number of adaptations to increase its effectiveness. For example, Lee (2014) found that a peer reading intervention in which students were taught peer assisted learning strategies contributed to gains in overall reading ability as well as student attitude towards reading (Lee, 2014). The concept of peer reading has adapted from the peer being a passive listener, to include efforts of examining the effects of having the peer become actively involved and provide feedback or instruction during the peer reading time.

Research has recently begun to extend the effectiveness of peer-reading, with studies attempting to incorporate peer tutoring strategies as well. Kourea, Cartledge, & Musti-Rao (2007) conducted a small, study with a limited sample of six 2nd and 3rd grade students and found increases in fluency and comprehension scores when peer-tutoring strategies were involved with peer reading. These strategies included tutoring and practicing specific sight words as well as encouraging and praising the reader (Kourea, Cartledge, & Musti-Rao, 2007). Similar studies have found that the concept of peer tutoring and peer coaching have added gains to the strategy of simply peer reading (Marr, Algozzine, Nicholoso, & Dugan, 2011). The research from this study appears promising in the adaptation of peer reading to include teaching strategies from peers to increase fluency among elementary school students, specifically for 2nd and 3rd grade students from the studies mentioned above.

Another modern twist on the traditional peer reading, and even classroom peer tutoring was trialed by Lin (2016) in an elementary school study between Taiwan and Australia in which the students were involved with peer assisted reading via telecollaboration. This study aimed to improve the oral reading fluency of the Taiwanese students as they were learning English. The

intervention showed significant improvements with fluency, specifically with significant gains in reading accuracy, speed, and expression (Lin, 2016).

With regard to in school reading fluency interventions, the most effective strategies produced in the literature are repeated reading (Begeny, Krouse, Ross, & Mitchell, 2009; Swanson, Vaughn, Wanzek, Petscher, Heckert, Cavanaugh, Kraft, & Tackett, 2011; Therrien, 2004; Stevens, Walker, & Vaughn, 2016), guided reading (Blok, Oostdam, & Boendermaker, 2012; Oostdam, Blok, Boendermaker, 2015), peer-reading without instruction (Topping & Bryce, 2004; Morrison, Everton, Rudduck, Cannie, Strommen, 2000; Fuchs, Fuchs, & Burnish, 2000; Koskinen & Blum, 1986) and peer-assisted reading with instructional and feedback strategies incorporated (Lee, 2004; Kourea, Cartledge, & Musti-Rao, 2007; Marr, Algozzine, Nicholoso, & Dugan, 2011; Lin 2016). It appears that multi-component interventions also prove effective (Begeny & Silber, 2006), and that there are many new advances in incorporating technology into classroom intervention for increasing fluency (Redcay & Preston, 2016; Lin 2016).

Other literature has emerged emphasizing the need for increasing fluency beyond repeated readings, and encouraging educators to increase the amount of reading students do with new materials through interventions known as ‘wide reading’, not solely repeated materials (Ardoin, Binder, Foster, & Zawoyski, 2016; Omer, 2015; Nathan & Stanovich, 1991; Stanovich 1986). Although the authors recognize and encourage the use of repeated readings when necessary or to develop the fluency skills of struggling readers, these studies argue that readers should be encouraged to explore new reading materials to bolster their proficiency when able, as this will increase fluency, comprehension, and vocabulary.

Home-Based Interventions

Historically, independent reading has been examined for its effectiveness on reading development and reading achievement. The National Reading Panel 2000 acknowledges the concept that increased independent reading results in increased reading achievement, as they presented evidence of strong correlational data, though they found mixed results with experimental studies studying relationships between independent reading and fluency.

A review of the literature finds that fluency has not always been incorporated as a measurement for academic achievement, and typically previous studies surrounding independent reading relied solely upon measures of vocabulary and comprehension for reading achievement (Nagy, Herman & Anderson, 1985; Ozburn 1995; Manning & Manning, 1984; Langford & Allen, 1983; Holt & O'Tuel, 1989; & Evans & Towner 1975). Many of these studies traditionally had elementary students read an additional ten to twenty minutes per day (Nagy, Herman & Anderson 1985; Ozburn 1995; Holt & O'Tuel, 1989), though the measures did not incorporate examining fluency. This critique has been noted to be problematic in assessing the true impact of independent reading on fluency and reading achievement (Williams, 2008). Langford & Allen (1983), however, did find a link between increased independent reading and a reported improvement in word reading, which would be considered a part of fluency. The National Reading Panel 2000 suggested that there were mixed results on the effectiveness of independent reading and therefore could not make conclusive statements on independent reading.

The previous gap in the knowledge with independent reading practices and its relation to reading development has attempted be rectified with further dedicated research on the specific outcomes associated with independent reading. Historically, the results were inconclusive with regard to the effectiveness of independent reading. The literature pre-2000 has few studies that

examine the experimental effects of independent reading on increasing fluency. Research conducted in more recent years, however, has examined the effects of print exposure, independent reading, and joint-reading for elementary aged students with promising results discussed in this section.

The literature has long-supported family efforts to become involved in a child's literacy attainment and development. Literacy specialists have proclaimed that parent-child reading is considered to be a critical investment to their child's language, literacy, life-long learning (Kalb, & van Ours, 2014), and reading achievement (Saracho & Spodek, 2010). Parents reading interactively to their child, co-reading with their child in which the child may read some words or follow along with a finger to the words and turn pages, or having their child read with or to them has been well-evidenced throughout the literature as a highly effective strategy to improve fluency and overall reading skills for younger children (Wundenber, Wyse, & Chaplain, 2013; Mol & Bus, 2011).

A recent meta-analysis of 99 studies (N=7,669) focusing on leisure time reading across the lifespan of preschool to university students found that reading comprehension and technical reading ability had moderate to strong correlations with the amount of print exposure. In primary school, print exposure explained 13% of the variance in oral language skills. Moderate associations of print exposure with academic achievement indicate frequent readers are more successful students. Home reading experiences facilitated language, reading, and spelling achievement throughout development, and low proficiency readers were noted to benefit especially from independent leisure reading time (Mol & Bus, 2011). This study found that effect sizes were .34 for oral language and .29 for overall reading skills utilizing studies from 1994-2009. These results corroborated an earlier meta-analysis (Bus, van Ijzendoorn, & Pellegrini,

1995) that found home print exposure had a similar effect size of .32 for oral language and .28 for overall reading skills when reviewing studies from 1951 to 1993.

Meta-analyses have examined the efficacious nature of reading fluency interventions within the home and have found that increased exposure time to reading is highly effective and connected to fluency and overall reading ability. This has been corroborated with studies finding that the amount of exposure and time spent reading aloud is well-linked to reading performance for elementary aged students (Zevin & Seidenber, 2004). Other recent studies have also supported this claim, but have added that the use of traditional books, rather than the use of electronic iPad books, were found to be significantly more effective especially in terms of comprehension of material (Krcmar & Cingel, 2014). Overall, findings of the extant literature for home-based reading interventions suggest that exposure to text and oral reading results in significant gains in terms of language development and reading proficiency. As research continues to develop, there has been a marked change in the field's understanding of the importance of increasing independent reading time, oral reading with others, and increased print exposure to elementary school students, and how these activities influence the development of reading fluency.

Dog-Assisted reading interventions, non-human interaction

Interventions with Therapy Dogs

With interaction as a crucial component of a successful reading intervention due to its encouragement of active engagement of the child, increased participation has been noted as a strengthening component. Research has begun to examine the fact that perhaps interaction may not require a human being, but rather other life-forms as part of that interaction. Research has

shown numerous positive benefits associated with dog therapy in a variety of settings, as dogs provide both positive interaction and foster engagement.

One approach to increasing active participation is through a supportive interaction as an intervention with the use of animals, specifically therapy dogs. Therapy dogs have been identified as animals that can produce both an emotionally secure atmospheres and interactive environments. They have been used extensively to help calm and relax humans in hospitals and retirement communities for decades (Nahm, Lubin, Lubin, Bankwitz, Blake, Castelaz, McAllister, Chen, Shackson, Aggarwal, Manik, Totten, 2012., Vitztum, Kelly, Cheng, 2016., Naoko, Junkichi, 2011., Scheibeck, Pallauf, Stellwag, Seeberger, 2011). Specifically, therapy dogs have been used to create emotionally secure, supportive, and interactive environments for recovering youth in hospitals after surgeries (Vitztum, Kelly, Cheng, 2016). In these studies, youth work extensively with a therapy dog as a component of their intervention and have shown remarkable gains in their overall physical health through the emotional security and connectedness that is formed solely through the presence of the animals.

The presence of dogs during therapy has been shown to have remarkable physiological responses which result in measurable decreases in anxiety and stress (Freimann, Thomas, & Eddy, 2000). This has led to the development and expansion of therapy dogs in a variety of other settings, including college campuses, court-room proceedings, veteran support programs, and more recently, dog-assisted reading programs in schools and libraries.

Specifically, research has linked the presence of therapy dogs with the reduction of physical symptoms, such stress, anxiety, and loneliness (Odendaal, 2001; Jalongo, Astorino, & Bomboy, 2004; Freidmann, Thomas, & Eddy, 2000). These studies have shown the presence of therapy dogs to diffuse symptoms of anxiety and to physiologically reduce the children's heart-

rate, while also decreasing feelings of stress and loneliness. Reading can be a taxing challenge for students to learn, even without the presence of a learning disability, and many students struggle during their elementary school years to practice their literacy skills regularly and with enthusiasm. Dog-assisted reading programs for children have been gaining popularity in recent years. Multiple studies have successfully implemented assisted-reading programs to help reduce these symptoms in elementary students as they read aloud to practice their literacy skills with a trained dog to produce an environment that is engaged, purposeful, and emotionally secure (Jalongo, 2005; Kirnan, Siminerio, & Wong, 2016).

For assisted reading, therapy dogs have been shown to help children focus on the reading material, increase their motivation and persistence for challenging reading material, and reported enthusiasm to read while being assisted by therapy dogs (Granger, Kogan, Fitchett, & Helmer, 1998). Students reported feelings of increased enthusiasm for the program and would be highly motivated to read with the assistance of therapy dogs. This increased engagement is a result of an interactive environment in which children feel comfortable to explore the newly learned skills of early literacy.

Therapy dogs may provide children with an engaging audience, in which the children are prompted with the belief that reading to the dogs calms the animal, or that the animal enjoys the stories. It allows for children to engage in active, out-loud reading while feeling purposeful in their endeavor of reading. Children have reported feelings of more self-confidence with dog assisted reading programs compared to reading with peers or adults (Jalongo 2005).

In library and school settings, children are positioned to be able to read out-loud, speaking to the dog, and to be able to pet or stroke the animal during their reading time. The dog is instructed to lay down next to the child or to sit at the child's feet if the child is sitting in a

chair (Nimer & Lundahl, 2007). These procedures ensure that the child is able to form a connection with the animal by reading out-loud directly to the dog, and by the ability to interact through touch in a manner to which the child believes the dog enjoys, or has pleasure, in listening to the child. The child forms a sense of connection with the dogs, which may result in more engaged participation as an outcome.

The use of therapy dogs in assisted-reading programs has demonstrated significant outcomes such as higher reading rate and fluency, accuracy, and comprehension after the intervention, even after controlling for maturity effects (Kirnan, Siminerio, Wong, 2016., Le Roux, Swartz, Swart, 2014., Booten, 2011., Shannon, 2007). These studies also collected qualitative data that reported positive feelings from the children towards the intervention program and increased enthusiasm for reading (Kirnan et al, 2016; Le Roux et al 2014; Booten, 2011). This reported enthusiasm demonstrates that children feel connected to the intervention and therefore are more engaged in reading. By creating an engaging interaction which involves active participation, interventions with therapy dogs have consistently produced measurable academic outcome results with regards to increasing reading fluency and reading comprehension with elementary school students while simultaneously receiving consistently strong feedback from participants.

Plant-Based Interventions, non-human interactions

Biophilia

To date, there have been no published literacy interventions involving children's reading to plants. Such an intervention would be novel in its design, however there is literature linking its potential with evidenced-based outcomes in other settings outside of the school. The theory of

biophilia, popularized by socio-biologist and esteemed environmentalist professor at Duke University, E.O. Wilson, proposes that humans have a genetic predisposition to instinctively bond with the natural environment and life surrounding it (Colman 2015). This theory states that humans have a natural affinity towards nature and animals, which has been utilized to possibly explain the remarkable beneficial role of animals, including the dog-assisted reading programs and other therapeutic animal interactions. As an extension of this logic, benefits should be derived from any interaction with objects in nature, not just animals such as dogs. If this is the case, then similar benefits could possibly be derived from other animals and perhaps other naturalistic interventions that have the potential for more manageable interventions in the classroom or home. As the children have been found to bond easily with therapy dogs, it would be logical to assert that children may respond positively to other living organisms, as long as the living thing provides a presence and the ability for the child to interact with it through reading.

Drawing on the theory of biophilia, it is proposed that other living organisms can provide benefits for child interaction as non-animal alternatives and could be explained as easier and less expensive natural objects to implement for a reading intervention with children.

Interventions with plants

A recent study found that plants had a significant positive therapeutic effect on recovery of patients in hospitals which included better health outcomes as well as lower ratings of anxiety and stress (Baldwin, 2012). A residential rehabilitation program introduced indoor plants as an intervention and noted significant increases in reported well-being for patients (Raanaas, Patil, & Hartig, 2010).

A large literature review conducted by Keniger, Gaston, Irvine, & Fuller (2013) examined experimental and correlational studies to understand the effects and the benefits of interacting with nature. The literature review examined benefits in areas of psychological, physiological, emotional, cognitive, spiritual, and tangible outcomes. The review produced significant evidence in support of interventions involving plants and nature. Specifically, the literature review cited studies that found exercising in natural environments or with natural landscape images significantly improved participant self-esteem and mood (Pretty, Peacock, Hine, Sellens, South, & Griffin, 2007). Other studies of note included the finding that psychological well-being was significantly promoted through intentional interactions with nature including gardening (Catanzaro & Erkanem, 2004; Van den Berg, & Custers, 2011), and watching wildlife (Curtin, 2009). Maller 2009 found that direct contact with nature through an activity-based curriculum in an elementary school had a positive impact on self-esteem and well-being for students. In terms of physical well-being, Ulrich (1984) found that post-operative healing took less time for patients with a window view of nature compared to a brick wall. Patients with a view of trees also required fewer painkillers, received fewer negative evaluative comments from nurses, and had fewer post-operation complications (Ulrich, 1984). The physiological, emotional, and psychological outcomes associated with plants has proved to be worthwhile of further research, especially given their low-cost, low-care nature. Contact with plants appears to increase overall psychological well-being and reduce physiological symptoms of stress across different age ranges and settings. This robust scholarship merits continued research as to the ways plants can be utilized in other fields.

Limitations

School-Based and Home-Based

The outcomes measured by the school-based interventions have demonstrated significant success in their goal to increase the reading fluency and comprehension of 2nd and 3rd grade students. Extant meta-analytic literature surrounding the effects of reading fluency, however, has been criticized for its limitation in its scope of investigation, commonly focusing on children with learning disabilities in reading (Morgan & Sideridis, 2006), failing to understand interventions usable for all students. This is evident in the literature reviewed in this paper, however there is also useful information as to which interventions have been recognized as the most effective, as well as the overall effect sizes of those interventions.

It is evident that many of these strategies have been implemented successfully, and with strong results to support their existence. Despite the substantial gains these interventions offer, they each have one core component in common which serves as a collective weakness: each of these interventions is inherently resource-intensive. From teaching and monitoring peer-tutoring, to small group instruction, to training and implementing technology in the classroom, each of these interventions requires time and a teacher or instructor with specialized training to ensure the intervention is implemented with fidelity and validity. This has been a well-noted concern from teachers throughout the decades, as elementary teachers have been interviewed and consistently report that they prefer interventions that are less time-intensive, and do not require small-group instruction (Witt, Martens, & Elliot, 1984; Marcoe, 2001). Unfortunately, many studies have highlighted the importance of parents reading with their children, but note that time constraints have always been a limiting factor in this regard as well with many parents reporting they cannot find consistent time to read with their child (Wundenber, Wyse, & Chaplain, 2013).

This study does not argue against the value and need for the interventions mentioned above, however, it does recognize a need for a reading fluency intervention that can be conducted in a more autonomous manner, without the constant instruction or monitoring of teachers or other professionals.

Dog-Assisted Reading

While much of this research with therapy dogs focuses on the therapeutic benefits and outcome of improved reading, it needs to be recognized that dog-assisted programs are not able to be implemented as long-term interventions. The context of these dog-assisted programs has been limited to libraries or short-term school programs, and therefore may not be transferrable to grade-wide implementation during the course of the year, nor may they be manageable to implement in the household. Therapy dogs are costly in resources and time, as each dog requires a volunteer or paid handler to be present, and therefore must be recruited through an agency to be provided.

Jalongo (2005) asserted that a number of steps that must be completed before therapy dog programs can be used with children. His research highlights that first, an organization must be sought out to provide the dogs and the handlers. This organization should be accredited to provide these services to ensure the dogs are well-trained. Secondly, administrative support should be gained in order to make the implementation more viable especially in the school setting. Liability and safety concerns include allergies. The context of the environment should be considered to ensure that the community would be willing to accept a program involving dogs. Budget and sanitation concerns should also be considered. Lastly, permission and consent should be obtained from the parents and children. These guidelines are necessary to fulfill if considering a therapy dog assisted reading program (Jalongo, 2005). With the extent of these guidelines, dog-

based interventions requires considerable time and resources to implement, which may make this unavailable in many schools. This creates a barrier of a time-constraint and access, as many of these programs do not extend past a few weeks. Along with these smaller barriers, these programs do not possess the potential to transition or continue such a program, as teachers cannot have a dog per classroom for reading, nor can families be expected to invest in having a dog at home solely for the benefit of improving their child's literacy rates. It is also not possible to create a year-long, sustainable intervention program with therapy dogs, as it would not be manageable after a few weeks.

Although highly effective, therapy dog assisted reading programs are nearly impossible to transition into daily classroom schedules or to the homes for regular practice, which would be a required component vital for success. Without the ability to procure a long-term program, interventions involving therapy dogs may never be incorporated into the curriculum. These programs involving dog-assisted reading are inherently short-term and therefore cannot be used as a regular intervention in the classroom, nor as a manageable intervention to transfer to the home. Other options should be explored that may provide similar benefits as dog-assisted reading programs, but that do not require the same amount of resources yet can still easily transfer into a year-long curriculum support or an intervention at home. The benefits of other potential interactive and emotionally secure interventions should be explored by further research in order to identify any manageable animals or natural life forms that may produce similar benefits as the dog-assisted reading programs, yet not as intensive in the requirement of resources. Interventions that may be long-term or transferrable to the home while maintaining the ability for a child to form a sense of connection and emotional security may be highly beneficial and produce similar effects that have been gained through the use of therapy dogs. By providing

other forms of interactive interventions in which the child may still connect could produce similar effects for reading fluency.

Plant-Assisted Reading

There are currently no published studies on the concept of students reading to plants or any analysis of the effects. Based upon the literature, however, there is a clear support for the benefits of human interaction with plants which may serve as a basis for this experimental study

With regard to increasing reading fluency through oral reading interventions in elementary aged students, there appears to be a considerable gap in the research for whole-class interventions that are not resource-intensive or dependent upon an adult. Many interventions focus on a small population of children with a learning disability whereas all require an adult to be fully present in the experience with the child aside from child independent reading habits. Previous research has shown that significant gains can be made when supplemental independent reading practice is added to pre-existing classroom instruction, however new avenues should be explored to better examine the ways in which children can be scaffolded to read more independently in an engaging manner. Recent studies have found elementary aged students to appropriately be able to implement math fluency interventions with significant achievement outcomes (Hulac, Dejong, & Benson, 2012), however there has been little research into children reading autonomously, through a purposeful activity, despite studies that assert the importance of exposure to print.

This study was designed to investigate the impact of implementing a reading activity into a 3rd grade science curriculum to encourage children to read aloud. With education standards of North Carolina emphasizing student knowledge of plants in the 3rd grade, it would be ideal to

integrate this intervention with a pre-existing curriculum. This study examined the effects of children reading aloud over a six-week period while simultaneously conducting a scientific experiment to understand the effects of the human voice on the growth rate of plants. It was integrated into the science curriculum by teaching children about the parts and function of plants and what plants require to live, such as sunlight exposure and water.

The study investigated if children at this age were encouraged to read aloud in the home would demonstrate increased fluency and comprehension as a result. To date, there have not been any published literacy interventions involving children reading to plants, however there is robust literature behind the concept of children reading independently and with therapy dogs. Gaining literacy is most effective through reading in an interactive process (Lonigan, Shanahan, Cunningham, & The National Early Literacy Panel 2008., Wundenber, Wyse, & Chaplain, 2013., Di Santo, Timmons, & Pelletier, 2016), however with independent silent reading being non-interactive, and dogs being a resource-intensive and inherently short-term intervention, this study examined the feasibility of an intervention that would encourage students to read aloud through a purposeful and engaging interaction with plants. If effective, this intervention could easily translate to a cost-efficient, resource-scare dependent home-based intervention to increase reading fluency for elementary students.

Reading alone is one component of overall instruction for reading, this still encourages increased exposure time to reading aloud with an autonomous and engaging intervention. This intervention could be utilized for any students, not just struggling readers, as a home-based intervention. Plants may be a viable alternative to an interactive reading intervention and could be used in reading-assisted programs, as children would practice reading aloud. Plants are far less resource intensive than dog-based or people-based interventions and would allow the child

an outlet to practice reading aloud without the required presence of an adult or peer. The choice of succulent plants, or other hardy plants that would persist in sub-ideal conditions, are ideal for this intervention in order to avoid a plant from dying and therefore negatively affecting the child. If effective, the accessibility and broader implementation of this intervention could be tremendous, and therefore it is an important area to investigate to determine if it is beneficial for literacy attainment for elementary students.

Research Questions

This study was designed to investigate the effects of a school partnered, home-based plant assisted reading intervention with third grade students on reading fluency, prosody, reading comprehension, and attitude towards reading. The study addresses five research questions:

Research Question One: Does a plant-assisted, home-based reading intervention/program significantly increase student reading fluency as measured by quantitative pre-post classroom assessment?

Research Question Two: Does a plant-assisted, home-based reading intervention/program significantly increase student prosody as measured by a qualitative pre-post marker?

Research Question Three: Does a plant-assisted, home-based reading intervention/program significantly increase student reading comprehension as measured by quantitative pre-post classroom assessment?

Research Question Four: Does a plant-assisted, home-based reading intervention/program significantly improve student attitude towards reading as measured by a pre-post attitude toward reading survey?

Research Question Five: Does a plant-assisted, home-based reading intervention/program significantly increase reading fluency and comprehension as measured by pre-post classroom assessment in an intervention group compared to a control group?

CHAPTER THREE: RESEARCH DESIGN

Given the innovative nature of this intervention as developed in this study, it is important to research the feasibility and acceptance of the intervention. The design of this research is based on the science of intervention development and the literature of other effective reading fluency interventions which also involve vocalized oral reading. The intervention requires participating students to read out-loud for at least ten minutes (Krcmar & Cingel, 2014; Ross & Begeny, 2015; Ardoin et al., 2016; Nagy, Herman & Anderson 1985; & Ozburn 1995), in keeping with the requirements of the local school setting. Many schools require students to read each night, therefore this intervention was integrated seamlessly into the pre-existing curriculum and instructed students to read for twenty minutes per night, as the participating school dictates. The students participating in the intervention were required to read out-loud rather than silently. Although previous interventions often range from 4-8 weeks with some even lasting months, the six week intervention time length in this study is consistent with the literature as being a sufficient time frame to show effective results (Swanson, Vaughn, Wanzek, Petscher, Heckert, Cavanaugh, Kraft, & Tackett, 2011; Begeny & Silber 2006; Begeny, Krouse, Ross, & Mitchell, 2009).

It is important to note that this study did not endeavor to replace any intervention or instruction in fluency, rather it examined the effectiveness of an added intervention upon already existing instruction. The limitations revealed in the literature review criticize the resource intensive requirement of previous interventions but makes no claims against their effectiveness

and importance in the school setting. This intervention, if effective, could have greatest potential as a supplemental intervention alongside current instruction and intervention in the schools.

Methods

Design

The study is a single group, mixed-methods, pre/posttest design with an intended sample size of 40 third grade students at a single elementary school. The sample size was calculated on the basis of a power analysis with a conventionally set power of .80, an effect size of .50 consistent with the literature of reading fluency interventions and a traditional significance level of .05 (Morgan, Gliner, & Harmon, 2006, pp 150). This yields a required sample size of 33 students.

The study incorporated one additional classroom to serve as a control group. Data was collected from the control classroom during pre-test and post-test data collection.

This is a quasi-experimental study due to the convenience sample of whole classrooms. Classrooms are a product of the children living within a certain school district, therefore the participants are not truly randomized as they will all be attending the same school. This threatens the external validity to generalize to other populations and makes conclusions about cause difficult due to its inherent non-randomized nature (Morgan, Gliner, & Harmon, 2006).

This is mixed methods research study designed to inform the development of this intervention. The purpose of this research was to first determine if the intervention was effective in bolstering reading fluency in third grade students, and then how to better capitalize on its effectiveness by examining the perspective of participating third graders on their experience. This study, without a control, would be classified as pre-experimental, which signifies that any

results gained from this study should be interpreted with caution and should only be utilized to inform a more rigorous study to test the effectiveness of the intervention (Morgan, Gliner, & Harmon, 2006, pp 82). The specific design of this study is a single-group pretest-posttest design as displayed in Figure 1 with a comparison for performance measures against a control.

Figure 1: Study Design

E: 01 X 02

C: 01 02

This design will commence with a pretest (01), followed by the implementation of the intervention (X), and lastly with a posttest (02). With the independent variable being recognized as the implemented reading intervention, the dependent variables are (a) reading fluency, (b) prosody, (c) reading comprehension, and (d) attitude towards reading. For feasibility purposes, the DIBELS reading assessment measure will be utilized as the fluency and comprehension measure, with an additional attitude towards reading scale administered at the pre-test and post-test. In this study, a single group, pre/posttest design was utilized for measures of attitude towards reading and prosody. An experimental design was utilized to compare the students participating in the intervention against a control group for reading fluency (words per minute and accuracy) and reading comprehension measures. A short essay was collected from the students to examine the perceptions of the participating students.

Participants and Setting

The sample size was calculated through a power analysis and yields a required sample size of 33 students with two points of testing for the single group design. A final sample size of

27 students was obtained. Eighteen students were selected to participate in the intervention group and an additional nine students were placed in the control group.

Ethical Considerations

This proposal underwent a review process from the Institutional Review Board before implementation and it was given official approval to be implemented in a public school. The principal of the participating school was informed of the study and approved the initial process. The district county reviewed the proposed study and approved the study to take place in the school. Informed parental consent and child assent was obtained prior to the study, and all participation was on a volunteer-basis with no penalty for withdrawal. The consent obtained permission to (a) gain access and use of the child's classroom assessments (DIBELS progress monitoring data), (b) permission to administer a whole classroom assessment on attitude towards reading, and (c) permission to re-test two subsets of the DIBELS assessment after the intervention (fluency and comprehension).

All data was stored according to best practices of the APA Division 16 Ethics Code of Conduct with the highest priority on maintaining security on personal information and confidentiality. All data was stripped of personal identifying information and replaced with alphanumerical codes and then stored in two places: (a) electronically with password encryption and (b) any original paper protocols or information was kept secured and locked with only the investigator having access. When appropriate and reasonable, the records will eventually be destroyed according to best practices.

Teachers were compensated with a small monetary amount given in gift cards for their effort and time to aid in the implementation of the intervention. Deception was not utilized in

this study. The students were informed that this is part of a research study and that they are participating in an intervention as a strategy for reading.

Materials

Succulent plants are hardy and highly adapted for a minimal care environment and thrive in dry conditions (Park & Allaby, 2017) and were an ideal and suitable candidate for this study as third grade students were not be required to provide intensive care. They typically require only a tablespoon or two of water each week and would need to be kept in a sunlight rich environment. They are relatively cheap and are expected to grow a maximum of a few inches over the course of 6-12 weeks. A plant will be required for each student with a few extra plants being bought as back-ups for spills or damage. Succulents typically come already potted therefore no supplementary materials would be necessary for the plant itself. The Fidelity Log (see Appendix A) required students track and sign off that they were completing the intervention with fidelity.

Lastly, the final cost was the thank-you gift cards for the teachers of the third-grade classrooms. Their collaboration was necessary for the implementation of this study, as homework fidelity logs were collected once per week, brief assessments were administered to collect data crucial to the study, and a small portion of class-time was diverted to introduce the intervention to the students. Students had access to the school library to bring home books for reading at their appropriate level, which the teachers aided in this process. The students were allowed and encouraged to select books that were of interest to them.

Measures

Four measures were used in this study. Baseline data included a collection of each of these four measures from each student. The same measures were collected post-intervention at 6 weeks. The measures included DIBELS (Dynamic Indicators of Basic Early Literacy Skills) for reading fluency and comprehension, a prosody marker, and an attitude towards reading scale referred to as the Elementary Reading Attitude Scale (ERAS). Their validity and reliability are discussed below.

In order to integrate more feasibly with the school systems, this study would utilize pre-existing measures and assessments. Pre-test data was collected through middle of the year (MOY) assessments using DIBELS measures of fluency (DORF) and reading comprehension (DAZE). These measures are consistent with the current literature assessing reading fluency with repeated measure intervention designs. It should be noted that there is a limitation in the DORF measure of reading fluency as it does not report student prosody.

As discussed in the literature review, reading fluency by definition has changed to encompass the concept of prosody. This is not measured by the DIBELS and was outside the feasibility of this study to incorporate due to the requirement of software programs which analyze hesitations to the second, and intonations to a degree that requires far more resources than administering the DIBELS alone. The additional time and financial requirements are significant, and there is an additional requirement of recording student voices while reading which was unnecessary for the scope of this study. Therefore, prosody was assessed by a short, qualitative marker directly after the DIBELS assessment in which the assessor ticked one of four boxes indicating the overall observed impression of the student's prosody. This was done to capture the prosody of the student in an objective manner. The qualitative marker was assessed

by the WIAT-III prosody scale included in the Oral Reading Fluency subtest, as reprinted in Table 1.

Table 1: Prosody Scale

Rating	Category	Definition
1	Monotone	Little sense of phrase boundaries, frequent word by word reading; little to no expression or intonation
2	Choppy	Frequent two- and three- word groupings; failure to attend to ends of sentences/clauses; improper intonation
3	Variable	Sometimes choppy or monotone, sometimes appropriate
4	Appropriate	Generally well-phrased clauses and sentences; appropriate pauses, expression, and intonation

The Elementary Reading Attitude Scale (ERAS) was utilized as an attitude towards reading for the students both in the control and experimental group. This was administered as a pre-test and a post-test measure. This scale was developed as a way for whole classes to be assessed with a valid and reliable measure in a brief period of time, reported collection time is under five minutes for the entire classroom (McKenna & Kear, 1990). This is an effective and an efficient tool as it can quickly assess an entire class through one administration thereby gaining important information from a psychometrically rigorous scale while being time-efficient when conducting research in school setting. For each individual student, it produced an overall attitude score, along with two subscale scores for recreational reading and academic reading. It yielded percentile ranks based upon grade levels once the raw score had been tallied from the twenty questions. This allowed for a quantitative score to be gained for individual students within an entire class (McKenna & Kears, 1990). This measure has been used in the literature to assess attitude towards reading for multiple experimental reading intervention studies (Lee 2014).

Reliability

According to Amplify Education, 2014, DORF Words Correct per Minute received a reliability coefficient of (.89) for alternate single form and (.97) for alternate three-form. When tested for reliability between raters, the DORF received an inter-rater reliability score of (.99). Each of these correlations were significant at the $\alpha < .001$ level.

The DAZE has been reported to have a reliability score of (.81) for alternate single form reliability, (.93) for alternate three form reliability, (.99) for single form inter-rater reliability and lastly, a reliability coefficient of (1.00) for three-form inter-rater reliability. Each of these correlations were significant at the $\alpha < .001$ level (Amplify Education, 2014). A recent study found that the DORF was highly reliable (~.90) with test re-test correlations (Barth, Stuebing, Fletcher, Cirino, Romain, Francis, & Vaughn, 2012).

The Elementary Reading Attitude Survey has a reported internal consistency as measured by Cronbach's alpha for its overall total (.88), cluster/subscale for attitude towards recreational reading (.80), and cluster/subscale for attitude towards academic reading (.81). This is well within the limits of a reliable measure. The reliability for this survey has been empirically validated by outside research as well (Worrell, Roth, & Gabelko, 2006).

Validity

According to Amplify Education, 2014, third grade end of the year DORF subtest received a concurrent validity coefficient of (.66) when correlated with the GRADE Total Test based on end of the year data. End of the year DAZE received a concurrent validity score of (.67) when correlated with the end of the year GRADE Total Test. Each of these correlations were significant at the $\alpha = .001$ level.

With regards to criterion related validity, third grade DORF correlated with National Assessment of Educational Progress (NAEP) 4th grade passage with a coefficient of (.96) (Amplify Education, 2014). A recent study found that DORF had excellent concurrent and predictive validity across multiple studies (Goffreda, & DiPerna, 2010). DORF was found to be reported with moderate convergent validity (Barth, Stuebing, Fletcher, Cirino, Romain, Francis, & Vaughn, 2012).

These two subtests of the DIBELS ensure that measures for reading fluency and reading comprehension are reliable, valid, and time-efficient. The DIBELS is a brief measure of reading proficiency and the entire assessment takes a few minutes per child. This assessment is already administered to the students and therefore would be time-efficient method for intervention assessment and evaluation.

The Elementary Reading Attitude Scale has multiple validity measures including construct validity for recreational attitude towards reading as measured by its correlation with those who had library cards ($p < .001$), those who checked out books from their library ($p < .001$), and those who watched less television each night ($p < .001$). The validity for the academic subscale was examined through the relationship of scores to reading ability ($p < .001$). A factor analysis was conducted to reveal that the two subscales reflect distinct aspects of reading attitude (McKenna & Kear, 1990). These claims for strong validity have been supported empirically as well (Worrell, Roth, & Gabelko, 2006).

A short essay prompt was administered to each of the students to collect qualitative data, as this study is innovative and therefore required further research as to the processes engaged and utilized by the students. An emic approach was utilized to conduct a thematic analysis of the student essays. An initial read of the essays informed the production of a codebook that was then

applied to the essays by two coders. Inter-rater reliability and agreement were calculated to ensure the codebook was translatable and could be accurately applied to the data. An analysis of the codes revealed prominent themes that were integral to the process of the intervention.

Procedure

The procedure began by selecting a school site that was willing to participate. Upon principal and district approval, informed consent letters were sent home to parents to obtain permission to (a) gain access and use of the child's classroom assessments (DIBELS) (b) permission to administer a whole classroom assessment on attitude towards reading, and (c) permission to re-test two subsets of the DIBELS assessment after the study. Once informed consent had been returned and MOY (middle of the year, typically in January) assessments had been collected, two classrooms of third grade students were randomly selected to participate and each student received a plant with instructions for care and to participate in the intervention. Any students that did not have consent to participate in the study still received a plant and followed the procedures of the study but did not have any data collected.

A classroom presentation took place on a Monday in which the researcher engaged with the whole class for approximately sixty minutes to discuss (a) what are the parts and functions of those parts in plants, (b) what plants need to survive, (c) introduce that there are some people who think plants grow and respond to sound, (d) 'invite' the class to help with this idea, (e) have each student collect a plant, (f) discuss the proper care for the plants at home with instructions written out, and (g) discuss the protocol and responsibilities for the students with instructions written out.

The students received explicit instructions on caring for the plants. These instructions were written and handed out (see Appendix B) and briefly described where to store the plant, and how much water it should receive. The researcher discussed the responsibilities for the students and what to expect for their homework. The written instructions were given (see Appendix C) and sent home along with instructions for plant care. The students were shown the “Fidelity Log” so that they were aware of the requirements to complete the log each night. A short ‘brainstorming’ session occurred to engage students to think about where they might read each night to the plants, such as in their bedroom or in their kitchen, and how they might keep track of the time they read aloud.

After the information session, the students took home the plant. The intervention began that night, as the students were expected to read for the pre-assigned time for five nights over the course of the following six weeks. Regular reminders were provided by the teacher and a visual poster was set up in the classroom to encourage students to continue their homework and read out-loud to the plant. Each Monday, the teacher sent home the Fidelity Log and the student was expected to return it for the week on the following Monday. As they turned in their filled-out Fidelity Log, they received a new Fidelity Log. This process repeated itself on the subsequent Monday for the six weeks of the study.

Following the six weeks, post-test data was collected through an additional administration of the DIBELS subtests for reading fluency, prosody, and reading comprehension, and the measure for attitude towards reading for the class. A short essay was administered inquiring about the student’s experience reading with the plant, if they enjoyed it, and why they did or did not enjoy it. Students were instructed to write for ten minutes. The essays were hand-

written, and all identifying information was removed and replaced with the student's encrypted alphanumerical code to match their quantitative data. Students were allowed to keep their plants.

Feasibility and Acceptability

Given the innovative nature of this intervention, a short interview process was conducted in the spring of 2018 in order to better determine the feasibility and acceptability for the implementation potential of the intervention. A systems-level literacy implementation coach and a building-level literacy interventionist in the Carrboro-Chapel Hill school district were both consulted to better determine the feasibility of this project.

A summary of these interviews indicated that there was a clear consensus among all members that the logic and intent of this intervention were solid on the basis of the literature and the need for implementation in schools. Given the limitations that there has been a failure the translation to practice for independent oral reading practice, both of the educators interviewed in this process stated that fluency was 'overlooked' for instruction and intervention, supporting the need for more interventions.

With fit and capacity, foreseeable challenges discussed in the interviews revolved mainly around the home, as the home environment can be unpredictable, and some students may receive more support and adherence to the intervention than others. With third grade students becoming more autonomous, there is more hope with implementation fidelity and a fidelity log was added to increase intervention adherence. Students were mostly autonomous in the implementation of the intervention. This was originally considered as a second-grade intervention, however it seems more appropriate for third graders due to their pre-existing curriculum which incorporates learning the parts and functions of plants.

Implementation Considerations

According to Maruyama & Deno (1992), considerable preventative steps of collaboration should take place when conducting research in an educational setting. This would include scheduling a meeting with those who will be involved in the project to explain its importance, its requirements and to understand their reactions and concerns while simultaneously increasing their sense of ownership with the project. It is also important to understand the distinct and unique culture of the school and how the school operates (pp 21). During this time, expectations should be made clear, and the researcher should offer to limit the resources taken away for the study. In the situation of this particular study, the researcher offered her time to help complete the classroom assessments and to help with the instructions and explanation of the study to students. A meeting was required to understand the policies of the school district for accessing information and if any other permissions must be obtained other than parental informed consent (pp 78). These small steps were taken in order to gain clearer expectations and a sense of collaboration between the school and the researcher.

Analytical Strategy

Quantitative

Pre-posttest measures were collected and analyzed for statistically significant differences for reading fluency, prosody, reading comprehension, and attitude towards reading. The pre/post comparisons were tested by paired *t*-tests for the one sample. This assessed whether the post-test scores were statistically significantly different from the pre-test scores in each area. Gains or losses in these areas were noted and were compared to the rate of normal development over a six-week period without the intervention for third grade students. According to research

methodology, a paired *t*-test is appropriate when one independent variable is being measured by a repeated measure of a pre and posttest (Morgan, Gliner, & Harmon, 2006 pp 191).

Improvements due to an intervention can be analyzed based upon the differences in scores from the repeated measure compared to the chance of that difference occurring by random chance (Morgan, Gliner, & Harmon, 2006, pp 191).

A control group was utilized for comparison with a *t* test of difference scores examined the variance in performance with reading fluency and comprehension based upon the participation with the intervention. In this case, the difference scores were calculated from the pre/post measures from the experimental group and were compared statistically to the difference scores from the pre/post measures from the control group.

Qualitative

A thematic analysis using an emic approach was employed for a dataset of the essays administered to each of the students in the study. A preliminary codebook was first developed based upon the themes from a sample set of ten essays and a research assistant was then trained in the codebook and given a different sample in order to test the applicability of the codebook to a new sample of the dataset. This revealed any areas of confusion or miscommunication within the codebook that would later be revised and rectified.

The primary researcher and a trained research assistant completed an inter-rater reliability (IRR) trial in order to test the accuracy and applicability of the codebook to a sample of five randomly selected essays, both coding an entire sentence as a unit of analysis when a code appeared. The results were compared using NVivo, an analysis soft-ware to compute a kappa which equates to the ratio of agreement of similar coding and the probability of achieving this by

chance. This kappa is strategically important to qualitative research as it serves as a reflection in the ability for the codebook to be mastered and accurately applied to a dataset (Viera & Garrett, 2005). A high kappa signifies the utility of the codebook and that it can be accurately applied to the entire dataset. An interpretation of kappa agreement can be seen in Table 2.

Table 2: Interpretation of Kappas

Kappa	Agreement
<0	Less than chance agreement
.001-0.20	Slight agreement
0.21-.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-.80	Substantial agreement
0.81-0.99	Almost perfect agreement

CHAPTER FOUR: RESULTS

The results chapter will be addressed with three sections. The first section will describe the total sample size and the logistics of data collection which impact the reported results. The second section will describe the quantitative results of the proposed study in response to each of the research questions and it will also report the statistics related to the reported fidelity of implementation of the intervention as well as for classroom differences. The third section will present the results of the qualitative analyses conducted to document the experiences of the participating students and their perception of the intervention.

Final Sample

The six-week intervention involved a total sample size of 27 students from a Wake County elementary school in North Carolina. There were 18 students who participated in the intervention, and the data collection process. Two students returned completed consent forms past the due date and as a result, some pretest measures were not obtained from them. The students were enrolled in the study, however with the result of some missing data from analyses. This will be evident in the result sections with the notation “n”, defining the sample size depending on the measure. The intervention sample size of 18 students was complimented by an additional 9 students participating in the control group. The 9 students in the control group did not participate in the intervention but did participate in the consent process and data collection for measures of reading comprehension and reading fluency as measured by words per minute and accuracy rate. Pre-test data collection occurred in late January with post-test data collection occurring six weeks later in mid-March. The total sample size of 27 is significantly smaller than the ideal sample size strived for in Chapter Three which limits the power of the study.

Quantitative Results

This section will address the research questions in order and provide the results of the statistical analyses. For statistically significant results, figures will accompany the results to provide visualization of the data.

Research Question One:

Does a plant-assisted, home-based reading intervention/program significantly increase student reading fluency as measured by quantitative pre-post classroom assessment?

The classroom assessment DIBELS was utilized as the pre/posttest measure for fluency assessing each student's rate of fluency, in terms of words per minute, and accuracy, reported as a percentage. The data collected for the pre and posttest is reported below in Table 3. A *t* test was employed to examine the difference in reading fluency and accuracy with a single group, pre/posttest design after affirming the normality.

Reading fluency, as measured by words per minute, single group, pre/posttest

Table 3: Descriptive statistics on reading fluency data, words per minute

Terms	Pre-test Sample	Post-test Sample
N	18 students	18 students
Mean	108.78 words	117.5 words
Range	43-175 words	59-178 words
Standard Deviation	30.83 words	27.5 words

A Shapiro Wilks Normality test was employed, $W = 0.99$, $p = 0.99$, with a reported skewness of 0.02 and kurtosis of -0.27. Given that the data is sufficiently normal, a *t* test was employed. The results, $t(17) = 2.0722$, $p = 0.05$ indicate that the difference in pre-test and post-test

scores was statistically significant as $p=0.05$. The difference scores in Table 3 show an improvement average of 8.72 words per minute compared to the pre-test scores.

Figure 2: Pairwise comparison, WPM

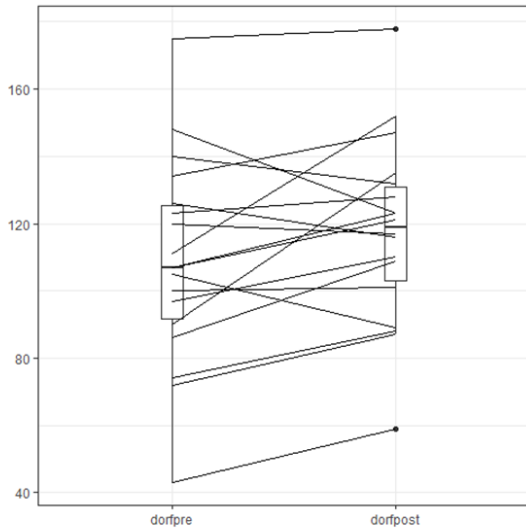
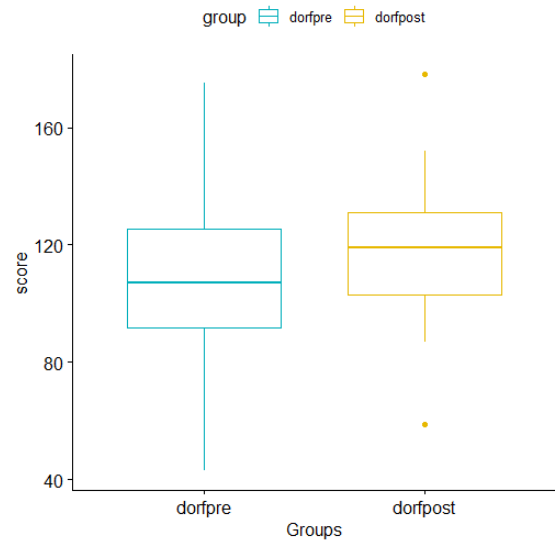


Figure 3: Boxplot, DORF, WPM



A t test was conducted to examine if the intervention group improvement in reading fluency differs from the expected rate of improvement for 3rd grade fluency growth as measured by words per minute with the DIBELS progress monitoring assessment system. The expected growth from Middle of the Year data collection (MOY) to End of the Year data collection (EOY), which occurs 18 weeks apart, is an increase from 86 words per minute at MOY to 100 words per minute at EOY. This is an increase of 14 words per minute over 18 weeks, which calculates to be an expected growth rate of .78 words per minute per week. Over the course of the six-week reading intervention, the expected rate of increase for a student would be 4.68 words per minute in this study.

Reading Fluency as measured by words per minute compared to expected growth rate

Table 4: Descriptive statistics on difference scores pre/posttest for fluency, words per minute

Difference scores, pre/post test, experimental group	
N	18 students
Mean	8.17
Range	45-70 words per minute
Standard Deviation	17.87 words per minute
Skewness	0.27
Kurtosis	-0.38
Shapiro Wilks Normality Test	W=0.96238; p= 0.666

The difference scores were calculated from the pretest data and the posttest data. Each pretest data point was simply subtracted from its posttest pair score to produce a single column of scores which represent the difference. As seen in Table 4, the data of these difference scores appears to be sufficiently normal. Thus, a t test $t(17)= 0.96032, p = 0.35$ indicate that the students participating in the intervention did not statistically significantly differ from the expected rate of improvement for six weeks of growth with regards to reading fluency as measured by words per minute during the DORF DIBELS test administration.

Reading Fluency as measured by accuracy, single group, pre/post

Table 5: Descriptive statistics on accuracy sample data

Terms	Pre-test Sample	Post-test Sample
N	18 students	18 students
Mean	97.67%	96.94%
Range	90-100%	92-100%
Standard Deviation	2.35 %	2.44%

In order to examine differences in student accuracy with reading fluency, a percentage of accuracy was recorded both pre and post intervention. The assumption for normality of the data for student accuracy with a Shapiro Wilks Normality Test ($W=0.73289, p<0.001$), kurtosis reported as 3.6, and skewness reported as -1.93 demonstrate concerns with normality. As a t test would not be appropriate for this data, a nonparametric method should be utilized (Pandis, 2015).

A paired sample Wilcoxon test, also known as the Wilcoxon signed rank test was conducted, as this is an alternative statistical analysis for comparing paired data when the data, as seen in Table 5, are not normally distributed (Fey, 2018).

The paired sample Wilcoxon test was employed $V=93$, $Z= -1.28$, $p=0.20$, with no statistically significant difference detected between the ranks of the pre-test and post-test scores for participating students with regards to their reading accuracy.

Research Question Two:

Does a plant-assisted, home-based reading intervention/program significantly increase student prosody as measured by a qualitative pre-post marker?

Reading fluency, as measured by prosody, single group, pre/post

Prosody was assessed by the researcher through observation as the student completed an oral reading passage. The student’s performance was assigned into a category ranging 1-4 based on reading fluidity corresponding to a category of prosody ranging from Monotone to Appropriate, as seen in the Prosody Scale (page 42). The category scores were measured before and after the reading intervention during the DORF administration as the student read aloud.

Table 6: Descriptive statistics on prosody sample data

Terms	Pre-test Sample	Post-test Sample
N	16 students	16 students
Mean	3.62	3.69
Range	2-4	2-4
Standard Deviation	.62	.60

The data reported kurtosis =0.32 and skewness -1.23 and the Shapiro Wilks normality test, $W=0.64833$, $p<0.001$ found the data to be insufficiently normal for a *t* test. Therefore, a

paired sample Wilcoxon test was conducted and reported $V=6$, $Z=-0.29$, $p=0.77$ indicating that the intervention did not statistically significantly affect reading fluency as measured by prosody.

Research Question Three:

Does a plant-assisted, home-based reading intervention/program significantly increase student reading comprehension as measured by quantitative pre-post classroom assessment?

Reading comprehension, as measured by the DAZE, single group, pre/post

Table 7: Descriptive statistics on reading comprehension data

Terms	Pre-test Sample	Post-test Sample
N	17 students	17 students
Mean	15	21.94
Range	2-28	10-34
Standard Deviation	7.24	6.63

The DAZE reports a score of questions answered correctly by a student within three minutes. The reported score is adjusted for guessing when an incorrect answer is given. The reported score is a whole number and serves as a measure of reading comprehension through the DIBELS progress monitoring system. The pretest data reported a kurtosis = -0.98 and skewness = -0.11. A Shapiro Wilks Normality test, $W=0.98071$, $p = 0.96$, indicated that the data were sufficiently normal. A t test was employed, $t(16)=5.7898$, $p < 0.001$ indicating a statistically significant effect. Thus, the students' performance on the reading intervention reflect a statistically significant increase in reading comprehension after six weeks. The reported mean difference from the pre-test scores to the post-test scores was an increase of 6.9 points after the reading intervention, as seen in Table 7. The data can be visualized in Figure 4: Pairwise comparison and Figure 5: Boxplot comparison.

Figure 4: Pairwise comparison of DAZE

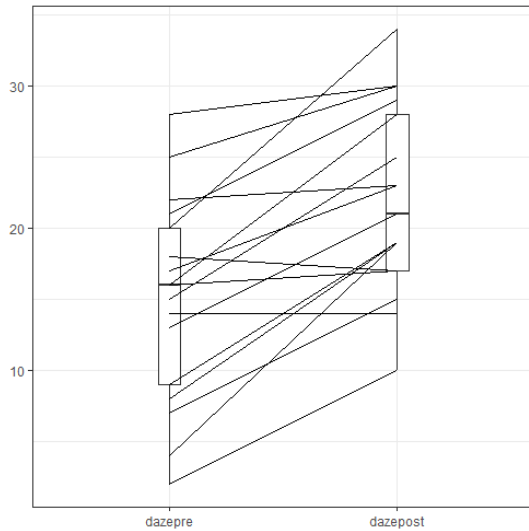
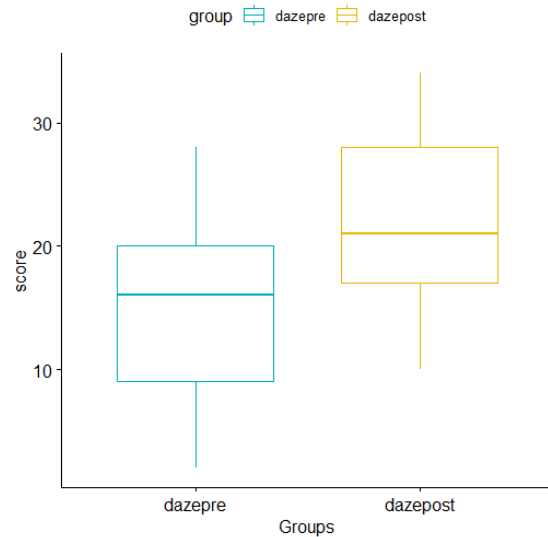


Figure 5: Boxplot comparison of DAZE



Research Question Four:

Does a plant-assisted, home-based reading intervention/program significantly improve student attitude towards reading as measured by a pre-post attitude toward reading survey?

To address this research questions, three statistical analyses were performed based upon the data collected through the ERAS survey. The survey reports a Total Attitude Towards Reading score, along with two additional scores representing Recreational Attitude Towards Reading and Academic Attitude Towards Reading. This survey was solely administered to the intervention group and therefore the results can only be compared through a single group, pretest-posttest analysis. It should be noted that the measure produces both raw scores as well as percentiles. The statistical analyses of the attitude towards reading scores provided below utilize the percentile values. This is considered best practice as using the percentiles rather than the raw scores increases the power of *t* tests, specifically by better protecting the Type 1 error rate (Zimmerman & Zumbo, 2005).

Total Attitude Towards Reading, single group, pre/post

Table 8: Descriptive statistics on Total Attitude Towards Reading sample data

Terms	Pre-test Sample	Post-test Sample
N	15 students	15 students
Mean	55.4	54.13
Range	43-66	35-73
Standard Deviation	6.2	10.17
Skewness	-0.49	-0.28
Kurtosis	-0.67	-0.55

The first analysis of the effect of the reading intervention on attitude was with the total attitude scores. The pretest descriptive data reported a skewness of -0.49 and kurtosis of -0.67 and a Shapiro Wilks Normality test, $W=0.93575$, $p= 0.33$. With no concerns with normality, as seen in Table 8, a t test was employed with the following results: $t(16)= -0.69332$, $p=0.50$, indicating there is no statistically significant difference between the pre-test total attitude towards reading scores and the post-test attitude towards reading scores. The reading intervention was not associated with any difference in student reported attitude towards reading. *Recreational Attitude Towards Reading, single group, pre/post*

Table 9: Descriptive statistics on Recreational Attitude Towards Reading sample data

Terms	Pre-test Sample	Post-test Sample
N	15 students	15 students
Mean	28.8	26.73
Range	19-34	15-38
Standard Deviation	4.59	5.87
Skewness	-0.77	-0.01
Kurtosis	-0.68	-0.58

The second analysis investigating the effect of the reading intervention on attitude towards reading examined recreational attitude towards reading. As seen in Table 9, the data appears to meet the assumption of normality with a Shapiro Wilks Normality test, $W=0.89506$; $p=0.08$. A t test was employed with the following results: $t= -2.1905$ $df(14)$, $p=0.05$ showing a

statistically significant negative effect of the reading intervention on recreational attitude towards reading. The decrease in scores for recreational attitude towards reading following the intervention is shown in Figure 6 and Figure 7.

Figure 6: Pairwise comparison of recreational reading

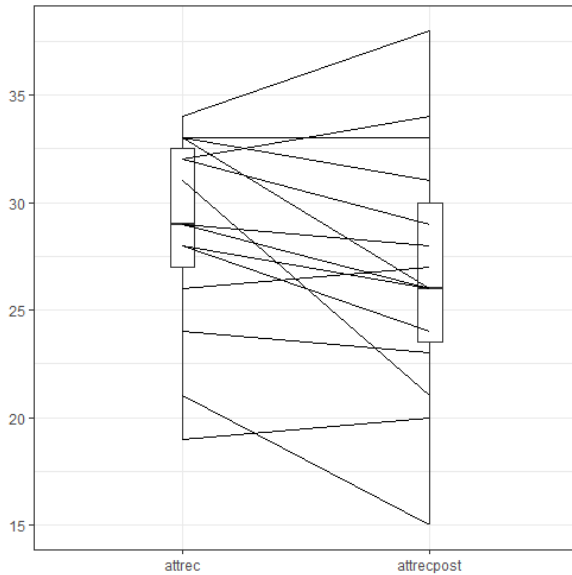
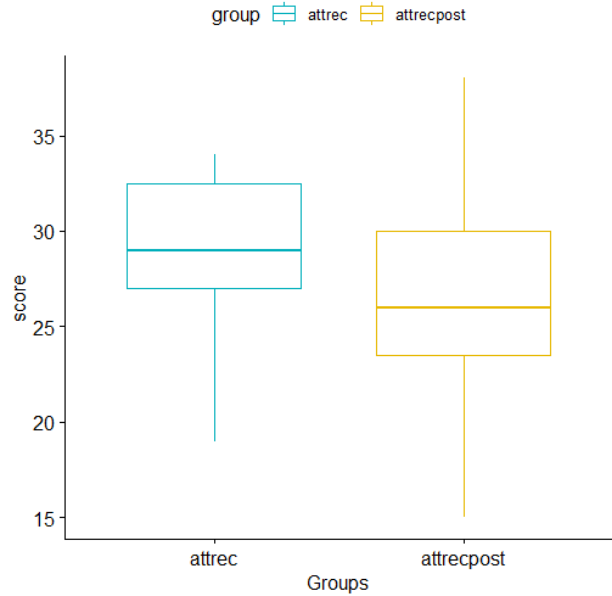


Figure 7: Boxplot of recreational reading



Academic Attitude Towards Reading, single group, pre/post

Table 10: Descriptive statistics on Academic Attitude Towards Reading data

Terms	Pre-test Sample	Post-test Sample
N	15 students	15 students
Mean	26.6	27.33
Range	19-33	15-35
Standard Deviation	3.52	5.55
Skewness	-0.37	-0.61
Kurtosis	-0.41	-0.61

The third measure examined the effect of the reading intervention on academic attitude towards reading. As seen in Table 10, the data appears to meet the assumptions of normality with a reported Shapiro Wilks Normality test, $W=0.97144$; $p=0.87$. Therefore, a t test was employed with the following results, $t(14)=0.63403$, $p=0.54$, reporting no statistically significant

difference between pre-test and post-test scores with regard to academic attitude towards reading.

Research Question Five:

Does a plant-assisted, home-based reading intervention/program significantly increase reading fluency and comprehension as measured by pre-post classroom assessment in the intervention group compared to the control group?

Reading Fluency, words per minute, experiment vs control

Table 11: Descriptive statistics on difference score for reading fluency words per minute for the intervention and control group

Terms	Intervention Group	Control Group
N	18	9
Mean	8.72	11
Range	-25-45	-17-39
Standard Deviation	17.86	18.94
Skewness	0.18	.008
Kurtosis	-0.4	-1.3
Shapiro Wilks Normality Test	W=0.95871, p=0.58	W=0.93164; p=0.50

To examine the effect of the reading intervention, a comparison was made of the pre and post difference scores of the intervention and control group. With assumptions for normality and homogeneity of variance were met, [F test, $F(17,8)$, =0.89, $p= 0.79$], a t test was conducted, $t(25)$, = -0.31, $p=0.76$. The results indicated that the reading fluency of students participating in the intervention did not differ significantly from that of the control group as measured by words per minute on the DORF subtest of the DIBELS classroom progress monitoring assessment.

Reading Fluency, as measured by accuracy, experiment vs control

Table 12: Descriptive statistics on difference score for reading accuracy for the intervention and control group

Terms	Intervention Group	Control Group
N	18 students	9 students
Mean	-0.78	0.41
Range	-6-2	-2-3
Standard Deviation	2.07	1.56
Skewness	-0.78	0.01
Kurtosis	0.08	-1.3
Shapiro Wilks Normality Test	W=0.93345; p=0.2232	W=0.96; p=0.79

To analyze the effect of the reading intervention, a comparison was made between the difference scores for the intervention group and a control group on reading accuracy. As seen in Table 12, the data appear to meet the assumptions of normality and for the homogeneity of variances [$F(17, 8) = 1.78, p = 0.41$]. Therefore, a t test was conducted, $t(25) = -1.51, p = 0.14$ which showed the difference scores of the intervention and control groups do not differ significantly from each other. Thus, no effect was found on the measure of accuracy between the intervention and control groups as measured by the DORF subtest of the DIBELS assessment.

Reading Comprehension as measured by the DAZE

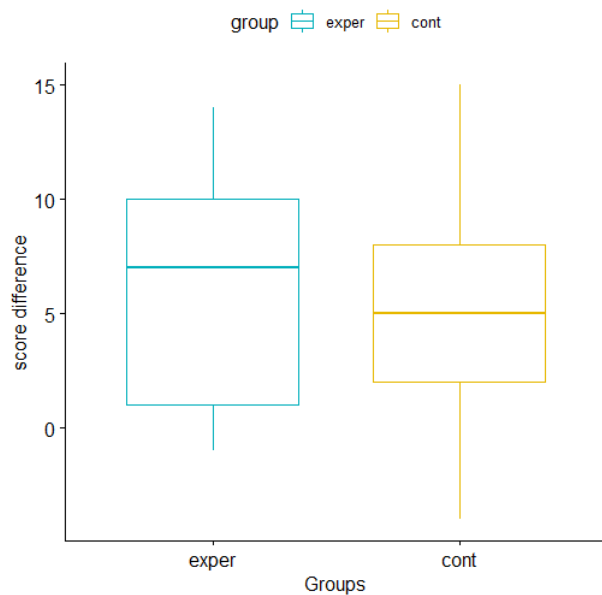
Table 13: Descriptive statistics on the DAZE scores of the intervention and control

Terms	Intervention Group	Control Group
N	17	9
Mean	6.941	3.22
Range	-1-15	-4-7
Standard Deviation	4.94	3.99
Skewness	-0.12	-0.49
Kurtosis	-1.3	-1.37
Shapiro Wilks Normality Test	W=0.95, p= 0.40	W=0.89; p=0.19

To analyze the effect of the reading intervention, a comparison was made with the pre and posttest difference scores from the intervention group and the control group. With assumptions

meet for normality as seen in Table 13, and the assumption of homogeneity of variances was met [$F(6, 8) = 1.53, p=0.55$], a t test was conducted, $t(24) = 1.94, p=0.03$. The results indicated the intervention group achieved a statistically significantly greater growth in reading comprehension following the six week intervention compared to the control group. The mean difference in scores between the pre/posttest for the intervention group was an increase of 6.9 points on the DAZE measure whereas the mean difference in scores between the pre/posttest for the control group was an increase of 3.2 points on the DAZE measure. Students participating in the reading intervention demonstrated more than double the increase in reading comprehension scores as measured by the DAZE compared to the control group. Visualization by boxplot of differences in scores by intervention and control groups for DAZE reading comprehension are provided in Figure 8.

Figure 8: Boxplot comparison of difference scores pre/post for reading comprehension



Post-Hoc Analyses

The analyses thus far were conducted in direct reference to the research questions and are considered *a priori* tests. The research questions have been answered with the data collected,

however it was determined that additional statistical analyses could be conducted to investigate any differences based upon available data regarding student fidelity logs and the differences between classrooms within the intervention group. These are considered post-hoc analyses and have been separated from the quantitative analysis result section, as they are distinctly different from the *a priori* research questions and related statistical tests conducted. This section will document the results following the post-hoc analyses regarding the fidelity of students and the effect on outcomes, as measured by the completion and return of the Fidelity Logs, and any classroom differences, as the intervention group consisted of eighteen students, twelve of whom were in Classroom A and six of whom were in Classroom B.

Fidelity Measures

The intervention group was required to return weekly fidelity logs which recorded each student's nightly reading throughout the week to ensure the intervention was being implemented as instructed for twenty minutes of out-loud reading per night, five nights per week, for six weeks. These fidelity logs were sent home on Monday and collected the following Monday. Students who returned completed fidelity logs more than 50% (at least four of the total six fidelity logs counted as returned) were considered high fidelity whereas students who returned completed fidelity logs 50% or less than 50% (at least three of the total six or fewer returned) were considered low fidelity.

The experimental data was divided into the categories of high fidelity or low fidelity and then the data was analyzed for the research measures to better determine if fidelity of intervention affected pre/post test scores.

Reading Fluency, Words per minute, high vs low fidelity in the intervention group

The data was analyzed to examine the effect of fidelity of the intervention on reading fluency as measured by words per minute. The high fidelity group presented with $n=8$ and a mean difference score of 8.88 words per minute with a standard deviation of 16 words. The change in scores from pretest to posttest ranged from -10 to 45 words. Skewness and kurtosis were within normal limits, reported as 1.04 and 0.01 respectively. A Shapiro Wilks Normality test, $W=0.85918$, $p=0.1178$ revealed sufficiently normal data. The low fidelity group was represented by 10 students with a mean score of 7.6 words per minute with and a standard deviation of 19.67 words. The change in scores from pretest to posttest ranged from -25 to 41 words. Skewness and kurtosis were within normal limits, reported as -0.12 and -1.12 respectively. A Shapiro Wilks Normality test, $W=0.96$, $p=0.73$, met the assumptions of normality. An F test was computed and the homogeneity of the variances were within normal limits, $F=0.72$, $p=0.68$. An independent two sample t test, $t(16)=-0.146$, $p=0.89$, indicated that there was no statistically significant difference between the high and low fidelity groups with regards to reading fluency as measured by words per minute.

Reading Fluency, Accuracy, high vs low fidelity in the intervention group

To examine the effect of fidelity of the intervention on the outcome score of reading fluency as measured by accuracy, the data was grouped into high fidelity and low fidelity categories. The high fidelity group ($n=8$) had a mean accuracy score difference of -0.75 with a standard deviation of 1.6 and score changes ranging from -4-1. The data revealed a skewness of -0.85 and kurtosis of -0.61. A Shapiro Wilks Normality test was conducted, $W=0.89754$, $p=0.2745$ reflecting no concerns with data normality. The low fidelity group reported $n=10$ with a mean accuracy difference score of -0.8 with a standard deviation of 2.47 and score changes

ranging -6-2. There were no concerns for skewness or kurtosis of the data, -0.63 and -0.62 respectively. A Shapiro Wilks Normality test was also conducted, $W=0.90611$, $p=0.2553$. An F test was computed, $F=0.42002$, $p=0.2657$ indicating that the variances of the two samples were sufficiently homogenous. A t test revealed no significant difference between the high fidelity and low fidelity groups, $t(16)= 0.049315$, $p=0.9613$, with regards to pretest/posttest score differences for reading fluency as measured by accuracy rate.

Prosody, high vs low fidelity in the experimental group

The data was analyzed to examine the effect of fidelity on outcome measures of prosody. The high fidelity group with a sample size of 7, reported a mean difference score in prosody rating of 0 with a standard deviation of 0.82 and a range of changing scores from -1 to 1. Skewness and kurtosis were within normal limits, calculated as 0 and -1.71 respectively. A Shapiro Wilks Normality test was conducted $W=0.86$, $p=0.14$ with no concerns with normality.

The low fidelity group reported a sample size of 9 with a mean difference score of 0.11 and a standard deviation of 0.33 with scores changing within a range of 0-1. Skewness and kurtosis were both reported elevated but within normal limits, with scores of 2.07 and 2.63 respectively. A Shapiro Wilks Normality test was conducted, $W=0.38984$, $p<0.01$, with no concerns with the normality of the data. An F test, $F=6$, $p=0.02$, met the assumption of homogeneous variances. Therefore, a t test would not be appropriate due to the inability of the data to meet the required assumptions of a t test. A nonparametric Wilcoxon rank test was utilized. The results, $W=29$, $Z=-0.26$, $p=.80$, indicate no statistically significant difference between the high fidelity and low fidelity group with regards to the difference in pretest/posttest prosody scores.

Reading Comprehension, high vs low fidelity in the experimental group

For reading comprehension, the DAZE scores were analyzed with high fidelity reporting $n=8$, mean = 7, with a standard deviation of 4.24, ranging from 1-14. Skewness and kurtosis appear to be within the limits of normality, 0.04 and -1.29 respectively. Shapiro Wilks normality test also revealed the data for the high fidelity group met the assumptions for normality, $W=0.95$, $p=0.68$. The low fidelity group reported descriptive statistics with $n=9$, mean = 6.89, with a standard deviation of 5.75, with scores ranging from -1-15. Skewness and kurtosis were within the normal limits with reported calculations of -0.15 and -1.71 respectively. A computed Shapiro Wilks test, $W=0.93$, $p=0.46$ met the assumption of normality. A computed F test, $F=0.54$, $p=0.44$ met the assumption for homogeneous variances. A t test was conducted, $t(15)=0.045$, $p=0.48$ reporting no statistically significant difference between high fidelity and low fidelity scores on reading comprehension as measured by the DAZE.

Total Attitude Towards Reading, high vs low fidelity in the experimental group

The data was analyzed for the effect of fidelity on the total reported score of attitude towards reading. The high fidelity group, $n=7$, reported a mean difference score of -1.71 with a standard deviation of 4.11, with score changes ranging -8 to 4 points. Skewness and kurtosis were within normal limits, reported as -0.24 and -1.49 respectively. A Shapiro Wilks Normality test, $W=0.96$, $p=0.84$, met assumptions for normality of the data. The low fidelity group, $n=8$, reported a mean difference score of 0.12 with a standard deviation of 9.28, with score changes ranging -14 to 16 points. Skewness and kurtosis, reported respectively as 0.14 and -1.16, fell within normal limits. A Shapiro Wilks Normality test, $W=0.98$, $p=0.98$, met the assumptions for normality. An F test was computed, $F=0.20$, $p=0.06$, which met the assumption for homogeneous variances. A t test was conducted with no difference between the pre/post changes from the high

fidelity group compared to the pre/post changes from the low fidelity group with regards to total attitude towards reading, $t(13) = -0.48, p = 0.64$.

Recreational Attitude towards Reading, high vs low fidelity in the experimental group

The data was analyzed for the effect of fidelity on the reported score of recreational attitude towards reading. The high fidelity group, $n=7$, reported a mean difference score of -2.57 with a standard deviation of 2.07 , with score changes ranging -6 to 0 points. Skewness and kurtosis were within normal limits, reported as -0.3 and -1.46 respectively. A Shapiro Wilks Normality test, $W=0.95, p = 0.69$, met the assumptions of normality. The low fidelity group, $n = 8$, reported a mean difference score of -1.62 with a standard deviation of 4.75 , with score changes ranging -10 to -4 points. Skewness and kurtosis, reported respectively as -0.56 and -1.27 , fell within normal limits. A Shapiro Wilks Normality test, $W=0.91, p=0.38$, met the assumptions of normality. An F test was computed, $F=0.19, p = 0.06$, which met the assumptions of homogenous variances. A t test was conducted with no difference between the pre/post changes from the high fidelity group compared to the pre/post changes from the low fidelity group with regards to recreational attitude towards reading, $t(13) = -0.49, p = 0.63$.

Academic Attitude towards Reading, high vs low fidelity in the experimental group

The data was analyzed for the effect of fidelity on the reported score of academic attitude towards reading. The high fidelity group, $n=7$, reported a mean difference score of -0.29 with a standard deviation of 2.69 , with score changes ranging -5 to 3 points. Skewness and kurtosis were within normal limits, reported as -0.44 and -1.23 respectively. A Shapiro Wilks Normality test, $W=0.97, p = 0.87$, met the assumptions for normality. The low fidelity group, $n = 8$, reported a mean difference score of 1.62 with a standard deviation of 5.66 , with score changes ranging -5

to 12 points. Skewness and kurtosis, reported respectively as 0.42 and -1.15, fell within normal limits. A Shapiro Wilks Normality test, $W=0.94$, $p=0.57$, met the assumptions for normality. An F test was computed, $F=0.22$, $p=0.09$, which met the assumption of homogenous variances. A t test was employed with no difference between the pre/post changes from the high fidelity group compared to the pre/post changes from the low fidelity group with regards to academic attitude towards reading, $t(13)=-0.81$, $p=0.43$.

Overall, no differences were detected based upon the return and completion of fidelity logs for this group of participating students in the intervention.

Classroom Differences

The final measure of fidelity to be considered is the presence of multiple variables with regards to teachers in separate classrooms. The total sample size for the intervention group is eighteen students. These students are from the same school, in the same grade experiencing the same curriculum, however twelve students are from Classroom A whereas six students are from Classroom B. This is a common problem in the field of educational research however it cannot be ignored as a different teacher may act as a different agent in the success and implementation of the intervention. In order to test the impact of the teachers, fluency and reading comprehension measures were compared between the two groups of participating students. The researcher was largely responsible for explaining the intervention, providing weekly reminders to students, and to collect the fidelity logs, however teachers have an integral role in the success of the intervention by communicating the importance of participation and frequent reminders to students for nightly implementation. Therefore, a t test was employed to examine if students participating in the intervention in Classroom A differed statistically from students participating in the intervention in Classroom B to capture any differences in student outcomes due to the

variable of the teacher. The classroom progress monitoring assessments of fluency as measured by words per minute and reading comprehension as measured by the DAZE were utilized to test for any differences between the two separate classrooms.

Reading fluency and reading comprehension, Classroom A vs Classroom B

There were no concerns with normality of the data from the descriptive statistics and Shapiro Wilks tests for Classroom A ($W=0.88$, $p = 0.09$) and Classroom B ($W=0.95$, $p = 0.76$). An F test was conducted, $F=0.7596$, $p = 0.6635$, which met the assumptions for homogenous variances. A t test was conducted comparing the students in the two classrooms, $t(15) = 1.82$, $p = 0.09$ which indicated that there was no statistically significant difference detected between Classroom A and Classroom B. Therefore, we cannot conclude that there were any statistically meaningful differences detected between the two classrooms regarding student fluency outcomes as measured by words per minute. A t test was conducted comparing the students in the two classrooms and their comprehension scores, $t(15) = -0.16$, $p = 0.87$, indicating no significant difference between the two classrooms on the DAZE reading comprehension measure. Overall, there were no differences detected between the two different classrooms of participating students on fluency or comprehension outcome measures.

Qualitative Results

The participating students were asked to complete a short essay which was administered after the six-week intervention ended. The students were asked to write for ten minutes and to answer the following prompt: *Did you like the experiment of reading to your plant? Do you think it had an effect on the plant? Tell me what you think!* Once the essays were collected, a codebook was developed through the application of a thematic analysis with an emic approach. The

codebook was then given to a trained research assistant who was then tested with a subset of the essays (25% of the total essays) in order to test the applicability of the codebook to the entire dataset of essays. This method is typically utilized to reveal any areas of confusion and miscommunication within the codebook that can be remedied with an improved iteration of the codebook.

An inter-rater reliability (IRR) trial was made of the coding in order to test the accuracy, reliability, and applicability of the codebook to a sample of five randomly selected essays which would inform any necessary revisions. Once the codebook was finalized, as seen in Table 14, it was then applied the entirety of the sample collected by the primary researcher and a trained research assistant.

Table 14: Codebook

Code	Definition	Includes	Excludes	Example
A.1 Enjoyment	Student communicates deriving a personal sense of enjoyment from the intervention	Stating the intervention was fun, exciting, a favorite activity, a liked activity, expression of continuation of intervention; answering yes with clear implication it is an answer to the question if they liked it	Ambivalent or disliking responses	EX "I liked it"; "it was fun!"
A.2 Dislike	Student communicates dislike of the intervention	Statement of dislike, not wanting to engage in the intervention, or want to discontinue intervention; answering no with clear implication it is an answer to the question if they liked it	Ambivalent or positive responses	EX. "No"; "I didn't like it"
A.3 Dislike of intervention (SUBCODE)	Student communicates dislike of intervention	Student explicitly refers to disliking the act of reading to the plant or having a plant	Dislike of reading in general	EX "I didn't like reading to the plant"
A.4 Dislike of reading (SUBCODE)	Students communicates dislike of reading	Student explicitly states dislike of reading as an activity	Dislike of intervention or of the responsibilities involved with caring for the plant	EX "No, I don't like reading outloud"

Table 14: Codebook (Continued)

Code	Definition	Includes	Excludes	Example
A.5 Ambivalent	Student communicates an unclear or vague sense of opinion about the intervention	Statement expressing a vague opinion without clear valence; or expressing an opinion that was brief or that changed	Clear statements of enjoyment or dislike	EX “I guess”; “it was OK”; “I don’t know if I liked it”; “sometimes I liked it”
B.1 Effect on plant	The student expresses that the intervention had an effect on the plant	Statements of noticing, believing, guessing, or measuring an increase in the plant’s height, growth, or well-being/ liveliness either indicating it is a result of the intervention or in clear response to the stated question “did the intervention have an effect on the plant?”	Clear statements in which any change in the plant was due to factors other than the intervention, such as sunlight or water	EX “it got taller”; “it grew by reading to it”
B.2 No effect on plant	The student expresses that the intervention did not have an effect on the plant	Statements that indicate no effect, change, or growth occurred during the intervention	Statements of growth or change of the plant or of the student	EX “I don’t think it had an effect”; “I don’t think it grew”
B.3 Connection to the plant or to others through the plant	Student communicates that they felt they had a purpose of reading out-loud	Statements that the student felt a connection or purpose by reading to the plant, or by reading in a group with the plant	Does not include statements of reading silently or without the plant	EX “you don’t’ have to read alone”; “I did it with my sister”
B.4 Effect on self	Student communicates that the intervention had an effect on themselves	Statements that the students noticed, believed, or guess that the intervention improved their reading, academic achievement, education, or responsibility in some capacity	Statements that refer to effects on the plant	EX “this experiment was about reading with fun, and fluency”;

The codebook aimed to address if students enjoyed the intervention experience and what beliefs and perceptions they had with regards to the intervention. Codes labeled with **A** were designed to code student responses which addressed the first research question concerning student reactions and overall opinion to the intervention. These A codes attempted to capture student opinions on did they like, dislike, or were ambivalent towards the activity of the intervention. Sub-codes were developed to examine any reports of dislike of the intervention to differentiate students who reported disliking the specific intervention versus disliking the activity

of reading in general. The codes labeled with **B** were designed to answer the research question on student perceptions of the intervention and their beliefs associated with the activity of reading to a plant. These codes aimed to capture student perceptions on their reasoning of reading to the plant.

A preliminary codebook was created and then, through the use of a random number generator, a quarter of the essays (five essays) were randomly selected and were used for an inter-rater reliability trial to test the applicability of the codebook. The software NVivo 12 Pro was utilized in this analysis in order to generate a Kappa coefficient to measure the agreement of the two raters and to identify any possible areas of reiteration for the codebook. The result of the inter-rater reliability (IRR) test indicated an overall average Kappa coefficient of .9788 demonstrating a high level of agreement (Viera & Garrett, 2005), as shown in Table 15. Each of the codes utilized for inter-rater reliability test also resulted in a high Kappa coefficient on an individual level, with each corresponding to an interpreted high level of agreement, as noted in Table 16. Therefore, the codebook was deemed to be translatable and applied to the entire dataset of 18 essays without any modification. A code summary report, see Table 17, contains the number of references throughout the essays as well as the frequency of occurrence for each code which is presented as a percentage for the total document of essays.

Table 15: Interpretation of Kappa Coefficient

Kappa	Agreement
<0	Less than chance agreement
.001-0.20	Slight agreement
0.21-.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-.80	Substantial agreement
0.81-0.99	Almost perfect agreement

Table 16: Kappa Summary for Inter-Rater Reliability Trial

Code	Kappa	Agreement (%)
Connection to Plants and Others	0.9632	99.35
Dislike (Reading)	1	1
Effect on Plant	0.9808	99.63
Effect on Self	0.9701	99.17
Enjoyment	0.9729	99.72
No Effect on Plant	0.9862	99.91

Table 17: Number of Students and References by Code Category and Frequency

Code	Number of students giving references	Number of References	Frequency of Occurrence
Opinions (A Codes)	18	30	20.05%
Enjoyment	14	22	12.72
Dislike (General)	2	1	0.09
Dislike of Intervention (Sub -Code)	0	0	0
Dislike of Reading (Sub-Code)	2	4	3.74
Ambivalent	2	3	3.5
Beliefs (B Codes)	18	27	30.93%
Effect on Plant	11	15	15.94
No Effect on Plant	2	2	1.64
Connection to Plant or Others	3	4	4.10
Effect on Self	5	6	9.28
No Effect on Self	0	0	0

CHAPTER FIVE: DISCUSSION

General Overview

This dissertation purports to examine the effects of an innovative intervention to target literacy attainment in elementary school students. The intervention was employed in a Wake County elementary school with a total sample size of 18 students to participate in the intervention and a total of 9 students serving as a control group. Students in the intervention group were instructed to read aloud to an assigned plant for twenty minutes per night, five nights per week, for six weeks. Fidelity reading logs were collected to measure fidelity to reading and pre/posttest measures were collected to examine the effects on reading fluency, reading comprehension, and attitude towards reading.

Quantitative

Reading Fluency

To address research question one with regards to the hypothesis that this intervention could increase student reading fluency as measured by quantitative pre/posttest classroom assessment, the results indicate that this intervention can increase reading fluency based upon words per minute. The results of a single group, repeated measures design $t(17)=2.07, p= 0.05$ indicate a small but significant effect in pre-test and post-test scores with the post-test scores improved an average of 8.72 words per minute from the pre-test scores. This study does support the previous literature indicating that reading aloud increases reading fluency (Neumann, Copple, & Bredekamp, 2000; Fountas & Pinnell, 1996).

This sample of third grade students had a positive, significant increase in words per minute growth after the six-week intervention, with an average growth of 8.72 words per minute. This outcome was then measured against the expected growth for third grade students during this time in order to rule out maturity as a threat to the validity of the results. The expected growth for this time period for third grade students was calculated to be an increase by a total of 4.68 words per minute. The comparison of the actual and expected difference scores of the pretest and posttest fluency measure of words per minute was not significant, $t(17) = 0.96, p = 0.35$. Thus, although the average growth reported was almost twice the expected growth, the students participating in the intervention did not differ significantly from the expected rate of improvement for six weeks of growth with regards to reading fluency as measured by words per minute. The results suggest that the role of maturity cannot be ruled out as a factor for the growth of words per minute as an outcome in the students in the intervention. It should be noted that students in the intervention were continuing on grade level expectations with considerable growth throughout the time of the study.

An additional measure of reading fluency that is captured through the classroom progress monitoring assessment is accuracy. A single group, repeated measures traditional t test could not be utilized due to the violation of assumptions that the data from the sample represents a normal distribution. A Wilcoxon signed rank test was employed, $V = 93, Z = -1.28, p = 0.20$, with no statistically significant difference detected between the pre-test and post-test scores for accuracy. The data indicate that this intervention did not impact reading accuracy to a statistically significant level over the course of six weeks. However, with these results, it is important to note that the pre-test data that was collected show that the majority of students reported high rates of accuracy with an overall average of 97.67%, with scores ranging from 90%-100%. As students are unable to

score above 100% with regards to accuracy, it is clear that this is a metric with little variance that can be captured and that third-grade students, at this point in their literacy attainment education, have already achieved a high level of reading accuracy. Therefore, reading accuracy would not be a targeted area for drastic improvement nor would it be an appropriate measure to document improvement as students in this sample were reading with high levels of accuracy and were, on average, already at grade level expectations (96%) before the start of the intervention.

Both measures of reading fluency (words per minute and accuracy as a percentage) were compared to a control group of nine students who did not participate in the reading intervention and solely read 20 minutes silently per night, five nights per week as instructed by the third-grade curriculum, in direct response to Research Question Five. The results indicate that students participating in the intervention did not differ significantly from the control group with regards to reading fluency as measured by words per minute or accuracy by the DORF subtest of the DIBELS classroom progress monitoring assessment. The lack of a difference may have been due to the short time frame of the study and it may also be possible that differences were not found because there may be no difference on fluency and accuracy based on reading out-loud or reading silently for the same amount of time. Silent reading is still an excellent form of reading practicing and has been consistently linked with achievement. The findings of this study however, do support the earlier research that out-loud reading is more beneficial to fluency and accuracy than silent reading (Neumann, Copple, & Bredekamp, 2000; Fountas & Pinnell, 1996).

Prosody

Research question two was designed to measure prosody, a critical component of fluency that is not measured by the classroom progress monitoring assessments. Prosody aims to measure the overall perceived fluency of a student reading aloud based upon proper intonation, hesitation, and

automaticity while reading. This is assessed by an observer during the classroom assessment and reported as a category ranging from Monotone to Appropriate converted to a scaled number ranging from 1-4 respectively. A Wilcoxon signed rank test was conducted indicating that the intervention did not significantly, ($V=6$, $Z=-0.29$, $p=0.77$), affect reading fluency as measured by prosody. It should be noted, however, that this measure may have also reached a ceiling effect with the pre-test sample data averaging a prosody scale score of 3.62 out of a total score of 4. The results suggest that this group of third grade students were already reading with proper prosody at this point in their literacy attainment education. Although prosody did increase over the course of the six-week intervention, the results did not indicate that this difference was significantly different from the pretest scores suggesting the increase was not an effect caused by the intervention. Prosody is typically not incorporated as a measured component for reading fluency progress monitoring, therefore there is no comparison for expected growth of prosody for third grade students, nor was it a measure for the control group.

Reading Comprehension

Research question three addressed the effect of this intervention on reading comprehension tested with a single group, repeated measures design. The results indicated a significant positive effect ($p < .001$) on reading comprehension as measured by the DAZE. Students participating in the intervention showed a significant difference in reading comprehension with an average increase in 6.9 points on the DAZE measure. This result is encouraging as reading comprehension is the ultimate goal of literacy attainment. This result is also consistent with the extant literature which has linked oral reading with increased reading comprehension (Prior, Fenwick, Saunders, Ouellette, O'Quinn, & Harvey, 2011). As students read aloud, they are also receiving auditory

input as they speak which reinforces comprehension of the information they are reading. Reading aloud helps the students to connect ideas, identify mistakes, and to better retain the information.

Posttest scores were shown to be associated with improved reading comprehension to a statistically significant level, ($p < 0.001$). These scores were then compared to a control group that was assigned 'business as usual' instruction which involves students reading nightly for 20 minutes, five nights per week as part of the homework. Reading comprehension was measured through a DAZE administration with the results reporting a statistically significant effect, ($p=0.03$) demonstrating that the intervention group demonstrated a significantly greater growth in reading comprehension following the six-week intervention compared to a control group engaged in equal time of silent reading. The mean difference in scores between the pre/posttest for the intervention group was an increase of 6.9 points, compared to the mean difference in scores between the pre/posttest for the control group of an increase of 3.2 points. Reading comprehension is the ultimate goal of literacy attainment as it ensures the reader is understanding, retaining, and connecting the ideas and themes presented in the text. Thus, although the current intervention did not result in a statistically significant increase in accuracy growth, it did affect participating students' ability to comprehend the text better compared to a control group receiving the same classroom instruction but reading silently rather than aloud, which directly answers Research Question Five. The discrepancy in the average difference reported was large, with the intervention group reporting more than double the growth, in a short period of time. This finding supports the extant literature on student oral reading being associated with increased reading comprehension (Prior, Fenwick, Saunders, Ouellette, O'Quinn, & Harvey, 2011).

Attitude Towards Reading

Research question four tested the effect of the intervention on students' attitude towards reading. This was tested using the Elementary Reading Attitude Scale which provides an overall score, as well as an Academic component and a Recreational component scores. The pre-post scores for the overall Attitude Towards Reading and the Academic Attitude Towards Reading did not differ significantly and contradicts the expectation that this reading intervention would improve student attitude towards reading. This may be due to the fact that attitude towards reading is complex and cultivated through the course of an individual's education, previous experiences with reading, and even their family's attitude towards reading. It may be that a single, six-week intervention may not be sufficient to affect a belief about the benefits and enjoyment of reading.

In testing pre-post differences for the sub-scale measure of Recreational Attitude Towards Reading, a significant negative effect, ($p=0.05$) was found indicating that students participating in the reading intervention reported a statistically significant decrease in scores for recreational attitude towards reading. This result may be due to the fact that students had to track their reading each night with the fidelity log and having the intervention being a required part of homework rather than being an intrinsically motivated choice for them. It is also possible that this result is due to students having to re-take the same measure only a few weeks later and circling through the pages with less attention and care as the measure was no longer novel. However, this result is contradicted by the qualitative research in which students expressed support and enjoyment from the intervention.

Post-Hoc Quantitative Analyses

Effects of Fidelity

The data from the intervention group was divided into two categories based upon the completion of reading logs as part of the homework to read each night to the plant. Students were given a Reading Log and asked to return it the following Monday, after one week. They were asked to fill in the log each night after reading and to record for how long they read. This was incorporated as part of the study in order to account for fidelity and adherence to the intervention requirements. Students who returned at least four completed logs out of the total six were considered to be ‘high fidelity’ with strong adherence to the intervention. Students who returned three completed logs or fewer were considered to be ‘low fidelity’ with moderate to low adherence to the intervention. The measures collected were then utilized to run *t* tests to examine the effects of fidelity on the students’ outcomes. The results for each of the measures indicate that fidelity had no effect on the outcome measures for reading fluency, accuracy, comprehension, prosody, or student attitude towards reading across all three measures: overall, academic, and recreational.

One could reasonably assume that these results reflect the inconsistent return of assignments and paperwork in general by third grade students rather than a true reflection of the adherence to the intervention. The results indicated that fidelity of the intervention as there were multiple anecdotal observations in the classroom of students who reported losing the fidelity log or forgetting the log at home, but were often insistent that they were reading nightly as instructed per the intervention requirements. If this was the case, the fidelity logs were an invalid measure of fidelity to the intervention with the logs solely capturing which students are more organized and returned the logs. Perhaps a better measure of fidelity would be to involve parents or family

members who are in the home to keep track of student fidelity to the intervention for future studies. An additional explanation of the limited effect of the fidelity logs across is sample size. The sample size in this study is small with a total of eighteen students in the intervention group, however these eighteen students were then divided into the two groups for fidelity categorization which resulted in an even smaller sample size. This affects the power of the t tests and therefore is inherently more difficult to find significant results. A larger sample size would prevent this problem, as the tests would not be underpowered.

Classroom Differences

No effects were noted due to the differences in teachers based upon classroom status. Students participating in the intervention from Classroom A did not differ significantly from students participating in the intervention from Classroom B with regards to outcomes as measured by fluency as words per minute and reading comprehension through the DAZE. Similar to the fidelity measures, a major limitation of this analysis is the reduced sample size as Classroom A contained twelve students and Classroom B contained six students.

In conclusion, the additional post-hoc analyses documented that no significant difference were detected between students with high reported fidelity and students with low reported fidelity when analyzing the outcomes of reading fluency, as measured by words per minute and accuracy, prosody, attitude towards reading, and reading comprehension. The major limitation to these additional measures is the reduced sample size. Although the results were not significant and the diminished sample size would be problematic even if significant results had been documented, these analyses were considered appropriate to explore given the available data and the approach to investigate the effects of extraneous variables of intervention fidelity and classroom differences.

Qualitative

After coding 18 essays from the third-grade students, it is evident that students, overall, view the reading intervention as a helpful and beneficial strategy. These findings can be grouped into over-arching themes. In response to the first question regarding students' overall attitude towards the intervention, the majority, (88%), reported enjoying the intervention. A few direct examples of writing coded as Enjoyment from student essays reported the following: "I did like the experiment," "I liked it because it was fun an exciting," "I liked it because it was a fun thing to do," "I loved the experiment, because I got to spend more time reading to the plant." These are direct quotations from student essays provided as an example and were each coded as Enjoyment as the student reported a sense of general liking of the intervention. Some students reported disliking the intervention, however this attitude was exclusively expressed directly at reading as an activity in general rather than the specific intervention of reading aloud to a plant. For example, writing that was coded as Dislike reported: "I don't like reading because it takes up time me playing fornite with my friends" while another student reported "I don't like reading out loud... I also don't like reading."

Although they were a minority of the total essays, there were some students who did not like reading in general and did not view the intervention as a new or exciting outlet to encourage reading. Two essays reported having 'ambivalent' feelings such as stating "I guess," in response to the question if they liked the experiment and another stated that "it was sometimes fun and sometimes boring. Also sometimes it felt like I was reading forever and sometimes I did not want to stop reading." These examples demonstrate that some students have ambivalent feelings regarding the intervention that were not clearly positive or negative. It would be beneficial to explore these responses in more detail to find out under which circumstances these students did

enjoy the intervention and which circumstances they did not. Perhaps a minor adaptation or modification could make this intervention more intrinsically enjoyable for these students who express some interest but whose enjoyment was wavering or unsustainable throughout the six weeks. These students did not elaborate on why it was sometimes ‘fun’ and why it was sometimes ‘boring’, which could be integral to an iterative improvement.

Along with examining the opinions of students, the findings also examine the students’ perceptions about the intervention and their reasoning for engaging with the plant. General themes of so called “effect” emerge which included statements that the intervention benefitted the plant through increasing its growth as a provided stimulation. A second general theme reported that students found the plant as a viable option to build a connection with while reading, as one student reported the plant to be a ‘good listener.’ Lastly, students reported that this intervention also likely benefitted themselves, by increasing their reading fluency, or more broadly reporting that they believed the intervention was a good activity for their education.

These findings can be grouped together through a thematic analysis to understand how and why the intervention was considered beneficial, and in doing so, it is apparent that four separate themes emerge of ways in which the reading intervention may be impactful on students.

Thematic Analysis

Two themes of the thematic analysis to be discussed currently are categorized as *Positive Student Effect*, which encompasses the codes for Enjoyment and Effect on Self and *Interacting Agent*, which encompasses the codes of Effect on Plant and Connection to Others. The first theme, *Positive Student Effect*, refers to interpreted experiences that students report a personal sense of pleasure as well as personal growth or achievement in their own reading skills. These

positive experiences are reported as part of the overall theme for having a positive impact through the reading intervention, whether they were statements of personal intrinsic enjoyment or of gaining skills. This theme provides insight as to the reasoning students found for participating in the intervention after six weeks with an emphasis on personal enjoyment through the activity, and a sense that the intervention was purposeful in their own growth with their reading skills and educational achievement. Participating students who support the intervention communicated that they viewed it as purposeful with the belief that reading aloud to the plant is having a positive effect on their own reading skills. The perceptions of growth in achievement were expressed by students in the written essays without the students having any knowledge of their scores from the measures in this study. Students were not made aware of any actual growth in their reading achievement, as the measures taken for fluency, comprehension, and attitude towards reading were not disclosed with them. Students reporting a growth in their reading skills as part of the written essay were reporting a self-perceived increase in skill without any objective knowledge of growth from the collected measures and results.

The second theme that emerged from the data is *Interacting Agent* which encompasses the codes of Connection to Others and Effect on Plant. This theme is especially important because it answers a major question and concern about this intervention. This intervention is unique because it involves the act of reading aloud to a traditionally unresponsive agent. In the literature and in previous studies, reading interventions typically involve reading aloud to a parent, peer, teacher, or even a live animal, such as a dog or cat. Each of these agents is active and highly responsive in the moment, whereas a plant does not provide any feedback or response in the moment. It appears that students may have interpreted the plant's growth as a metric of a response and perhaps attributed at least some of the plant's growth to their efforts of providing a

stimulus of reading. This theme supports the notion that students have an overall positive view of the intervention and in some cases, have reported forming a meaningful connection with the plant or through the plant to other people. Some students reported the plant to be a ‘good listener’ while other students reported reading aloud to the plant and teaching their sibling to read to the plant as well. This theme demonstrates that students report being able to form a personal connection to the plant with the construct that the plant is a participating agent, or utilizing the plant to connect with others. This theme also encompasses the idea that the intervention is dually and mutually beneficial as students report sharing this intervention with students reporting a desire to share the intervention activity with siblings or parents, highlighting the potential for this to be a solitary or partnered activity in the future.

The third theme, *Negative Student Effect*, encompasses the opinion codes Ambivalent, Dislike (General), Dislike (Reading), and No Effect on Plant. This theme attempts to encapsulate the reported reduced buy-in, general statements of dislike of reading, and the lack of purposeful engagement with the intervention. This theme represents a minority of the data provided by the students however it is important to examine all reports in order to inform any or modifications to be made to the intervention. This theme encompasses statements that were coded as Ambivalent, with some students reporting some enjoyment and some boredom coupled with students who were unwaveringly opposed to the intervention with clear statements of dislike. Further, this theme represents the opinion of some students as they did not report consistent enjoyment of the intervention. It appears, through these codes, that students either sometimes enjoyed the intervention or reported that they did not enjoy the general activity of reading. There were no reported negative statements referring to the intervention itself (the concept of reading to the plant) which perhaps demonstrates that students who inherently do not enjoy reading will also

not enjoy this intervention. This theme reflected the idea that the intervention did not have an effect on the plant at all, including the following: “I don’t think it grew.” This theme was evident in some essays indicating that some students did not state a perception of growth from the plant.

The final major finding from the qualitative analysis lies within the confluence of these themes as it is evident that a pattern has evolved. Students who report enjoyment, or even mixed feelings with some enjoyment (Ambivalent), also report the perception that their plant grew due to their reading efforts. Twelve out of the eighteen students reported both feelings of personal pleasure and enjoyment with the intervention and reported the belief that the intervention directly affected their plant. It appears this underlying belief of the student, that the reading does in fact affect the plant may have enhanced the experience of the intervention by giving purpose for some of the students. However, this was not the case for all students. For example, one student essay stated, “No! I don’t like reading out loud. I don’t think it grew either.” Another student reported enjoying the intervention but did not report the belief that the intervention affected the plant in any way. The remaining essays only answered either if they liked/disliked the intervention or if they thought the intervention had any effects on the plant. It appears that this concept, the idea that the plant is a responsive, interacting agent that responds with growth to the oral reading by the student may contribute to the buy-in, enjoyment, and effect of the intervention for the student.

The above finding that students participating in the intervention reported the perception that their oral reading had an effect directly impacting the plant is a topic of consideration for future research. Students were encouraged to read aloud to the plant and to ‘see what would happen’ over the course of the intervention. Students reported the perceptions that the plant responded positively to the intervention and grew in height or by sprouting new leaves directly in

response their reading. This may be an area for future studies to examine the underlying psychological constructs and what beliefs students held about intervention of reading aloud to the plants. One hypothesis would stem from a theory of attachment in which the students felt a connection to the plant similar as one might feel to a stuffed animal. Another hypothesis may be that students maintained the belief that plants respond to their surroundings and environment and that reading aloud to the plant they would stimulate its growth. Further research would be the basis for other theories.

A future consideration for research may be with regards to selecting different plants in the intervention. A succulent plant which does not grow much within a short time period compared to a faster growing plants may be an option, as the immediate and dramatic growth might be more encouraging for the students if the visual growth serves as a form of encouragement or purpose for the students. In this study, this option was eventually replaced with succulents due to the succulent's hardy nature and low likelihood of mortality compared to the high need and high mortality rate of faster growing, perhaps more encouraging plants, such as pea plants.

In summary, the majority of students (16 students) reported an overall or partial sense of enjoyment in this study. A theme that provides insight into the success of this intervention emerged from student report that suggested the underlying belief that the oral reading had an effect on the plant. This may be integral in providing a sense of dedicated purpose for the students. This study opens new territory in reading interventions that purposefully engages students in out-loud, oral reading without the requirement of intensive resources, such as another person. This study merges the positive effects of oral reading without the resource intensive requirements of a teacher, parent, peer, or dog to be present in order for the experience to be engaging, purposeful, and interactive. This approach would potentially allow for a less resource

dependent intervention to encourage students to engage in independent, autonomous, oral reading. This low-cost intervention has promising positive effects and can be implemented autonomously by the student at home.

Implications

Overall, this intervention for a whole class breaches completely new territory building upon the success of other interactive reading fluency interventions, such as reading to a peer, parent, teacher, or therapeutic animal. The objective, quantitative results demonstrate the positive effects derived from this short-term reading intervention. The essays completed by the students revealed that the activity captured the interest of the students. A recurrent theme reported was that students interpreted the plant's growth as a metric of a response and attribute the plant's growth to their efforts of providing a stimulus of reading. It appears that the underlying concept that the plant is an interacting agent responding with growth to the stimulus of oral reading by the student is a factor to the reported buy-in, enjoyment, and success of the intervention for the student.

The intervention could potentially be a low-cost alternative that provides students with a purposeful, engaging, and interactive reading intervention that can capitalize on the benefits of regular, practiced oral reading. This intervention was designed for and can be successfully implemented in the home as part of a regular homework activity, or as an option of choice for students to practice reading. It was implemented with third grade students due to its seamless integration into the third-grade curriculum, as this is the year in which the science curriculum addresses parts of plants. However, the approach may also be useful for second graders. This research may provide insight into new ways educators can encourage oral reading among

elementary students without dedicating intensive resources, including time during the school day.

Limitations

A major limitation of this research study was its sample size. An initial power analysis revealed that the ideal sample size should involve 33 students for pre/posttest comparison and 66 students for experimental vs control designs. In this research study, the sample size involved a total of 18 participating students in the intervention and an additional 9 students for the control group. These numbers result in an underpowered study. Across the analyses, the sample size varied due to the fact that a few students returned consent forms after pre-test data collection. Many of the tests conducted had significantly fewer participants, as some measures involved dividing the already intervention group of 18 for tests to examine fidelity or classroom and teacher differences. The highest power achieved throughout this study was 0.5163, which is still underpowered from the ideal 0.8 meaning all results should be interpreted with caution (Morgan, Gliner, & Harmon, 2006, pp 150). This study has provided groundbreaking data with an innovative intervention not previously researched, however the results offer preliminary evidence due to the limited sample size are statistically weak due to the sample size.

An additional limitation of the study is inherent to the setting of a single school. Students attending a single school are all within the same district and county and are typically even from the same or nearby neighborhoods which may represent a demographically homogenous population. This research study would be more generalizable and rigorous in terms of design if it were able implemented across multiple schools, including rural and urban educational settings providing a more heterogeneous and variable demographic sample that is more representative of the population.

Third, this study was limited as a result of a purposeful choice. The extant literature currently addresses reading fluency interventions for specific populations, typically for students who are struggling with reading. This intervention was designed to be implemented for a whole class, not as a tiered intervention of support for a specific population. As no specific demographic data were collected on participating students, differences in those who benefitted the greatest or least from this intervention could be made. This limitation curtails the possibility of identifying which populations of students would likely benefit the most from this intervention, such as identifying students with specific learning disabilities, or from certain socio-economic status households, or perhaps even a certain gender.

Specific to the method of data collection, the qualitative analysis was limited in the quantity of data collected which stems from a limitation in the collection method. Students were given ten minutes to write about their thoughts and perceptions. Although this was an excellent method of data collection given that all students can participate in the written essay at the same time and therefore this was a time efficient method, it unfortunately may be biased in that typically students who struggle to read also struggle to write. Therefore, students who would be most likely to dislike the intervention or to not reap any benefits from the intervention would likely also struggle to write a ten minute essay response that would elaborate on their experience. The written requirement for the essay is a limitation because it limited the quantity of information collected. If students were asked through an interview or through a focus group, in which they would be able to talk freely, it is likely that more information would have been provided by the students. The interview data collected could have been transcribed and then coded similarly to the essay. The difference between these data collection methods would be that the interview would take significantly longer

as each child would be administered the structured questions, rather than a single administration of a simultaneous essay.

Lastly, a final limitation for this study was the use of fidelity logs. Fidelity logs were created and dispensed with the intent to accurately capture individual intervention fidelity in order to improve the intervention. The fidelity logs were judged to be an inadequate measure of intervention adherence due to the inconsistent return of the logs that appeared to have no relationship to actual adherence to the intervention. Students often forgot their logs but insisted on completing the intervention. Given a third grade student population, failure to return papers would not be developmentally inappropriate. The fidelity logs were therefore a limitation as they did not accurately capture the adherence to intervention requirements. Future studies may want to involve parents to monitor student adherence to the intervention.

Future Studies

A more rigorous method design would better determine the true effects of the intervention. In order to substantiate the rigor of the study and to control for existing reading level for each individual student, classrooms should first match pairs of students based upon pre-test scores before randomly assigning into either the experimental or control group. This would increase the rigor of the design, as the investigator could randomly assign the intervention condition to half of the students in each classroom, with business as usual to the remaining half of each class rather than having whole classrooms grouped. The best way to ensure this could occur is to have students paired together and ‘share’ a plant in partners. This is typically utilized when attempting to reduce error variance and involves grouping participants into dyads based upon a characteristic that is related to the variable being measured (Morgan, Gliner, & Harmon, 2006, pp 190). In this case, the participants would be grouped into dyads based upon similar

reading levels, which is related to the dependent variable of their reading fluency and comprehension. This method is consistent with the literature when assessing the effectiveness of an intervention for reading fluency within a classroom setting (Lee 2014; Wilder-Kingsby, 2014). This design is would be regarded as a strong pretest-posttest quasi-experimental design (Morgan, Gliner, & Harmon, 2006).

Due to the matching of the participants, this would be a within-subjects design (Morgan, Gliner, & Harmon, 2006, pp 190). With the control group occurring within each classroom, multiple variables will be accounted for including classroom instruction, teacher-related variables, and classroom context variables which were failed to be fully accounted for in the current study, although no statistical differences were noted. This design would also capture maturation of natural reading ability as a result of progress through the curriculum. See Table 18 for a visual representation of the future study’s proposed design with “X” signifying a testing period, either pre or post, with “Tx” denoting the treatment group, and “C” denoting the control group.

Table 18: Research Design

Classroom	Design Groups	Post-Test
Classroom 1	X Tx	X
	X C	X
Classroom 2	X Tx	X
	X C	X
Classroom 3	X Tx	X
	X C	X
Time in weeks	0	6

With the independent variable being recognized as the implemented reading intervention, the dependent variables are (a) reading fluency, (b) reading comprehension, and (c) attitude towards reading.

According to Goos 2010, when a completely randomized design cannot be achieved, a split-plot design is a useful alternative. This design originally began during agricultural experimentation due to different plots of land that were being used. A key feature of split-plot designs is the concept that one factor is assigned to an entire plot (whole plot), whereas other factors are assigned to parts of these whole plots (split-plots) thereby having smaller experimental units (the treatment groups) being nested within the larger, whole plots (classrooms) (Goos, 2010). See Table 19 as a reference for the analysis plan for the split-plot design for a future study.

A split plot factorial design recognizes distinct group differences between classrooms and allows for a statistical analysis to examine the effects of the intervention as well as the effects of extraneous, uncontrolled variables (separate classrooms, separate teachers, etc.), and if there are interaction effects (Goos, 2010). This will allow the researcher to determine if differences in scores can be attributed to the intervention, or if they are attributed more to classroom variables, or an interaction of the two. A split plot factorial design would be useful for this study, as the participants are nested within classrooms that innately possess their own variables, such as the teacher or the instruction.

The split plot factorial design would be utilized to examine differences in the treatment pre-post test results compared to the difference in the control pre-post test results. This will allow for the researcher to examine differences due to the intervention and due to the classroom effects, and any variation with the combinations. No follow up tests or Tukey tests are required with this methodology. This design is most useful when complete randomization is not possible but allows for increased precision (Goos, 2010).

Table 19: Split Plot Factorial Design

Classroom 1	Student Pairs	Treatment Difference Scores (Pre/Post)			Control Difference Scores (Pre/Post)		
	P1 P2 P3 . . P10	Fluency	Compr.	Attitude	Fluency	Compr.	Attitude
Classroom 2	Student Pairs	Treatment Difference Scores (Pre/Post)			Control Difference Scores (Pre/Post)		
	P1 P2 P3 . . P10	Fluency	Compr.	Attitude	Fluency	Compr.	Attitude
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X
Classroom 3	Student Pairs	Treatment Difference Scores (Pre/Post)			Control Difference Scores (Pre/Post)		
	P1 P2 P3 . . P10	Fluency	Compr.	Attitude	Fluency	Compr.	Attitude
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X
		X	X	X	X	X	X

*P denotes pair of student, X denotes the calculated difference between pre/post scores

Other areas for future study include examining the relationships between student perceptions surrounding the intervention. A future study would ideally examine the relationship between student perceptions and beliefs involved with the purpose of reading to the plant and student outcome measures. The present study found that students who believed the plant was responding to their reading efforts and growing due to the provided stimulation also reported higher enjoyment. This should continue to be explored by analyzing the outcomes of these students to examine if their beliefs and enjoyment are associated with their outcome measures for fluency and comprehension.

This study was designed for whole-class administration, which is scarce in the extant fluency intervention literature. Whole-class administration would also be ideal to better examine

the associations between this intervention and certain populations of students, especially those who are identified by the school as eligible for special education services, specifically under the category of Specific Learning Disability for reading. Other populations to consider are students learning English as a second language, students involved with the tier systems of support for reading, and other populations defined by socio-economic status, gender, or grade level.

This study involved a fluency reading intervention designed to run for six weeks. Although statistically significant results were achieved, this intervention was quite short compared to other reading fluency interventions in the literature. A future study could examine the long-term effects when implemented for six, eight, and twelve weeks with students randomly assigned to each level within the same study. This could be analyzed through a simple ANOVA to better understand the impact of time with the intervention.

Lastly, another area of further research involves the psychological constructs that emerged from the thematic analysis of student responses. Student comments reflected the underlying belief that their efforts of reading aloud to the plant may have positively affected it with regard to its growth in height or with new sprouts. This underlying belief is a novel finding that may relate to theoretical concepts touching on human attachment, personified projection into inanimate objects, and into theories of biophilia. This may be a productive area for future research, especially emphasizing the collection of more qualitative data. This may also relate to the Wise Intervention paradigm in the field of psychology which describes mundane intervention within everyday experiences that can alter ways in which people think and feel in subtle, yet profound ways, improving their quality of lives and aiding their development towards flourishing (Walton, 2014). This broad category of interventions is referred to as Wise interventions as they address and modify underlying psychological processes in order to facilitate flourishing and the

positive development of individual's lives. The current study may fit within this category of Wise interventions in that the simple act of reading aloud to a plant resulted in the students' report of these psychological beliefs on attachment and projection of personification-like responses connecting a reader and plant. This is an area of consideration for more research into the perceptions and experiences of elementary students participating in future interventions.

Conclusion

An innovative intervention designed to capitalize on providing an interacting stimulus as part of a third-grade reading fluency intervention was employed for six weeks at a North Carolina Wake County public elementary school. Eighteen students participated in a single group pre/post method design on measures of reading fluency, prosody, reading comprehension and an attitude towards reading survey. A control group consisting of nine students provided comparison data for measures of reading fluency including words per minute and accuracy, as well as reading comprehension. Participating students in the intervention demonstrated a significant increase in reading fluency, with an average growth of 8.72 words per minute. Students participating in the intervention demonstrated significant growth in reading comprehension. When compared to the control group, the students participating in the intervention were characterized by significant growth in reading comprehension, averaging 6.9 points of growth on the DAZE measure compared to 3.2 points of growth for the control group. However, students participating in the intervention were characterized by a statistically significant decline in their reported recreational attitude towards reading.

A qualitative component was collected in order to identify the constructs and perceptions of the students involved with the intervention. This was conducted through an essay prompt administered at the end of the intervention in order to understand a) if participating students

generally liked or disliked the intervention and b) what perceptions or beliefs did students have about the mechanisms and purpose of the intervention. A thematic analysis was conducted with the essays with the finding that, overall, the majority of students reported enjoying the intervention. Students also reported the perception that the intervention enhanced their reading skills and the perception that the intervention benefitted the plant by providing the plant a source of stimulation resulting in the plant's growth, whether that growth was perceived in height or in new sprouts of leaves. It appears that students who reported believing that the plant's growth was due to their purposeful reading efforts also reported enjoying the intervention, which provides insight into an important link for student engagement with this intervention.

APPENDIX

Appendix A.....Fidelity Log
Appendix B.....Instructions for Care
Appendix C.....Intervention Instructions

APPENDIX A: FIDELITY LOG

READING LOG

Name: _____

Date: _____

Day of the Week:	Parent Signature	Student Signature	Book Title
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			

*Remember, it is OK to read during the weekend in place of a weeknight! It is just important that we read five nights of the week. Just sign a day of the week if you read over the weekend 😊

APPENDIX B: INSTRUCTIONS FOR CARE

Plant Care Instructions

Step One: Place the plant by a window with sunlight



Step Two: Water two tablespoons once per week



Step Three: Keep away from pets and doorways so it is safe!



APPENDIX C: HOMEWORK INSTRUCTIONS

HOMEWORK INSTRUCTIONS

Step One: Every school night (Monday-Friday), place your plant near you, maybe on your kitchen table or near your bed in your room. Make sure to be comfy!

Step Two: Pick out a book you want to read either from home or from the school library.

Step Three: Read out-loud for ____ minutes. You can use a clock, a stopwatch, or ask someone in your family to record the time.

Step Four: Make sure you sign your Reading Log!

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