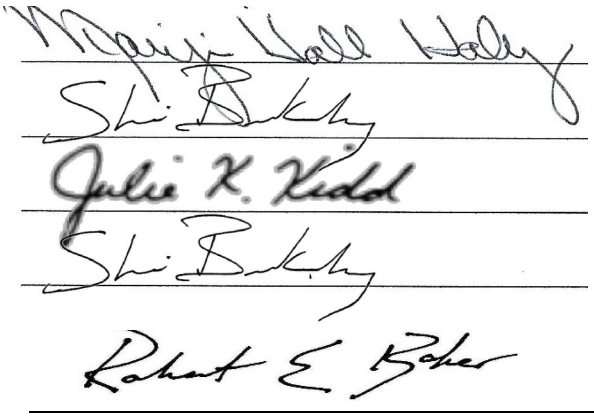
A VOCABULARY INTERVENTION UTILIZING MULTIMEDIA AND NATIVE LANGUAGE SUPPORTS FOR DUAL LANGUAGE LEARNERS

by

Chelseann Christopher
A Dissertation
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Doctor of Philosophy
Education

Committee:



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Fall Semester 2020
George Mason University
Fairfax, VA

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Chelseann Christopher
Master of Education
Duquesne University, 2011
Bachelor of Science
Slippery Rock University, 2009

Director: Marjorie Hall Haley, Professor
College of Education and Human Development

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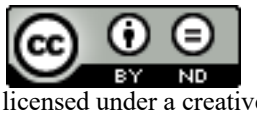

DEDICATION

To my students, past, present, and future. You are the inspiration behind this dream. You are the reason I did this. All that I've learned and experienced from my time spent with you motivated me to chase my dream, in the hopes that it could help you reach yours. Thank you for always being the positive light and incentive to keep going, no matter how difficult, exhausting, or impossible it felt. I hope you always keep that light and reach for your dreams, too.

And for Moose, my companion of 13 years, who supported me through all of my higher education endeavors right from the very start. You missed the end of this journey by just a year. You were the best dog in the world, and are always thought of, loved, and missed. Thank you for always being there for me.

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I would also like to extend my sincerest gratitude to my committee members, Dr. Berkeley and Dr. Kidd. You both supported and encouraged me and provided the inspiration and guidance that I needed to complete this dream. Dr. Berkeley, thank you for always pushing me to reach beyond my limits—I would have never presented at such prestigious conferences without your guidance and support. Dr. Kidd, thank you for giving me the opportunity to teach in higher education—I would not have pursued that dream so soon without your guidance and support. Thank you for providing invaluable experiences that have certainly shaped me as a researcher and educator.

I would like to give my deepest, heartfelt appreciation to my husband, Zachary. You were there throughout this entire journey, encouraging, pushing, and supporting me, especially at the moments when I struggled the most. You were always my number one cheerleader, and at times, had more faith in me than I did myself. Thank you for the hours of editing, weekends spent alone, summer weeks spent as a "single parent" to the boys, and nonstop emotional support. I absolutely could not have finished this without you. I love you most.

Thank you to my sons, Quill and Tighe, for just being you. Your bright smiles and infectious laughter were always there for me when I needed it most. You are the light in my life. I love you more. And thank you to Otter, my other "kid", for being the best cuddler and happy go lucky dog. Your emotional support was invaluable.

I would like to acknowledge my parents, Carolee and Chuck, for all of their unwavering support throughout my entire life. You have always believed in me and supported my dreams and pushed me to go farther and do better. I could not have done this with your encouragement. And a special thank you to my Mom and Grandma for coming to watch Quill weekly in order to allow me to work, even when it meant long drives, little sleep, and extra work hours. I would never have been able to complete this without you.

I would like to thank my Pap for pushing me to be a teacher in the first place. It may have been for questionable reasons, like salaried pay and summers off, but it ultimately led me to my passion. I like to think you knew what road was the best for my future, long before I did.

I would like to thank all of my colleagues at George Mason, especially Meghan. Thank you for always being my sounding board, listening to the good, the bad, and the ugly, and providing your unconditional support.

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I would like to thank the College of Education and Human Development for awarding me the Dissertation Research Fellowship that provided funding for expenses associated with dissertation completion.

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Thank you to all of my family and friends who've supported me throughout this journey. Thank you for always attempting to listen to my jabbering, even when you had no idea what I was talking about, supporting me when I was stressed and down, and understanding when I needed to miss events to finish my work. I love you all!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Analysis of Variance ..... ANOVA
Computer-Assisted Language Learning ..... CALL
Dual Language Learner ..... DLL
English as a Foreign Language ..... EFL
English Language Learner ..... ELL
English Learner ..... EL
English Speakers of Other Languages ..... ESOL
Expressive Vocabulary Test-3 ..... EVT-3
Kindergarten Readiness Assessment ..... KRA
Limited English Proficient ..... LEP
Multivariate Analysis of Variance ..... MANOVA
National Assessment of Educational Progress ..... NAEP
National Association for the Education of Young Children ..... NAEYC
National Center for Educational Statistics ..... NCES
National Head Start Association ..... NHSA
Peabody Picture Vocabulary Test-5 ..... PPVT-5
Pre-Idea Proficiency Test ..... Pre-IPT
Program Information Report ..... PIR
Targeted Vocabulary Assessment ..... TVA
U.S. Health and Human Services ..... HHS
United States ..... US

ABSTRACT

A VOCABULARY INTERVENTION UTILIZING MULTIMEDIA AND NATIVE LANGUAGE SUPPORTS FOR DUAL LANGUAGE LEARNERS

Chelseann Christopher, Ph.D.

George Mason University, 2020

Dissertation Director: Marjorie Hall Haley

An experimental crossover research design was utilized to investigate the effects of multimedia-enhanced instruction on the vocabulary acquisition of dual language learners in the early childhood age range. Sixteen 3-year-olds stratified by classroom and randomly assigned to condition participated in an eight-week intervention that incorporated evidence-based strategies to instruct vocabulary. The intervention focused on combining the strategies of multimedia and native language supports in order to increase vocabulary attainment in the areas of expressive and receptive language. Repeated measures given pre-, mid-, and post-intervention were used to evaluate the effectiveness of the intervention in the targeted area of vocabulary, as well as the generalized areas of expressive and receptive vocabulary.

CHAPTER ONE

Statement of Problem

Dual language learners (DLLs) face many disadvantages in the United States education system. DLLs are children who have a home language other than English and are simultaneously learning two languages (U.S. Department of Health and Human Services [HHS], 2017). These students are often developing their first and second languages at the same time due to their early childhood age range, defined as birth through six years old (HHS, 2017). Also referred to as English language learners (ELLs), these students typically require specialized or modified instruction in both the English language and in their academic courses in order to be successful (The Glossary of Education Reform, 2013). The term ELL often encompasses or overlaps with other terms frequently used, such as Limited English Proficient (LEP) or English learner (EL) (HHS, 2017).

This population is underachieving across all disciplines when compared to their native English-speaking peers (Murphy, 2014). The results of this lack of achievement can be detrimental to students in their education, as graduation rates for this population are substantially below the national graduation rate (National Education Association [NEA], n.d.). This in turn may lead to less lucrative careers and poorer life outcomes, as non-high school graduates are three times more likely to be unemployed, and even when

employed, earn about $8,000 less per year than high school graduates (Alliance for Excellent Education, 2020).

A key to addressing this issue in achievement disparity is to ascertain ways to assist this population in being academically successful, one of which is by providing academic interventions starting at an early age (The National Early Childhood Technical Assistance Center, 2011). DLLs who participate in early intervention programs, such as Head Start, have improved educational outcomes in both the short-term and long-term (McNamara, 2016). DLLs who participate in these early intervention programs have significant short-term gains in receptive vocabulary and early literacy skills, as well as significant long-term gains, including a greater likelihood of graduating from high school and college (McNamara, 2016). In order for these early interventions and programs to have the greatest effect on DLL academic achievement, specific learning areas must be targeted using research-based strategies that will produce the most significant effects on academic achievement.

When I started my undergraduate studies in western Pennsylvania in 2005, I had set out with the intention of becoming an elementary educator. The field experiences in my undergraduate program did not include much in terms of diversity, especially not with regard to language. My program did not address DLL/ELL populations in the course studies, and the only guidance I ever received was when a guest speaker came to one of my classes and spoke for 30 minutes. I essentially had no experience or knowledge of how to work with DLLs/ELLs.

As fate would have it, I was one of a handful of students selected to complete my student teaching in North Carolina. The elementary school where I completed my internship was much more diverse than my field experiences in Pennsylvania, exposing me to a variety of backgrounds, races, ethnicities, and languages. I was placed with fifth grade and kindergarten aged students. In both placements, I had the chance to work with DLLs/ELLs, and quickly realized I had absolutely no idea what I was doing. I turned to my cooperating teachers for help, and found that they also had no idea what to do. Their responses were, “They’ll pick it up eventually!”, and “That’s just the way it is!”, with no additional supports, scaffolding, differentiation, or even thought given to these students’ needs. Essentially, they told these students to sink or swim.

This was a pivotal moment. I knew that there was no way this should be acceptable. There had to be techniques and ideas for how to effectively reach these students and give them a great education. Clearly something was lacking in our teacher programs (and in some mindsets). I developed an interest in these students, and found that I was drawn to them, amazed by their motivation and enthusiasm, even though their teachers hardly ever engaged or supported them. I started experimenting and trying to find ways to work with them, much to the disapproval of my cooperating teachers, as they thought this was a waste of time. The excitement and gratitude I received from the students when I attempted to communicate and help them was so rewarding for me. I knew I had to learn more about how to work with DLLs/ELLs, so I decided to pursue a graduate degree in the field.

Locating a Master's program with licensure for English Speakers of Other Languages (ESOL) proved difficult, especially in western Pennsylvania. I quickly realized that this was not a popular field in this location in the United States, and found only two colleges that offered the program. I immediately applied, was accepted, and completed the program in 2011. I then accepted a job as an elementary ESOL teacher and relocated to Virginia, as there were no opportunities in this field in Pennsylvania.

Moving to Virginia was challenging, as was taking on a first-time teaching position in a highly diverse, socioeconomically challenged school with a large DLL/ELL population. Combining my knowledge of elementary education from my undergraduate program with the knowledge I had gained from my Master's program was one of the things that enabled me to successfully work with my students. I loved working with, learning from, and engaging with my students and their families. They were always the motivation behind me wanting to continue to learn and do better.

As I continued my career as an ESOL teacher in both Virginia and Maryland, I found that the issues I had encountered with my undergraduate and graduate programs and cooperating teachers were not atypical. There seemed to be a trend with lack of knowledge and training for teaching DLLs/ELLs in education, as I was often consulted for support, training, and advice on how to work with these students by not only classroom teachers, but also specialists, and even other ESOL teachers. Clearly some changes needed to be made at a systemic level, but in the meantime, I thought, what could I reasonably do as an educator? This is where the dream of pursuing my PhD was born. I felt as though I had done a great deal of positive work within the classroom, but

now I was ready to spread and share this knowledge to a larger audience. I knew I wanted to research and find ways to help my students be more successful, as well as help current and prospective teachers become more comfortable and capable of working with these students, in order to enable DLLs/ELLs to be successful in school and in their future outcomes.

I often found myself wondering what could be done to help my students who were struggling, especially those students who were further along in their education. After reviewing achievement statistics for my own school, I found that there was a startling disparity in achievement starting at a very young age for DLLs/ELLs. I continued to research and found that this was not only a trend within my own school, county, or even state, but a national issue. With my background and understanding of early childhood and DLLs/ELLs, I thought that early intervention may be the key to helping these students. When I considered the needs of DLLs as well as what type of instruction could be used cross-curricular, vocabulary stood out as a good fit to meet both of these needs. This led me to the current study, as I wanted to find out what strategies could be beneficial to help DLLs at a young age with their vocabulary development, in order to decrease this disparity in achievement I was seeing, as well as to help these students be successful over the long term in both their education and future lives.

Given the current COVID-19 pandemic, research in the area of education, specifically with traditionally underachieving populations, and especially with the use of multimedia in technology, is critical. As classrooms are moved to partial or entirely virtual models for the current time, as well as for the foreseeable future, research on

effective practices that work as the new model is imperative. Although the data for this study were collected pre-pandemic, there are implications that can be applied to the current times, which will be discussed in Chapter Five.

In this chapter, I will share the national and state demographic and academic achievement statistics that illustrate the disparities in achievement between DLLs/ELLs and non-DLLs/ELLs and define important key terms in the field necessary to understanding this work. Additionally, I will identify the purpose of the current study, discuss the theoretical framework that supports the framework of this study, and identify the research questions that will be examined.

National and State Demographic and Academic Achievement

National and state statistics for DLLs in the early childhood age range, especially for students in pre-kindergarten, are not readily available at this time. In order to fully comprehend the imbalance and impacts of this population's achievement when compared to native English-speaking peers, available national and state statistics must be examined in multiple contexts.

The following sections present various grade level and content area statistics in order to gain a comprehensive understanding of the disparity of achievement between DLLs and their native English-speaking peers. First, the national demographic and academic achievement of kindergarten through 12th-grade DLLs/ELLs is presented in order to gain clarity about the issue of the population as a whole from the wide scope of a national context. Next, national demographic and academic achievement statistics specifically for kindergarten are presented. This is to narrow the focus of the issue toward

early childhood, while maintaining a national context. Finally, Head Start demographic and academic achievement is presented to further narrow in on early childhood's disparity in achievement between DLLs and their native English-speaking peers.

Following the presentation of national statistics, state statistics are given, as this information is imperative due to the variance of DLL/ELL populations among states. These statistics are presented in the same fashion as the national statistics, with statewide kindergarten through 12th, statewide kindergarten, and finally statewide Head Start statistics.

National K–12 Statistics

While national statistics are not indicative of the achievement of specific populations in specific areas, they are imperative to consider when discussing the disparity in achievement of DLLs as a whole. The following demographic and academic achievement statistics are presented to demonstrate the depth of this problem.

Demographics. The DLL/ELL population continues to grow at a steady pace in the United States. According to the National Center for Educational Statistics (NCES), for the 2015 school year, the number of public school students in grades kindergarten through 12 participating in programs for ELLs was approximately 4.8 million, or 9.5% of the total student population (NCES, 2017). This is an increase from the 2004 school year, in which the number of public school students participating in programs for ELLs was 4.3 million, or 9.1% of the total student population (NCES, 2017). This steady increase is expected to continue, thus justifying the necessity of continued research of this population.

According to NCES (2017), the most commonly reported language for students in 2015 was Spanish, at 77.1%, far surpassing any other language, reported at 2.3% or less (NCES, 2017). In addition, Hispanic was the most commonly reported race at 77.8%, with Asian following at 10.7% (NCES, 2017). Reported language is important for this particular study, as native language supports are one of the strategies being utilized and examined. These reported statistics make it evident that the use of Spanish as a native language support for this study is warranted.

Academic Achievement. Across reading and math contexts, and in multiple grade levels, ELLs are not achieving at the same rate as their native English-speaking peers. In 2015, the National Assessment of Educational Progress (NAEP) found that there was a gap between ELL and non-ELL students' reading achievement levels in fourth, eighth, and 12th grades, ranging from 37% (fourth grade) to 49% (eighth and 12th grades) (NCES, 2016b).

NAEP found similar results for achievement levels in mathematics for 2015, with fourth-grade ELL students achieving on grade level status at 25% less than their native English-speaking peers. The gap in mathematics achievement continued for eighth-grade ELL students at 38%, and 12th grade ELL students at 37% (NCES, 2016a). These massive disparities in achievement call for the continued research of effective strategies and interventions for DLLs, in order to prevent gaps in achievement later in their educational careers.

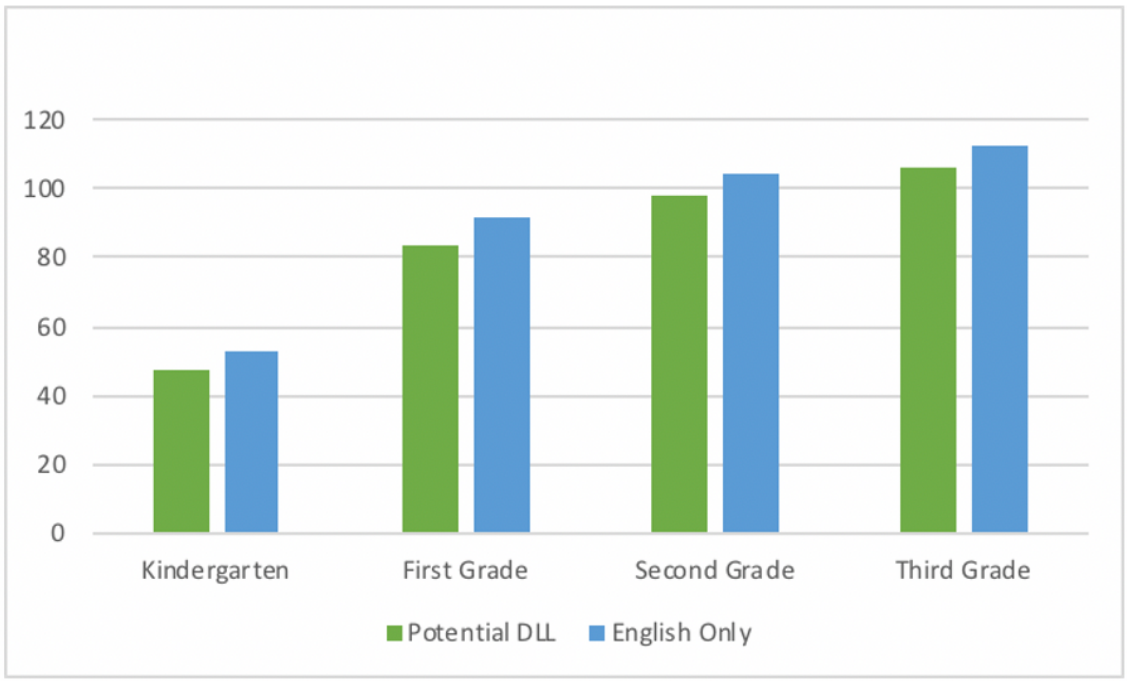
National Kindergarten Statistics

As this study focuses on pre-kindergarten DLLs, it is important to consider the population and achievement of the closest grade level, kindergarten. These statistics are indicative of pre-kindergarten students, as many students' first school experience starts at kindergarten.

Demographics. When considering the DLL population, one of the most valuable pieces of statistical evidence for lack of achievement and the need for continued research comes from the kindergarten grade level, as this is the most readily reported for the DLL age range at the national level. According to NCES (2016c), in 2014, the number of DLL students enrolled in kindergarten in a public elementary school was 16.7% of the total population (NCES, 2016c). As this is the highest reported percentage of DLL/ELL students for all grade levels, this age range is critical to consider when researching strategies and interventions for increasing achievement (NCES, 2016c).

Academic Achievement. The disparities in achievement are evident from upper grade level ELLs all the way down to DLLs in kindergarten. NCES conducted a longitudinal study that followed kindergarten students through Grade 3 and found that students entering in the fall of 2010 who identified as having a non-English home language (referred to as potential DLLs from this point forward) achieved lower on their mean reading scores at 47.2, while those students who identified as having only English as their home language scored a mean of 53.1 (NCES, 2016b). This trend continued as these students progressed through school, with potential DLLs scoring 83.3 in first grade, 97.8 in second grade, and 106.2 in third grade, and English-only students scoring 92.0 in

first grade, 104.6 in second grade, and 112.3 in third grade as shown in Figure 1 (NCES, 2016b).

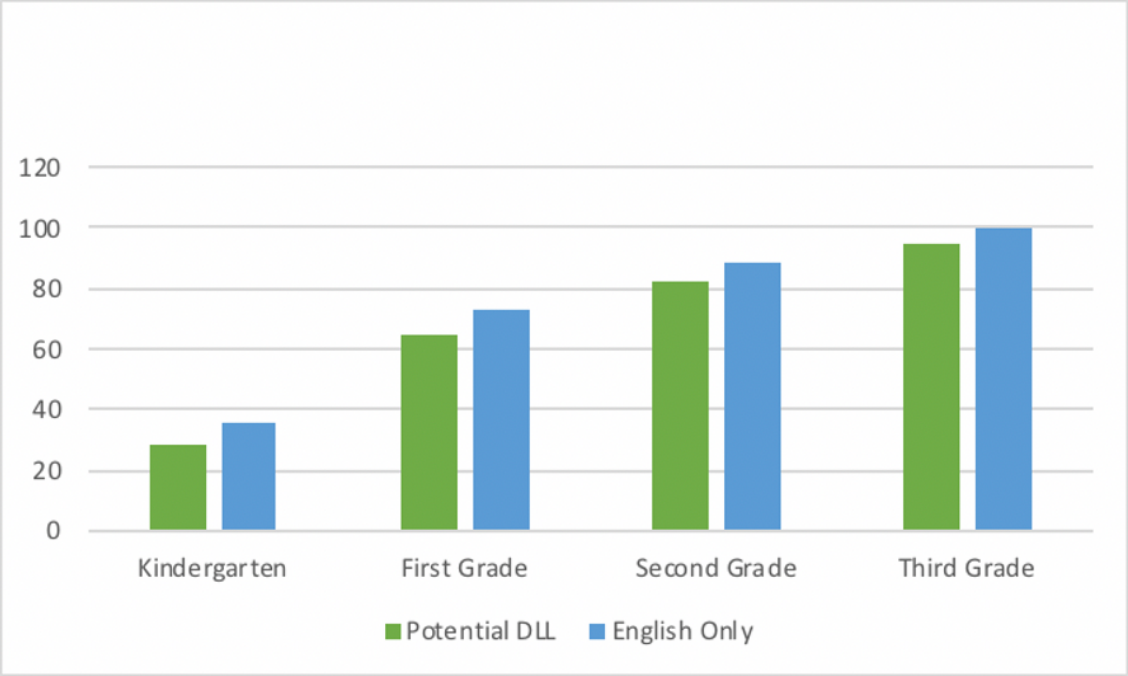


Source: NCES, 2016b.

Figure 1: Kindergarten Reading Achievement 2010–2014

Similar results were reported for math, where the same group of kindergarten students who identified having a non-English home language achieved lower on their mean math scores at 28.5, when compared to those students who identified having only English as their home language, whose average was 35.5 (NCES, 2016a). This trend also continued throughout the course of the study, as potential DLLs scored 64.4 in first grade, 82.3 in second grade, and 94.7 in third grade, while their English-only peers

scored 73.3 in first grade, 88.6 in second grade, and 99.7 in third grade, as shown in Figure 2 (NCES, 2016a).



Source: NCES, 2016a.

Figure 2: Kindergarten Mathematics Achievement 2010–2014.

It can be argued that these reported statistics are outdated to some extent, as they start from 2010. However, based on the increase in reported DLLs and ELLs nationally, it is likely that the disparities in achievements have also increased, based on the achievement levels presented from this longitudinal study (NCES, 2016b). While the difference in achievement for both reading and mathematics was not immense, it is significant in that potential DLLs should be achieving on the same level as their English-

only peers, especially as they progress throughout school (Halle et al., 2014). The inability of the potential DLLs from this study (NCES, 2016b) to close the achievement disparity in reading and math compared to their English-only peers illustrates the need for the current study. The research of evidence-based vocabulary strategies will aid DLLs in being as successful as their English-only peers, and work to help decrease the disparity in achievement between DLLs and non-DLLs.

National Head Start Statistics

The National Head Start Association (NHSA) is a federally funded early childhood program that provides services for vulnerable children ages three through five (NHSA, 2018). While the following statistics do not account for all pre-kindergarten-aged students in the United States, the statistics can be utilized as a reference point to determine the current state of this population.

Demographics. According to data from the 2017–2018 Head Start Program Information Report (PIR), a total of 681,880 participants were enrolled in Head Start in a variety of program types, including center and home-based as well as child care or locally designed (NHSA, 2018). Of the participants enrolled, 27% were identified as DLL (NHSA, 2018). The primary language of these DLLs is Spanish at 21.2%, with Middle Eastern or South Asian Languages at 1.4%, and East Asian Languages at 1.2% (NHSA, 2018). Additionally, Central American, South American, Mexican, Caribbean, Native North American, Alaska Native, Pacific Island, European or Slavic, African, as well as other and unspecified languages were also represented, but at less than 1% each (NHSA, 2018).

Academic Achievement. No academic information is available at the national level for this specific population. The previous presentation of the academic achievement of kindergarten-aged students assists in filling this gap in the statistics. The following section presents the statistics for the DLL population in a mid-Atlantic state, as this is where the current study takes place.

Mid-Atlantic State K–12 Statistics

While national statistics are imperative to understanding the disparity in achievement for DLLs and their native English-speaking peers, it is also important to note statistics at the state level where this study takes place, as DLL/ELL populations can vary greatly from state to state. For example, in 2015, 21% of California's student population was identified as ELLs, whereas West Virginia only had 1% (NCES, 2017). As this study takes place in a mid-Atlantic state, the following sections discuss statistics for this specific state (NCES, 2017).

Demographics. The mid-Atlantic state's ELL population is increasing at a faster rate than the national average at 4.9% (3.3% national average) as shown in Figure 3. It has grown from approximately 20,000 students in 2004, or 2.5% of the total student population in this state, to approximately 60,000 students in 2015, or 6.9% of the total student population in this state. The majority of ELLs in this mid-Atlantic state speak Spanish, at 51.07%. As this population continues to grow at a rapid pace in this specific state, so does the need for continued research with this population.

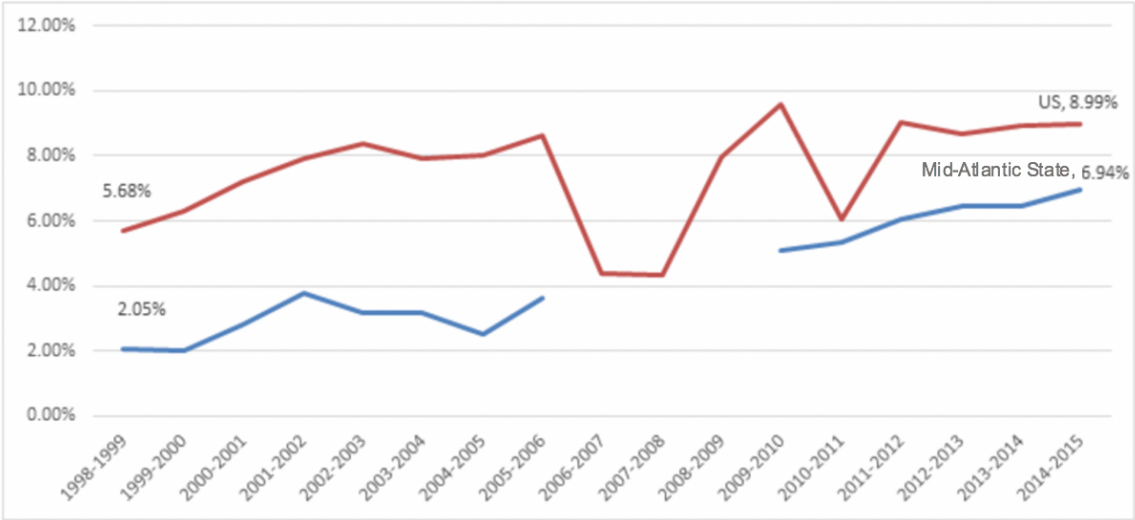


Figure 3: ELL Student Population in Mid-Atlantic State and the US, 1998–2015

Academic Achievement. The disparities in achievement present at the national level continue at the state level. Fourth-grade ELLs had an average scale score of 189, while non-ELLs had an average scale score of 226. This also was evident for eighth-grade ELLs who had an average score of 226, while non-ELLs had an average score of 269. The same was noted for 12th-grade ELLs in 2015, where ELLs scored an average of 240, while their native English-speaking peers scored an average of 289 (NAEP, 2017b). These gaps in achievement at the state level are similar to those seen at the national level, making a case for this problem persisting at the local level.

The same disparity was also present for achievement in mathematics. According to NAEP, on the 2017 mathematics state assessment, fourth-grade ELLs had an average scale score of 214, while non-ELLs had an average scale score of 244. This trend

continued through the grade levels, as eighth-grade ELLs scored an average of 246, while their native English-speaking peers scored an average of 285. The same was noted for 12th-grade ELLs in 2015, where ELLs scored an average of 115, while their native English-speaking peers scored an average of 153 (NAEP, 2017a).

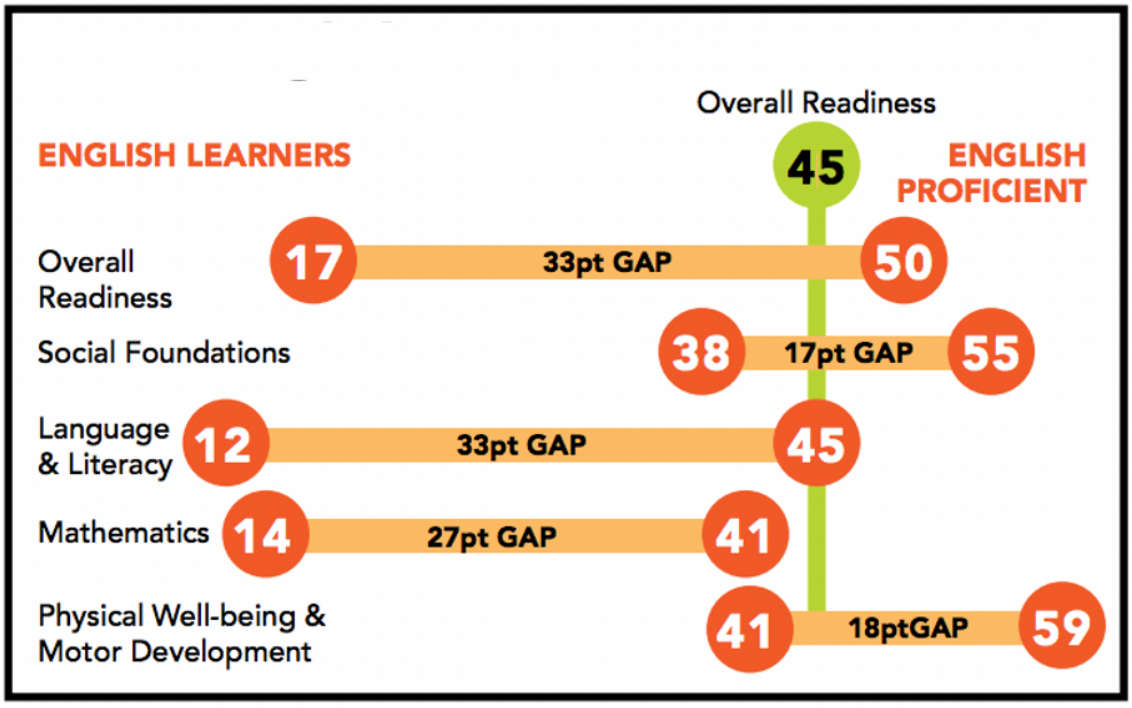
Mid-Atlantic State Kindergarten Statistics

As this study focuses on pre-kindergarten DLLs, it is important to consider the population and achievement of the closest grade level, kindergarten. These statistics are indicative of pre-kindergarten students, as many students' first school experience starts at kindergarten. This state utilizes different assessment and reporting measures from that presented at the national level. While the national and state levels cannot be compared to each other, it is imperative to gain a comprehensive view of the problem, including its impacts on the disparities in achievement.

Demographics. Statistics from a 2016 state report indicate that 15.8% of the students enrolled in kindergarten were identified as DLLs. Of the 63,187 students enrolled in kindergarten, approximately 9,984 students were identified as speaking a language other than English in their home. This mid-Atlantic state's kindergarten DLL enrollment increased by 60% between 2007 and 2017, a substantial increase.

Academic Achievement. The Kindergarten Readiness Assessment (KRA) is an assessment administered to kindergarten students in the fall and spring that focuses on social foundations, language and literacy, mathematics, and physical well-being and motor development. As shown in Figure 4, this assessment shows many gaps exist between DLLs and non-DLLs, with the largest in the academic areas of language and

literacy, and mathematics. In 2018, only 12% of DLLs demonstrate readiness in language and literacy, compared to 45% of their English-speaking peers, according to a state report. In addition, only 14% of DLLs demonstrate readiness in math, compared to 41% of their English-speaking peers, according to a 2018 state report. Overall, including all assessed categories, only 17% of DLLs show readiness for kindergarten based on all areas, compared to 50% of their English-speaking peers. These are large discrepancies in achievement between DLLs and their native English-speaking peers, hence adding to the case for the need for research with this population.



Source: Mid-Atlantic State Department of Education. (2018). The 2017–2018 Kindergarten Readiness Assessment Report.

Figure 4: English Learner Readiness

Mid-Atlantic State Head Start Statistics

Head Start programs are present in this state, in addition to other pre-kindergarten programs offered at the private level. Again, while the specific identification of DLLs is not provided at this age range, based on the parent/guardian information on languages spoken at home, it can be gathered that a substantial proportion of DLLs exist within the Head Start and Early Head Start programs in the United States. While these numbers do not account for all pre-kindergarten-aged students in this state, it can be used as a reference point to determine the current state of the population.

Demographics. In 2017, 9,188 children were enrolled in a Head Start program in this mid-Atlantic state (NHSA, 2018). The largest percentage of reported primary language spoken in the home was English at 83%, as indicated on a 2014 state report. Spanish was the next largest at 14%, as indicated on the same report. While no concrete numbers for DLLs can be ascertained, based on these state statistics that indicate that DLLs make up 15.8% of students in kindergarten, as well as Head Start students' primary language spoken in the home reported as 14% Spanish, it can be gathered that a substantial number of DLLs are present within this population.

Academic Achievement. No academic information is available at the state level for this specific population. The previous presentation of the academic achievement of kindergarten students assists in filling this gap in the statistics.

The next section defines key terms to better explain the commonly used terms in the field and to avoid any potential misunderstandings or misuse of these terms.

Definitions of Key Terms

Dual Language Learner (DLL). Children defined as ages birth through 6 who have a home language other than English and are simultaneously learning two languages. This term may encompass or overlap with other terms frequently used, such as Limited English Proficient (LEP), English language learner (ELL), or English learner (EL) (HHS, 2017).

English Language Learner (ELL). People who have a home language other than English. For the purposes of this dissertation, designated as age 7 or older, or beyond the kindergarten grade level.

Multimedia. The use of a technology that combines sound, video, and text, such as videos, DVDs, and software Merriam Webster Online, 2015).

Native Language Supports. The use of a dual language learner's first language to assist in academic and language learning.

Expressive Vocabulary. The words we use ourselves, in the form of oral discourse or written text (Graves et al., 2012).

Receptive Vocabulary. The words that we understand when we hear them from others, in the form of listening to discourse or reading text (Graves et al., 2012).

Language Proficiency. Refers to a person's level of language capabilities within reading, writing, listening, and speaking.

Purpose of the Study

As a DLL/ELL educator, I am vested in working to find the best research-based strategies for DLLs/ELLs to help them be successful in both their education and future

lives. This research is critical for not only the success of this vastly growing population, but also for their educators. We need to find out what is going to help these students be successful in decreasing the achievement disparity between them and their native English-speaking peers, as well as to inform educators about the teaching strategies they should be using in order to be as effective as possible. The lack of research in this specific area has brought me to the current study. This study has the potential to influence education, research, and future outcomes for many children who are in a critical area of need of support.

While the current research for ELLs that addresses academic achievement is expansive, the research for DLLs is somewhat lacking in this area (The National Academies of Science, Engineering, & Medicine, 2017). There is minimal research for a modest variety of evidence-based instructional strategies to increase the vocabulary attainment and language proficiency of DLLs (The National Academies of Science, Engineering, & Medicine, 2017). Due to this, the need for research in this area is critical (The National Academies of Science, Engineering, & Medicine, 2017). As the DLL population continues to grow in the United States, so does the need for research to find the most effective strategies to help DLL populations be as successful as their native English-speaking peers. As discussed above, this population has shown to be underachieving when compared to their English-speaking peers in multiple contexts, both across grade levels and in various content areas (Mid-Atlantic Department of State, 2018; NAEP, 2017a; NAEP, 2017b; NCES, 2016a; NCES, 2016b; NCES, 2016c).

One way to support DLLs is by providing early interventions in targeted areas of language utilizing research-based strategies. For this study, an experimental group design was employed to study the effectiveness of evidence-based strategies designed to increase the vocabulary attainment of DLLs in pre-kindergarten.

Current Vocabulary Achievement

Interventions that involve vocabulary show gains for both academic achievement and language for DLLs. Research with DLLs has found that vocabulary is one of the best predictors of reading comprehension, and is more than just learning words, which happens at home and at school (The National Academies of Science, Engineering, & Medicine, 2017). Evidence-based practices that have proven to be effective include storybook reading (Hickman et al., 2004), games and pictures (Kim, 2008), technology-enhanced storybook reading with Spanish bridging (Leacox & Jackson, 2014), and pictures with words and shared writing (O'Connor et al., 2012). Numerous studies indicate that a DLL's language and vocabulary acquisition are closely connected. It has been found that when an intervention is used to increase vocabulary acquisition, reading comprehension also increases (Carlo et al., 2004). An increase in vocabulary development also affects a DLL's ability to comprehend grade-level text and perform well on assessments (August et al., 2005). Research from a nine-year longitudinal study shows that oral language, specifically vocabulary, has an impact on later English reading proficiency (Kieffer, 2012). English vocabulary skills are the second-best predictor of the DLL students' English word reading (Yesil-Dagli, 2011). Vocabulary plays a crucial role in the development of word reading, listening comprehension, and reading

comprehension in ELLs (Uchikoshi, 2013). Vocabulary is a crucial part of the development of DLLs, as it leads to an increase in language proficiency, which then leads to an increase in academic outcomes (Calderón et al., 2011; Kieffer, 2012; Kojic-Sabo & Lightbown, 1999; Uchikoshi, 2013).

In 2015, NAEP found that the average national scale score for vocabulary for Grade 4 ELL students was 184, while the average score for non-ELL students was 229 (NAEP, 2017c). This trend continues into higher grade levels, as eighth-grade ELL students scored 216 for vocabulary, while non-ELLs scored 268, and 12th-grade ELL students scored 230, while non-ELLs scored 295. For the examined mid-Atlantic state, in 2013, the average scale score for fourth-grade vocabulary was 195 for ELLs, while non-ELLs scored 228 (NAEP, 2017c). No data are available for the state's eighth- or 12th-grade vocabulary, as reporting standards were not met (NAEP, 2017c). These disparities in vocabulary achievement between ELLs and non-ELLs provide support for the need for the current study. More research is needed with evidence-based vocabulary strategies for DLLs in order to assist in decreasing this disparity in achievement.

Early Childhood Vocabulary Interventions

These gaps in achievement seen in vocabulary at upper grade levels could be addressed with interventions that start in the early childhood age range (HHS, 2016). Interventions based in vocabulary attainment could effectively work to address the gaps in achievement seen in these national and state scores (HHS, 2016). These interventions could prove to be especially effective if they are provided at the early childhood level, as they increase language proficiency for ELLs, which ultimately increases academic

outcomes (The National Academies of Science, Engineering, & Medicine, 2017; The National Early Childhood Technical Assistance Center, 2011; HHS, 2016).

Vocabulary is classified into two categories, receptive and expressive (Graves et al., 2012). Receptive vocabulary is defined as the words that are understood when heard from others, in the form of listening to discourse or reading text (Graves et al., 2012). Expressive vocabulary is defined as the words that are used ourselves, in the form of oral discourse or written text (Graves et al., 2012). When assessing DLLs, it is imperative to include both categories, as achievement in these areas can vary based on language level, as well as other cultural factors (National Association for the Education of Young Children [NAEYC], 2003, 2005).

Vocabulary interventions are especially effective for DLLs if they are performed during the early childhood years, defined as ages birth through 8 (HHS, 2016). According to Farkas and Beron (2004), the acquisition of vocabulary begins at an early age and is a precursor skill needed for the development of more advanced skills such as reading. Gains in oral vocabulary acquisition can predict growth in comprehension and later reading performance (Elleman et al., 2009). Vocabulary interventions are key to developing an ELL's academics, especially regarding long-term academic and language proficiency (The National Academies of Science, Engineering, & Medicine, 2017; The National Early Childhood Technical Assistance Center, 2011; HHS, 2016).

Current Study

For this study, an experimental research design supports an intervention that combines the evidence-based strategies of multimedia and native language supports for

the vocabulary attainment of DLLs. Multimedia is the use of a technology that combines sound, video, and text, such as videos, DVDs, and software (Merriam Webster Online, 2015). Multimedia for DLLs in the form of e-books, multimedia shared stories, videos, and applications have been shown to be successful for vocabulary attainment (Foster et al., 2018; Silverman & Hines, 2009; Terantino, 2016; Tsou et al., 2004; Verhallen & Bus, 2010; Verhallen et al., 2006). Native language supports use an ELL/DLL's first language to assist in academic and language learning, which significantly supports academic achievement (Teaching English to Speakers of Other Languages [TESOL], 2016). Numerous studies have found the use of native language supports to increase vocabulary growth for DLLs (Cardenas-Hagan et al., 2007; Carlo et al., 2004; Nemeth & Simon, 2013; Rodriguez et al., 2012; Schwartz, 2014).

This intervention study was designed to examine ways to increase vocabulary in the areas of expressive and receptive language utilizing these two specific strategies. This study enhanced the understanding of multimedia and native language supports' effect on language acquisition of students in the early childhood age range. This new knowledge will build on previous studies done and will help build the pathway for future research.

In the next section, I will describe the theories that account for the framework of this study, including several different theories across multiple fields that work together to support the current study.

Several theories account for the framework of this study. Since the participants in this study are DLLs and the focus is on increasing vocabulary, this theoretical framework must be grounded in Second Language Acquisition Theory in order to support language

development. Sociocultural Theory must also take a grounding role in order to support the learning of early childhood-aged children, specifically DLLs. Second Language Acquisition Theory and Sociocultural Theory support both the use of native language supports and multimedia as research-based strategies for increasing the vocabulary of DLLs. These two theories are denoted in red and yellow as shown in Figure 5.

Three additional theories, which work together to support the use of multimedia, fall underneath the two most prominent theories named above. Dual Coding Theory, Cognitive Theory of Multimedia Learning, and Universal Design all support the different aspects that are presented in the use of multimedia in the study. These three theories are denoted in blue in Figure 5.

Theoretical Framework

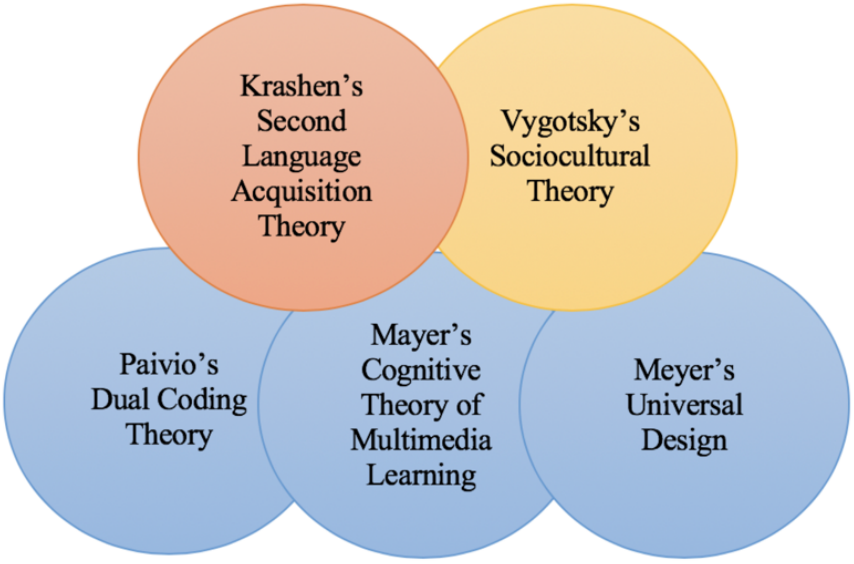


Figure 5: Theory Integration Visual Representation

All five of these theories work together and support each other to create a sound theoretical framework for the current study by supporting all aspects of the study, including language development, vocabulary development, native language supports, and multimedia.

Theory to Support Language Learning

The following presents the grounding theory for this study. As this research is for DLLs, it is critical that this framework is based in theory on language attainment.

Second Language Acquisition. Krashen's Second Language Acquisition Theory states that language acquisition occurs subconsciously and is an involuntary process that occurs when input is comprehensible (Krashen, 2013). Input is made comprehensible with the use of pictures, realia, movement, and interesting activities (Krashen, 2013). This theory supports the use of multimedia as a strategy for DLLs, as it combines a high level of engagement by utilizing pictures, sounds, and animation. It also supports the use of native language supports for DLLs, as this is considered to be an interesting activity that would support a high interest level. Both multimedia and native language supports allow for varying levels of difficulty, which lend themselves to the use of comprehensible input at an appropriate level for students.

Theory to Support Native Language Supports

The following theory supports the use of native language supports as a strategy for DLLs, as it encourages the use of prior knowledge to build new knowledge.

Sociocultural Theory. Vygotsky's Sociocultural Theory supports the idea that learning language is a social practice used for communication purposes, and that culture,

including beliefs and practices, affects how cognitive functions are developed (Vygotsky, 1978). This theory supports the use of native language supports as a strategy for DLLs, as it builds on students' prior knowledge from their first learned language to increase the learning of an additional language. This supports the use of native language supports, as it utilizes the participant's knowledge of vocabulary in their first language to increase the participant's knowledge of vocabulary in their second language.

Theories to Support Multimedia

The following theories support the use of multimedia as a strategy for DLLs, as they call for specific requirements to be maintained and met for maximum learning capacity when utilizing multimedia.

Dual Coding Theory. Paivio's Dual Coding Theory states that there are three different types of processing (Clark & Paivio, 1991)—the first being representational, which is the direct activation of verbal or non-verbal representations (Clark & Paivio, 1991); the second being referential, which is the activation of the verbal system by the nonverbal system or vice-versa (Clark & Paivio, 1991); and the third being associative processing, which is the activation of representations within the same verbal or nonverbal system (Clark & Paivio, 1991). Any given task may require any or all of the three kinds of processing (Clark & Paivio, 1991). This theory supports the use of multimedia, as the presentation of both words and images can lead to an increase in learning, since it uses more than one type of processing.

Cognitive Theory of Multimedia Learning. Mayer's Cognitive Theory of Multimedia Learning is based on three main assumptions: there are two separate channels

(auditory and visual) for processing information, there is limited channel capacity, and learning is an active process of filtering, selecting, organizing, and integrating information (Mayer, 2009). This theory is critical to consider when using multimedia, as the brain does not interpret a multimedia presentation of words, pictures, and auditory information as individual components, but is more successful when presented together to produce logical mental constructs (Mayer, 2009).

Universal Design. Meyer's Universal Design for Learning has multiple principles that guide educators in finding innovative ways to make curriculum accessible and appropriate for individuals with different backgrounds, learning styles, abilities, and disabilities in various learning situations and contexts (Rose & Meyer, 2006). This is critical to consider when using multimedia, as these principles serve as the guidance to creating effective programs that have the potential to meet the needs of DLLs.

Second Language Acquisition Theory, Sociocultural Theory, Dual Coding Theory, Cognitive Theory of Multimedia Learning, and Universal Design for Learning all work together to build the framework for the current study and support the use of multimedia and native language supports to increase the vocabulary attainment of DLLs.

In the following section, I have identified the research questions that will be examined for the current study.

Research Questions

Strategies for increasing the vocabulary attainment of DLLs in the early childhood age range need to be researched further, so that early interventions can be

provided in order to lessen the disparity in achievement and ultimately improve educational outcomes for DLLs. The research questions for this study are:

1. What effect does an intervention utilizing the strategies of multimedia with native language supports have on the vocabulary attainment of dual language learners in the areas of receptive and expressive vocabulary?
    a. Does the intervention have varying effects on receptive and expressive vocabulary based on DLLs' language proficiency level?

In this chapter, I have shared the national and state demographic and academic achievement statistics that illustrate the disparities in achievement between DLLs/ELLs and non-DLLs/ELLs, defined important key terms, identified the purpose of the current study, discussed the theoretical framework that supports the framework of this study, and identified the research questions that will be examined.

In Chapter Two, I present the current literature on the topic for both ELLs and DLLs to include vocabulary's effect on language achievement, vocabulary intervention strategies, the specific strategies of native language supports and multimedia in technology, and finally, a problem statement for the current study.

CHAPTER TWO

Literature Review

In Chapter One, I identified the problem, purpose, and theoretical framework for the current study. In Chapter Two, I review the current literature, starting with a wider scope and presenting vocabulary's effect on language achievement, then narrowing in on effective vocabulary intervention strategies and, finally, identifying the specific strategies being examined in the current study, in order to gain a holistic understanding of the current literature in the field that supports the research questions being examined, as shown in Figure 6. A statement of the problem supported by the current literature is presented as the foundation for the current study. Finally, a pilot study conducted prior to the current study is described and analyzed.

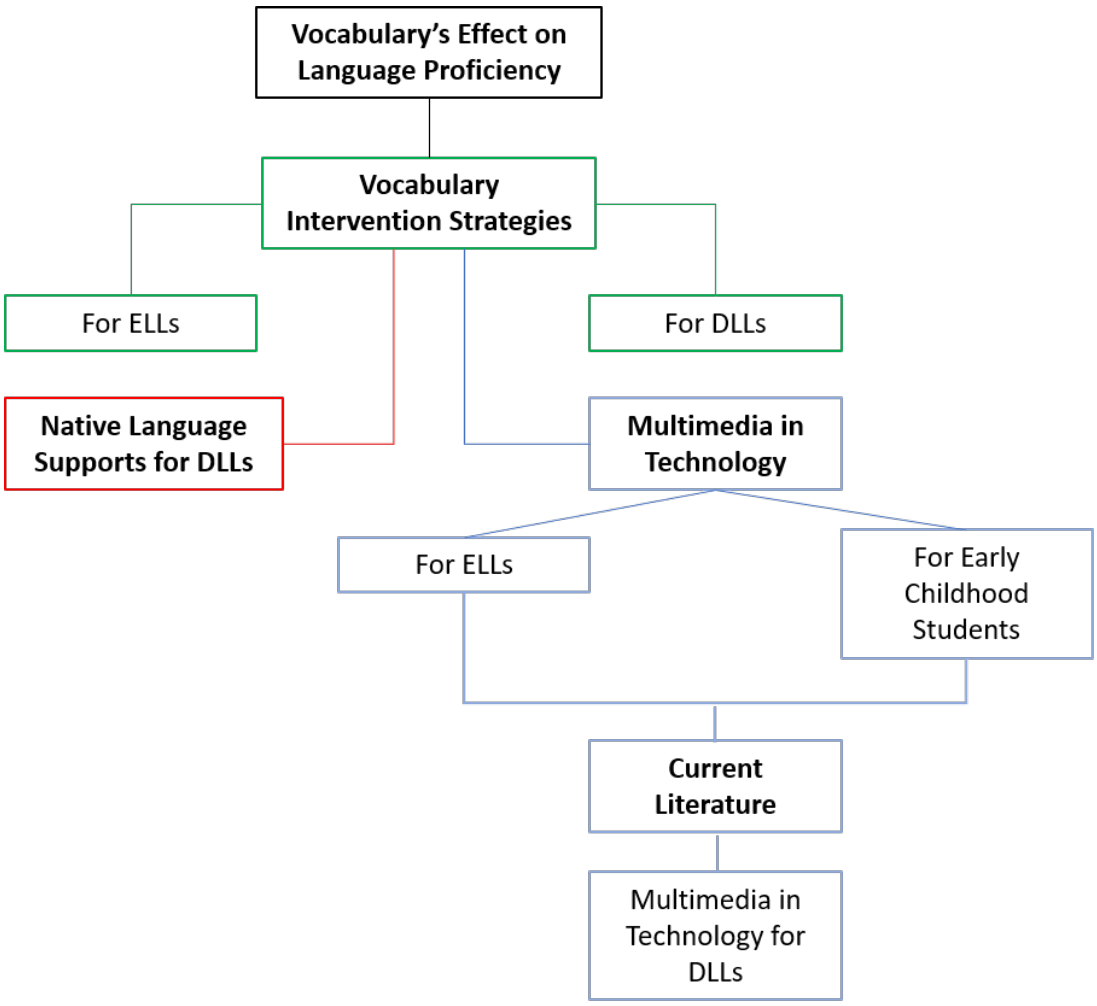


Figure 6: Literature Review Concept Map

Search Procedures

To find relevant articles for this review, a search was conducted to locate vocabulary intervention, native language supports, and multimedia in technology studies for both ELLs and DLLs. Additionally, where information for DLLs was unavailable, I searched for early childhood-aged participants (ages 3 to 8). These studies were focused on research conducted within the last 15 years (2005–2020), but also included relevant

research from the last 25 years (1995–2020). First, a database search was conducted using PsychNet, ERIC, and Social Science Index databases using a combination of the following key words: DLL, domain, dual language learner, early childhood, ELL, English language learner, first language, home language, intervention, language bridging, language proficiency, multimedia, native language, strategies, technology, and vocabulary. Ancestry and descendent searches were conducted using relevant studies. Previous literature reviews and meta-analyses were also included.

Vocabulary's Effect on Language Proficiency

Vocabulary is defined as a collection of words and phrases employed by a language, group, or individuals Merriam Webster Online, 2020). For DLLs/ELLs, vocabulary is split into two categories: receptive and expressive. Receptive vocabulary includes the words that are understood from others, while expressive vocabulary includes the words that are produced (Graves et al., 2012). Early childhood students will use more spoken language in their receptive and expressive vocabularies, while older adults may use more written language with these vocabularies (Graves et al., 2012). When discussing vocabulary as it pertains to DLLs/ELLs, it is important to note that words are often broken into three different tiers. The first tier includes everyday words that have a single meaning, such as "happy" or "baby" (McKeown, 2014). These words are often only taught at the surface level and are present in everyday language (McKeown, 2014). Tier two words include technical words such as "virtual" or "consistent" (McKeown, 2014). These words can be used across subject areas but are not typically used in everyday conversation (McKeown, 2014). Tier three words are subject-specific words such as

"photosynthesis" or "numerator" (McKeown, 2014). These words often need to be taught in a larger context and cannot rely on only definitions in isolation (McKeown, 2014).

Language proficiency refers to a person's level of language capabilities within the four language domains of reading, writing, listening, and speaking. In order to construct meaning from oral and written language, and to express ideas and information, DLLs/ ELLs must process and produce language within these domains (WIDA, 2012). These domains are not to be used in isolation, but rather, should utilize a DLL/ELL's stronger skills in one domain to support another (WIDA, 2012). To show processing or understanding of language, students may produce language orally, in writing, or using semiotics (WIDA, 2012). To develop academic language necessary for success in school, DLLs/ELLs must have opportunities to use and apply language (WIDA, 2007).

Vocabulary has been documented as critical to the development of second language learners, particularly within the context of academic language (WIDA, 2007). Research shows that an increase in vocabulary acquisition leads to an increase in language proficiency (Kojic-Sabo & Lightbown, 1999), and that vocabulary development is an important first step that with explicit and comprehensive instruction leads to higher oral, reading, and writing language proficiency (Calderón et al., 2011).

As eloquently stated by Francis et al. (2006, p. 7), "Mastery of academic language is arguably the single most important determinant of academic success for individual students. It is not possible to overstate the role that language plays in determining students' success with academic content."

Several studies point to the relationship between vocabulary development and reading comprehension outcomes, with some specifically addressing longer term outcomes. These key studies are discussed in depth below, as well as for the researcher's implications for needs of future research and development.

Kieffer (2012) examined national longitudinal data on DLLs/ELLs to determine how oral language proficiency predicts later growth in reading. Growth models showed that English proficiency in kindergarten predicted levels of English reading in third through eighth grade (Kieffer, 2012). Expressive vocabulary was found to be a better predictor of English reading than other more complex measures (Kieffer, 2012). The author calls for the need to develop research in early childhood to increase vocabulary for DLLs (Kieffer, 2012).

Yesil-Dagli (2011) investigated the role of English letter naming fluency, sound fluency, and vocabulary skills for early childhood-aged students from kindergarten into first grade. Results of the study revealed that vocabulary skills were the second best predictor of oral reading fluency in first grade for DLLs (Yesil-Dagli, 2011). The author calls for the development of early intervention to include extensive and varied vocabulary instruction in order to acquire a range of words (Yesil-Dagli, 2011).

Swanson et al. (2008) examined the role of oral language and phonological awareness on third grade DLLs to determine the best predictors of reading comprehension to include measures on pseudoword reading, word identification, and passage comprehension. The researchers found that vocabulary best predicted literacy

outcomes, indicating that oral language skills play a major role in reading skills of DLLs (Swanson et al., 2008).

Davison et al. (2011) investigated the relationship between Head Start (pre-kindergarten)-aged DLLs' receptive language development and reading outcomes in first grade. Researchers found that growth in receptive vocabulary and oral comprehension during preschool predicted reading abilities in first grade for DLLs (Davison et al., 2011). These researchers call for more high quality language interventions that target language development in the preschool years (Davison et al., 2011).

Uchikoshi (2013) evaluated oral language and word reading skills as predictors of reading comprehension for DLLs. The participants were assessed during second grade on multiple measures including word reading, phonological awareness, oral proficiency, vocabulary, and listening comprehension (Uchikoshi, 2013). Results indicated that vocabulary played significant roles in English reading comprehension (Uchikoshi, 2013). The author calls for early intervention for DLLs with a focus on oral language, to reinforce vocabulary instruction to aid in reading comprehension (Uchikoshi, 2013).

Proctor et al. (2005) examined the effects of reading comprehension on fourth-grade ELLs to include decoding measures of alphabetic knowledge and fluency, with oral language measures of vocabulary knowledge and listening comprehension. Results indicated that vocabulary knowledge is crucial for English reading outcomes for ELLs (Proctor et al., 2005). These authors call for research on effective practices in improving vocabulary knowledge and interventions for school-aged ELLs (Proctor et al., 2005).

Grimm et al. (2018) conducted a longitudinal study to investigate the literacy development of DLLs/ELLs from third through eighth grade, as well as the impact of kindergarten letter knowledge, phonological awareness, word reading, and vocabulary on literacy development. Kindergarten vocabulary was the most predictive of literacy development from third through eighth grade (Grimm et al., 2018). These researchers call for oral language instruction to begin as early as kindergarten, and for educators to target vocabulary skills, as they have a greater long-term impact on achievement (Grimm et al., 2018).

Vocabulary acquisition has a strong effect on the language proficiency of DLLs/ ELLs, specifically in the area of reading comprehension. As presented and discussed in the previous chapter, academic outcomes are often tied to reading comprehension, therefore making this a critical area of development. Vocabulary has been shown to be an effective way to increase academic outcomes; therefore, specific strategies that increase vocabulary acquisition will be addressed in the following section.

Vocabulary Intervention Strategies for ELLs

Several literature reviews have examined vocabulary instruction for ELLs. These reviews have documented the best methods and instructional strategies to teach academic vocabulary to ELLs. The following discusses the literature review findings from August et al. (2005); Wallace (2007); Barr et al. (2012); and Moody et al. (2018), in order to give a comprehensive overview of effective vocabulary instructional strategies.

Literature Reviews. August et al. (2005) reviewed research on methods that develop vocabulary knowledge of ELLs. They found that utilizing native language

supports (including cognates), ensuring that the meanings of basic words are understood, and providing sufficient review and reinforcement were all useful strategies for increasing the vocabulary of ELLs (August et al., 2005). August et al. (2005) identify that the most effective strategies for vocabulary instruction include providing definitional and contextual information about each word's meaning and actively involving students in word learning by talking about, comparing, analyzing, and using the target word. In addition, the researchers suggest providing multiple exposures to meaningful information about each word as well as teaching word analysis (August et al., 2005).

The researchers call for the increase of research to develop vocabulary strategies that work best for ELLs, as well as methods that reinforce the words students have learned, including the use of technology.

Wallace (2007) reviewed literature on the effective practices for teaching vocabulary to ELLs and found that the use of cognates, teaching the meaning of basic words, and review/reinforcement are effective strategies for increasing the vocabulary of ELLs. Additionally, Wallace (2007) found the use of direction instruction combined with word-learning strategies to be an effective vocabulary instructional strategy.

Barr et al. (2012) reviewed peer-reviewed journals and other published studies to determine if reading and vocabulary instruction should be used as core strategies for supporting ELLs. The researchers found that ELLs benefit from explicit teaching of vocabulary to include a variety of methods designed to explore the relationships among words, word structure origin, and word meaning (Barr et al., 2012). Direct instruction, structural analysis, linking old and new vocabulary, focusing on semantic relationships,

using synonyms, antonyms, and dictionary definitions, analyzing the structure of new words, using contextual analysis, maintaining personal word lists, and working cooperatively were all found to be effective strategies for attaining vocabulary for ELLs (Barr et al., 2012).

Moody et al. (2018) examined articles from two specific journals, *The Reading Teacher* and *Journal of Adolescent and Adult Literacy*, from 2007 to 2017, to identify word-learning strategies with regard to vocabulary development. The researchers identify contextual analysis, semantic strategies, and repeated exposure as strategies that are found to impact vocabulary achievement for ELLs. Additionally, they identify general word knowledge and semantic strategies to include the use of dictionaries, graphic organizers, and discussions to also be beneficial strategies for the vocabulary attainment of ELLs (Moody et al., 2018).

As indicated by the literature reviews described above, there are many documented instructional strategies that work to increase the vocabulary attainment of ELLs. Next, specific studies are highlighted and discussed in depth in the following section in terms of word structure origin (roots, prefixes, suffixes), word meaning (definitions), and relationships among words (synonym, antonym, homonym, categories) as identified by Barr et al. (2012) as the best methods for teaching vocabulary to ELLs.

Word Structure Origin. Lesaux et al. (2010) found an intervention program that incorporated the instructional strategies of word meanings in context and morphological analysis for middle school-aged ELL participants to be successful. Findings suggest that text-based academic vocabulary teaching is a successful approach for teaching

vocabulary (Lesaux et al., 2010). The researchers call for more research to determine the conditions under which ELLs' learning can be accelerated to catch up with their monolingual peers (Lesaux et al., 2010).

Davidson and O'Connor (2019) found that morphological instruction was an effective strategy for teaching vocabulary to ELLs. Davidson and O'Connor (2019) found that the use of this instructional strategy, specifically using suffixes, was effective to increase the vocabulary of fourth- and fifth-grade ELLs. The researchers call for additional research on morphological instruction to include the use of the ELLs' native language to derive word meanings (Davidson & O'Connor, 2019).

Word Meaning. Carlo et al. (2004) found that a direct instruction approach that consisted of a focus on teaching academic words, awareness of polysemy, strategies for inferring word meaning from context, and tools for analyzing morphological and cross-linguistic aspects of words to be successful in increasing ELLs' vocabulary. Carlo et al. (2004) examined fifth-grader reading achievement using an intervention that aimed to increase vocabulary with a variety of reading strategies, including using context, cognates, and native language supports. Participants in the intervention group gained more knowledge on vocabulary, understood multiple word meanings, and improved reading comprehension, specifically the ELL participants in the study (Carlo et al., 2004). Outcomes indicated that teaching word analysis and vocabulary strategies increases comprehension outcomes for these students (Carlo et al., 2004).

August et al. (2016) found that the use of extended and embedded instruction were effective strategies for increasing vocabulary achievement. August et al. (2016)

examined the effects of these two instructional strategies on the vocabulary attainment of third- and fourth-grade ELLs, where embedded instruction seeks to target vocabulary in informational text and utilize cognates, and extended instruction consists of pre-teaching vocabulary, as well as the incorporation of picture cards, word walls, interactive reading, and games. Results indicated that these two strategies were effective in increasing the vocabulary attainments of ELLs (August et al., 2016). The researchers call for future research on strategies that engage students, are easily implemented, address individual students' needs, and incorporate new technologies to develop ELLs' vocabulary knowledge (August et al., 2016).

Relationships Among Words. Townsend (2009) found that the use of games led to higher gains in vocabulary for ELLs. Townsend (2009) examined the effects of Language Workshop, an after-school intervention for middle school-aged participants that incorporated the vocabulary instructional strategies of direct instruction with discussions focused around diagrams and pictures, as well as the inclusion of games and activities that incorporated synonyms and antonyms. Results indicated that the use of games and activities are an effective approach to increasing vocabulary for ELLs (Townsend, 2009). Townsend (2009) calls for future research in this area.

In addition, multimedia has been shown to be an effective strategy for vocabulary acquisition, as well as native language supports, which will be discussed in depth in the upcoming sections of this chapter. While these vocabulary intervention strategies have been proven to be effective for ELLs, strategies vary for DLLs, as discussed in the next section.

Vocabulary Intervention Strategies for DLLs

Several literature reviews have examined vocabulary instruction for DLLs. These reviews have documented the best methods and instructional strategies to teach academic vocabulary to DLLs. The following discusses the literature reviews and findings of Moody et al. (2018) and Guiberson and Ferris (2019) in order to give a comprehensive overview of effective vocabulary instructional strategies.

Literature Reviews. Moody et al. (2018) examined articles from two specific journals, *The Reading Teacher* and *Journal of Adolescent and Adult Literacy*, from 2007 to 2017, to identify word-learning strategies with regard to vocabulary development. The researchers identify adult-child conversations, interactions with peers and siblings, and shared storybook readings as the best strategies for young children (DLLs) to develop vocabulary. Additionally, they highlight repeated exposures, explicit instruction, and sufficient time to engage with new words as essential to vocabulary development (Moody et al., 2018).

Guiberson and Ferris (2019) examined literature of early language interventions for DLLs from a total of 27 sources. They found that supporting a child's native language with their caregivers to use family-specific vocabulary as well as teaching new words and phrases were popular methods throughout the research (Guiberson & Ferris, 2019). Engaging in shared storybook experiences was also a popular strategy, which could include modeling behavior, asking questions, retelling and predictions, as well as enhanced vocabulary instruction (Guiberson & Ferris, 2019). Guiberson and Ferris

(2019) noted that a limitation to the review was the shortage of intervention research with young DLLs and indicated the need for more research for this population as a priority.

As indicated by the literature reviews described above, several documented instructional strategies work to increase the vocabulary attainment of DLLs. Specific studies are highlighted and discussed in depth in the following section in terms of adult-child conversations, interactions with peers and siblings, and shared storybook readings as identified by Moody et al. (2018) as the most important vocabulary teaching strategies for DLLs.

Adult-Child Conversations. Cohen et al. (2012) found that the use of dialogic reading improved vocabulary attainment of DLLs. Cohen et al. (2012) examined the use of dialogic reading, an evidence-based approach to shared book reading that engages children in a conversation about text, on pre-kindergarten students ages 3 and 4. Results indicated that participants increased their vocabulary skills when using this instructional strategy, and should use predictable books with short reading times, align books with classroom themes, identify three to five key vocabulary words, place prompts on Post-It notes, and allow time for extended explanations and opportunities for practice (Cohen et al., 2012).

Gonzalez et al. (2014) found that questioning techniques used during a storytelling associated with vocabulary leads to better receptive vocabulary outcomes and expressive vocabulary in ELLs. This study examined vocabulary of 4- and 5-year-old preschoolers using interactive shared reading to include teacher talk of guided discussions, visual representations, and questioning (Gonzalez et al., 2014). Results

indicated that engaging children in interactive shared reading increases vocabulary attainment (Gonzalez et al., 2014).

Interactions with Peers and Siblings. Silverman et al. (2013) found that a read-aloud plus intervention was effective to increase the vocabulary of DLLs. Silverman et al. (2013) examined the use of reviewing words and hands-on activities related to the vocabulary words, including physical gestures, on Head Start-aged participants. Hands-on activities included morning meeting, small group writing, and working in centers with peers on the new vocabulary words (Silverman et al., 2013). Results indicated that the read-aloud plus activities were beneficial to the attainment of vocabulary (Silverman et al., 2013). The researchers call for future research on how read-aloud plus extension activities could be designed to target children with limited vocabulary (Silverman et al., 2013).

Shared Storybook Readings. Collins (2010) found that storybook reading is especially helpful to new vocabulary acquisition and should be part of read-aloud instruction. Preschool participants ages 4 and 5 participated in a storybook reading that focused on visual representations of the vocabulary word, a general definition, synonym, gesture, and different context to understand word meaning. Hearing words combined with rich definitions were found to have the most significant impact on vocabulary achievement (Collins, 2010). The researcher calls for future work to examine the effects of first- and second-language vocabulary on increasing gains in new vocabulary (Collins, 2010).

Chlapana and Tafa (2014) found that questions that motivate DLLs to extract clues and information from the illustration, story text, and background knowledge help to infer the meaning of the unknown words have been found to be the most effective strategies for vocabulary. This study examined the effect of direct and interactive instruction on storybook reading for kindergarten DLLs (Chlapana & Tafa, 2014). Results showed interactive instruction, including pointing to words and illustrations, as well as answering questions, to be more beneficial than direct instruction on vocabulary attainment (Chlapana & Tafa, 2014).

Crevecoeur et al. (2014) found using direct instruction with storytelling to be an effective strategy to increase the vocabulary of DLLs. Kindergarten DLLs participated in an intervention that utilized visual word representations coupled with multiple contexts and reviewing of the target words (Crevecoeur et al., 2014). The researchers found that DLLs benefit from the instructional strategies of direct instruction and storytelling. The researchers call for intervention designs that embed strategies that target scaffolding, oratory/visual discrimination, and kinesthetic approaches for teaching vocabulary (Crevecoeur et al., 2014).

In addition, multimedia has been shown to be an effective strategy for vocabulary acquisition, as well as native language supports. These two strategies will be discussed in depth in the next two sections of this chapter.

Native Language Supports for DLLs

Native language support is the use of a DLL/ELL's first language to assist in academic and language learning. Teaching English to Speakers of Other Languages

(TESOL) states that the use of native language supports significantly enhances academic achievement and school completion (TESOL, 2016). In addition, native language correlates positively with the acquisition of literacy in English (TESOL, 2016). For ELLs, the most effective environments for second-language acquisition are those that promote ELLs' native language as a foundation for English language and academic development (TESOL, 2016).

DLLs continue to use their native language as they develop their new language (WIDA, 2014). When the development of two languages is strongly encouraged and effectively supported, DLLs use both their cognitive and linguistic assets to become successful language learners (WIDA, 2014). Developmental and cognitive psychology education research, and neuroscience, all point to the benefits of supporting the native language of young children alongside their English language development (HHS, 2016). Nemeth and Simon (2013) suggest that all early childhood educators use native language supports in order to honor and respect the background and identity their DLLs, as well as to build on knowledge already gained in their native language. These authors recommend that supporting the native language will benefit all children in the classroom as it builds cultural and linguistic bridges that aid in communication and create a global community (Nemeth & Simon, 2013).

Several studies have examined the use of native language supports as an instructional strategy for DLLs in varying applications. Specific studies are highlighted and discussed in depth in the following section in terms of reading and vocabulary instruction utilizing native language supports.

Reading. Rodriguez et al. (2012) examined the effects of using first-grade DLLs' native language to support reading comprehension in a computer-based literacy program. Results indicated that native language supports increased reading comprehension, specifically with fluency and word reading (Rodriguez et al., 2012). The authors call for additional research to compare various digital programs designed to teach DLLs (Rodriguez et al., 2012).

Cardenas-Hagan et al. (2007) examined the use of native language instruction on the early literacy skills of kindergarten DLLs. The researchers found that participants who had a strong native language were able to identify more letters than those who did not, supporting the idea of transfer and a relationship between Spanish abilities and English language acquisition (Cardenas-Hagan et al., 2007). Additionally, they found that letter and sound identification skills are correlated across language beginning in kindergarten (Cardenas-Hagan et al., 2007). The researchers suggest that educators should emphasize strategic scaffolding in early literacy for the similarities and differences between the native and second languages (Cardenas-Hagan et al., 2007). Cardenas-Hagan et al. (2007) call for more research to examine a broader range of skills in varied populations.

Restrepo et al. (2010) examined the use of a supplemental language instruction program that utilized native language supports to increase oral language for preschool-aged DLLs. Results indicated that participants who received the supplemental instruction made gains in length of words and subordination index, compared to those who participated in the English-only instruction (Restrepo et al., 2010). The researchers note

that encouraging the use of the native language, especially for those at risk of future academic failure and language disorder, is essential for children's academic, social, and cognitive growth (Restrepo et al., 2010).

Spencer et al. (2019) examined the effects of language lessons that incorporated native language use in storytelling and vocabulary on DLL preschoolers. Results indicated that the participants made gains in English narrative retelling and improvements in English vocabulary (Spencer et al., 2019). The findings suggest that dual language interventions that incorporate the native language have promise for promoting English language (Spencer et al., 2019).

Vocabulary. A study conducted by Lugo-Neris et al. (2010) studied the effects of English-only vocabulary instruction versus English vocabulary instruction with Spanish bridging on the vocabulary acquisition of preschool DLLs aged 4 to 6. The researchers found that those who received the Spanish expansions of vocabulary words as opposed to English-only expansions during an English storybook reading resulted in greater growth of the children's knowledge of the vocabulary, specifically in the use of expressive definitions (Lugo-Neris et al., 2010). The researchers call for future research to examine other factors that influence word learning in relation to native language (Lugo-Neris et al., 2010).

Leacox and Jackson (2014) examined the use of technology-enhanced storybook reading with Spanish bridging vocabulary instruction with preschool- and kindergarten-aged DLLs. The native language instruction in this intervention included a preview of the vocabulary words, as well as pre-recorded definitions throughout the storybook (Leacox

& Jackson, 2014). DLLs had more word learning gains when the native language instruction was utilized (Leacox & Jackson, 2014). The authors recommend strategies for vocabulary development to include repeated readings, multiple and varied exposures, and vocabulary definitions in the DLLs' native language (Leacox & Jackson, 2014). The researchers call for future studies to examine additional use of Spanish bridging with technology-enhanced English readings (Leacox & Jackson, 2014).

Mendez et al. (2015) examined the impact of the use of English-only instruction versus Spanish and English instruction on the vocabulary attainment of preschool-aged DLLs. Results indicated that participants from the native language instruction group acquired significantly more English vocabulary than those in the English-only instruction group (Mendez et al., 2015). They found vocabulary instruction that uses a DLL's first language knowledge prior to introducing a concept in the second language to be beneficial (Mendez et al., 2015). The researchers call for additional research on vocabulary instruction for preschool classrooms in a bilingual modality (Mendez et al., 2015).

There is evidence to support the use of native language supports as an instructional strategy for DLLs, as outlined above. In the next section, multimedia in technology will be presented, first examining the literature on ELLs, followed by the literature on early childhood students, and then finally bridging together the previous research with the current limited research on DLLs.

Multimedia in Technology for ELLs

Multimedia is defined as the use of a technology that combines sound, video, and text, such as videos, DVDs, and software (Merriam Webster Online, 2015). Many studies have found success when using multimedia as a strategy to increase language and literacy development. While this research is continuing to grow and evolve, it is currently quite fragmented with many gaps in terms of quantity. This is due, in part, to the vast availability of multiple types of multimedia in technology. In order to gain a comprehensive view of the current state of the literature, the following section on multimedia in technology for ELLs is presented categorically with sections on features, platforms, and programs, as all of these hold implications for the use of varying types of multimedia.

Technology Features. Technology features can include items such as screen size, hyperlinked words, glossing, animations, and spaced repetitions. As Proctor et al. (2007) state, children should be provided with access to the varied ways of knowing provided in digital environments, which may require higher level information-processing skills, synthesizing in distinct modalities (text, image, video, etc.) and within nonlinear hypertext structures, and a more fundamental experience with information presentation in order to increase general familiarity with computer interfaces. These features are critical to consider when designing programs, as they can serve as successful venues for deepening our knowledge on teaching and learning processes that incorporate verbal and nonverbal options of reading and learning (Korat et al., 2014). However, due to the limited evidence, vocabulary teaching and learning would benefit from other studies with

respect to the effective use of different methods or strategies through information communications technology and multimedia (Baturay et al., 2009).

Screen Size. Screen size refers to the actual circumference of the screen on which the multimedia or technology is projected for viewing or interaction. While only one article addresses screen size, it has been cited many times in the articles following as a means for the use of computers, iPads, or larger-based systems as opposed to smaller, mobile devices.

Kim and Kim (2010) investigated the effects of screen size on multimedia instruction to determine its effects on vocabulary learning on 135 Korean middle school students. Results indicated that the large screen helped the students to learn more vocabulary than the small screen. Screen size may not only affect language learning but also the thinking processes and reasoning in language learning, which makes a case for using larger screens in order to decrease the cognitive load (Kim & Kim, 2010).

Hyperlinked Words. Hyperlinked words are those that are linked to additional content such as definitions, visuals, or videos that are activated by the click of a mouse. The following articles speak to the use of adaptive computer programs for personalized learning via hyperlinks, which promotes the idea that educators should consider developing material that facilitates vocabulary learning with repeated exposure to lexical items (Wang, 2016).

Wang (2016) investigated the effects of using a customized online reading program with immediate and repeated meanings of unknown words on 72 Taiwanese college students' vocabulary learning. Results indicated that word retention and word

gain were significantly better using the adaptive online reading system, where participants were given multiple opportunities to click on unknown words, as opposed to the typical online reading system where those opportunities did not exist. Proctor et al. (2007) found similar results when they utilized a digital supported reading program that also gave access to hyperlinked vocabulary words with definitions, translations, example sentences, and relevant graphics to 30 fourth-grade students to increase vocabulary knowledge. Results indicated that vocabulary gain scores were associated with the frequency of hyperlinked glossary items selected.

Glossing. Glossing is the description of an unknown word or sentence in the margin of a reading passage. With multimedia glossing, this can be in the form of a sentence, definition, picture, animation, or video. While the following articles address multimedia glossing as an effective feature for vocabulary learning with technology, Akbulut (2007) warns that ELL readers need to add new strategies to their repertoire in order to be independent during the reading process, such as deciding when to use a specific type of multimedia mode and interpreting textual information in the presence of other multimedia modes.

Khezrlou et al. (2016) examined 99 university students to determine the effectiveness of explicit, incidental, and intentional learning conditions using multimedia glosses with text, audio, and picture on vocabulary acquisition. Results indicated that glossing was effective in vocabulary learning indicating that time spent clarifying word meanings and enriching the text with multimedia glossing facilitates text comprehension and vocabulary learning. Akbulut (2007) also examined the effects of glosses using

annotations with definitions, pictures, and short videos on Turkish university students' vocabulary attainment, and found that the groups who had the definitions with visuals presented had significantly higher vocabulary scores. Çakmak and Erçetin (2017) investigated the effects of the use of glosses (pictorial, textual, and pictorial/textual) in a mobile phone story on the vocabulary learning of 88 university students in Turkey and found that participants in all of the gloss conditions had significantly higher vocabulary learning, regardless of type, than those in the control group with no gloss. Shahrokni (2009) investigated the effects of online textual, pictorial, and pictorial/textual glosses in computerized reading texts on the vocabulary attainment of 90 adult learners in Iran and found that the combination of text and images resulted in significantly better vocabulary learning. Finally, Proctor et al. (2009) investigated the effects of a vocabulary intervention for 246 fifth-grade students who read multimedia texts with embedded vocabulary instruction that included a multimedia glossary and pictures. Results indicated that there were significant effects for the treatment group for vocabulary (Proctor et al., 2009).

Animations. Animations are the use of visuals in movement, usually with accompanying sound. Animations are created either with drawings or computer images and are not real-life recorded images. Mohsen (2016) addresses the use of animations as a feature of technology to increase vocabulary learning. These animations could be used to assist students in overcoming difficulties they may face when performing listening comprehension tasks related to vocabulary acquisition (Mohsen, 2016).

Mohsen (2016) investigated the effects of using annotated captioned animation and annotated transcript animation in a multimedia listening environment on vocabulary acquisition for intermediate school-level Arab students, and results indicated that these help options were successful in increasing vocabulary.

Spaced Repetitions. Spaced repetition of words is the increase of intervals of time between subsequent reviews of the vocabulary words (Baturay et al., 2009). Timing in multimedia and technology can potentially play a critical factor in vocabulary retainment, as discussed by the articles in this section. It can be conservatively claimed that the time-control technology can play a pivotal role in facilitating the automatization of L2 word decoding skills (Sato et al., 2013).

Sato et al. (2013) utilized a multimedia application using a time-control function to increase the vocabulary attainment of Japanese university students. They found that word recall was greater with the group who received the treatment, with quicker recall of meanings and higher accuracy rates and average scores. Those who participated in the iPad application with the time-control technology not only recalled more words but also recalled meanings more quickly than those who used a paper list on which the target vocabulary was written. Baturay et al. (2009) found similar success when they examined the effects of a web-based program utilizing spaced repetitions to increase the vocabulary of university students, and results indicated that learners' vocabulary retention increased.

Technology can be presented using a variety of features, including screen size, hyperlinked words, glossing, animations, and spaced repetitions. The previous articles

discussed the use of technology features as a means to enhance vocabulary learning. The next section discusses the use of technology platforms to increase vocabulary acquisition.

Technology Platforms. Technology can be presented in a variety of platforms, including interactive whiteboards, television, e-books, and smartphones. The following articles discuss the use of technology platforms as a means to enhance vocabulary learning. While the majority of these studies found success using these varying technology platforms, since there is a limited research base, technology-mediated comprehension is often accompanied by limited applications in schools (Dalton et al., 2011). Future studies should establish an instructional design to help students practice and review English vocabulary (Wu & Huang, 2017). If we provide support for examining more comprehensive views of reading skills rather than fragmented views and combine it with careful scaffolding and opportunities for supported and independent practice, students can build success using these platforms (Trainin et al., 2016).

Interactive Whiteboards. Interactive whiteboards are instructional tools that utilize a white surface with a projector in order to display images that can be interacted with by touch. While only one article provides evidence for the use of this platform, the findings demonstrate that the use of the interactive whiteboard not only helps teachers create active learning environments but also assists students who are learning English in class and at home, which results in higher test scores (Hur & Suh, 2012).

Hur and Suh (2012) examined effective ways to use interactive whiteboards, podcasts, and digital storytelling on vocabulary development of 11 third- and fourth-graders. Results showed that using the whiteboards for interactive games, visual

representations, and test reviews increased vocabulary acquisition. Based on the results, the researchers suggest that teachers use this technology in their classrooms to support ELL learning (Hur & Suh, 2012).

Television. Television is a device that receives images and sound from signals to produce them on a screen for entertainment. The following two articles incorporated the use of this platform as a means of increasing vocabulary learning with specific attention to the use of subtitles. Subtitles are the text of the sound displayed on the television. While both groups of researchers found success with the use of subtitles, Peters et al. (2016) warn that more research is needed to study which type of audiovisual input (cartoon, documentary, movie, etc.) is best suited to vocabulary learning.

Frumuselu et al. (2015) investigated the effects of using a subtitled television series to increase the vocabulary of 40 undergraduate students in Spain. Results indicated that those who received the intralingual (English sound with English subtitles) mode performed better than those who received the interlingual (English sound with Spanish subtitles) mode. Peters et al. (2016) examined the differential effect of first language subtitles and captions on vocabulary learning. The findings indicated that captions benefit vocabulary learning, indicating that learners can learn new words with watching a television program with subtitles or captions in their first language.

E-books. An e-book is an electronic version of a printed book, displayed on a computer, iPad, or other type of mobile device. E-books differ from traditional books in that they offer additional features, such as interactive texts, videos, and dictionaries. The following articles address this aspect of technology for ELLs.

Dalton et al. (2011) investigated the contribution of interactive vocabulary in a web-based scaffolded e-book. Eighty-six fifth-grade participants read multimedia folktales, and results found that embedded technology vocabulary supports were beneficial to not just vocabulary acquisition, but also the comprehension of the overall text. Trainin et al. (2016) also found success with this platform when they examined the effects of using QuickReads (a science/social studies e-book program) with the technology format in 1,484 students in second through fifth grades to increase vocabulary knowledge. Results indicated that QuickReads with technology was successful at increasing vocabulary attainment.

Smartphones. Smartphones are mobile devices that transmit services such as phone calls and text messages, and also have internet connection functions that enable them to perform other tasks, such as running applications (or apps) and connecting to e-mail. The following articles cite this platform as an effective means for vocabulary learning, with two focusing on the use of text messages, and the other focusing on the use of an application. The use of smartphones as a platform was found to be successful, as they are effective tools for learning English vocabulary (Wu, 2015) and can use developed applications as an educational tool in teaching English as a second language (Cavus & Ibrahim, 2017). Although smartphones are best suited to present small chunks of information due to their small screen size, their portability and immediacy should be considered when comparing them to paper-based methods (Saran et al., 2012).

Saran et al. (2012) examined the effectiveness of using multimedia messages via text message with mobile phones to assist in vocabulary learning for elementary and pre-

intermediate Turkish students. The messages used definitions, sentences, visual representations, word formation, and pronunciation. Results indicated that students who participated in the multimedia messages groups retained more words than those who used the web- and paper-based materials. Taki and Khazaei (2011) investigated the effects of a multimodal representation via text message for vocabulary learning using mobile phones with annotations and pictures for 158 young adult students in Iran. It was found that presenting the words with pictorial or written annotations was more effective than without.

Wu and Huang (2017) examined an app that uses a mobile game-based vocabulary practice system using a block clearing game to increase Taiwanese university students' vocabulary. Results indicated that the program enabled students to learn more vocabulary. Wu (2015) examined the effects of a smartphone app in assisting Chinese college-aged students in learning English vocabulary. Results indicated that those who participated in using the app attained more vocabulary than those who did not. Cavus and Ibrahim (2017) investigated the use of a mobile application that uses children's stories to teach vocabulary to 37 students ages 12 to 13. Results indicated that the treatment group had stronger statistically significant improvements then the control group with regard to vocabulary.

Technology can be presented in a variety of platforms, including interactive whiteboards, television, e-books, and smartphones. The previous articles discussed the use of technology platforms as a means to enhance vocabulary learning. The next section discusses the use of technology programs to increase vocabulary acquisition.

Technology Programs. Technology programs are a type of interactive learning that can include games and are designed with a specific goal or population in mind. The following articles discuss the use of specific programs to increase vocabulary learning using games, specific programs, and multimedia shared stories. These types of programs offer different learning pathways and can influence the learning outcomes (Yang & Wu, 2015), as the electronic environment provides a wide range of resources that allows for more information than conventional resources (Dodigovic et al., 2013).

Games. Games are interactive ways of learning that usually include a component of competition and motivation for the learner. Several articles examined games as a means to increase vocabulary learning. These games took place in several different formats, including computer, internet, and gaming system. As Franciosi (2017) warned that the use of games is marginalized because of a perceived lack of effectiveness in learning outcomes, more research needs be done in the field of gaming, specifically with vocabulary learning outcomes, in order to determine the depth and realm of possibilities of using this strategy to increase vocabulary.

Yip and Kwan (2006) conducted a study to evaluate the effectiveness of using online games versus activity-based lessons for vocabulary learning with 100 undergraduate engineering students in Hong Kong and found that experimental group who participated in the online games scored higher than the control group with regard to retainment and retrieval of vocabulary words. They determined that if the games are fun, relaxing, motivating, and confidence boosting, the learners' interest is more likely to be aroused, and therefore it is essential to ensure the games offer continuous motivation (Yip

& Kwan, 2006). This agrees with Ebrahimzadeh and Alavi (2016), who found that enjoyment was essential to the gaming experience, and in order to increase vocabulary, recommended that it have a central role in the game-play with different dimensions of enjoyment in order to improve the chances of encountering the target items. Their study examined the effects of vocabulary learning using a digital video game, Warcraft III, for high school students in Iran, and results indicated that vocabulary attainment increased regardless of players or watchers of the game, and it correlated to e-learning enjoyment (Ebrahimzadeh & Alavi, 2016).

Franciosi (2017) investigated the effects of using a computer game-based lesson for Japanese university students. Results indicated that the use of game-based approaches can improve the transferability of learned vocabulary. Lan (2013) also found success with utilizing a gaming approach on 61 sixth-grade students' vocabulary attainment in Taiwan, where results indicated that the program benefited vocabulary attainment, especially when performed with the sharing of other online learners. Scaffolding and co-sharing were also important factors in this study, which enhanced the vocabulary learning of these students (Lan, 2013).

Specific Programs. Several specific programs were utilized to increase vocabulary learning. These programs used multiple modalities, where their participants were engaged with a variety of technology features, including animations and pictures. While the following articles all found success with their programs on vocabulary achievement, it is impossible to compare one directly to another, as each program used

different features, and it would be impossible to know which specific feature was responsible for the success of the program.

Yang and Wu (2015) investigated the effects of an e-learning system, MyEVA, which uses a mixed-modality approach, to improve vocabulary acquisition for undergraduate students in Taiwan. Results indicated that the program increased vocabulary retention longer term. Wicha et al. (2012) examined the effects of a program, Total Communication with Animation Dictionary (TCAD), for 18 hearing-impaired fifth-grade students. This program incorporates animation, pictures, finger spelling, lip reading, and contextual illustration. Results indicated that the TCAD program was more successful at increasing vocabulary knowledge than traditional methods. Kurt and Bensen (2017) examined the effects of using Vine vocabulary videos (short, looping videos) to improve vocabulary for 32 university students in Turkey. Results indicated that those who used the Vine vocabulary videos were more successful in attaining vocabulary than those who did not. Fahim et al. (2011) examined the effects of e-mailing on vocabulary retention for 40 Iranian young adult students. Results indicated that e-mail can enhance the retention of vocabulary better than handing out a paper version of the same words, definitions, and sentences. Dodigovic et al. (2013) examined the effects of technology-supported flashcard activities using WordChamp to increase vocabulary learning. Results indicated that there was a statistically significant improvement in target vocabulary learning.

Multimedia Shared Stories. Multimedia shared stories use technology to facilitate reading between adults and students using a program to enhance the e-book that may

include animation, sound, or video. Two articles found success with this strategy, specifically with students who also have a disability. English and Spanish vocabulary acquisition for culturally and linguistically diverse students with moderate ID can be improved utilizing multimedia shared stories (Riveria et al., 2014). Since this was proven to be effective with those with a disability, multimedia shared stories have the potential to help others, as primary language, shared stories, technology, and systematic instruction can be combined to provide effective vocabulary instruction to meet students' needs (River, Spooner, & Hicks, 2013).

Rivera et al. (2014) investigated the effects of a multimedia shared story to teach vocabulary words in English and Spanish to an ELL with moderate ID. Results indicated that the participants acquired Spanish vocabulary words as well as English vocabulary, but the English words were at an accelerated rate. Rivera et al. (2013) examined the effects of a multimedia shared story intervention on two elementary ELLs with ID. Both participants made gains in English vocabulary acquisition.

Multimedia in technology, as discussed in this section, has been proven to be an effective strategy for ELLs based on the current literature. In the following section, the current literature for multimedia in technology for early childhood students is discussed.

Multimedia in Technology for Early Childhood Students

Now that a broad view of the literature for ELLs and the current standing of multimedia in technology has been presented, a more narrowed view is needed to understand the current state of the literature for DLLs. Since there is little evidence specifically citing DLLs, this section will present the literature on multimedia in

technology for early childhood-aged students who are learning only one language. Following that, the two sections, “Multimedia in Technology for ELLs” and “Multimedia in Technology for Early Childhood Students”, will be bridged together and combined with the current limited research on DLLs in order to demonstrate the current gap in the literature that substantiates the need for this research.

While the research on multimedia in technology for early childhood-aged students is not as deep as the research for ELLs, it will be presented in the same format as the previous section (technology features, platforms, and programs), in order to assist with making connections between ELLs and early childhood-aged students.

Technology Features. Technology features can include items such as screen size, hyperlinked word, glossing, animations, and spaced repetitions, as discussed in the previous similar section for ELLs. While there was no research found on these features for early childhood students, an overwhelming amount of evidence points to the use of videos as a technology feature for increasing the early childhood students’ vocabulary. Video watching by students in this age range has increased from 5 minutes per day in 2011 to 47 minutes per day in 2017, indicating the need for an intentional approach to the design of media to offer opportunities to learn vocabulary (Neuman et al., 2018).

Videos. Videos are visual images that move with accompanying sound. They utilize images of the real world and are often shot in real time. Similar to the evidence for the use of videos in vocabulary learning for ELLs, few articles provide insight specifically on videos for students in the early childhood age range. This evidence is

important, as utilizing videos can enhance children's vocabulary, while also capitalizing on children's interest in educational media (Neuman et al., 2018).

Neuman et al. (2018) studied the effects of online streamed videos for vocabulary learning of low-income preschool students. They identified the prevalence of vocabulary opportunities as well as the pedagogical supports within the multimedia, which showed that ostensive cues and attention-directing cues were most frequently used. Additionally, they found that children with higher vocabulary scores were more likely to use these cues, and thus increase their vocabulary at a higher level. Cambers et al. (2006) found that multimedia-embedded videos can enhance receptive vocabulary learning by combining both visual and verbal memory systems for first graders. Adding this multimedia aspect to a beginning reading program enhanced the students' ability for achievement. Neuman et al. (2011) investigated the use of videos in a year-long intervention for 3- and 4-year-olds. They found that those in the treatment group made gains in targeted word knowledge and were able to sustain the results six months later. Gremmen et al. (2016) investigated vocabulary attainment with 3- and 4-year-olds using multimedia video-based home activities. Results indicated that the children learned significantly more vocabulary words receptively and expressively.

Technology can be presented using a variety of features, including screen size, hyperlinked word, glossing, animations, and spaced repetitions. The previous articles discussed the use of technology features as a means to enhance vocabulary learning. The next section discusses the use of technology platforms to increase vocabulary acquisition.

Technology Platforms. Technology can be presented in a variety of platforms, including interactive whiteboards, television, e-books, and smartphones, as discussed in the previous section for ELLs. The following articles discuss the use of technology platforms as a means to enhance vocabulary learning via e-books, as cited by the current field of research. E-books usually include multimedia effects such as music, sound effects, and animations, which act as a built-in support that improves comprehension (Korat, 2010).

E-books. An e-book is an electronic version of a printed book, displayed on a computer, iPad, or other type of mobile device. E-books differ from traditional books in that they offer additional features, such as interactive texts, videos, and dictionaries. E-books have the potential to increase vocabulary learning, as the technology allows for adaptations to different linguistic groups (Leacox & Jackson, 2014).

Leacox and Jackson (2014) examined the effects of technology-enhanced repeated readings of e-books on the vocabulary attainment of 24 preschool and kindergarten students in the United States. While those in the repeated readings group showed more significant gains than the control group, it is not possible to determine if this is a direct result of the technology features or other strategies used in the study. Roskos and Burstein (2012) found that preschool-aged children attained target vocabulary words in e-book stories of about two new words per week expressively, and one word per week receptively, determining that an e-book may extend the opportunities for word learning when combined with direct teacher support. Korat and Shamir (2012) investigated the use of e-books to increase the vocabulary of Israeli pre-kindergarten and

kindergarten students to increase their vocabulary definition knowledge. This was supported by the dictionary feature, which supported the students with word meaning. Korat (2010) studied the effects of repeated e-book readings on kindergarten and first-grade Israeli students, and found that vocabulary was increased for both groups, but was more significant for kindergarten students. Korat et al. (2014) later examined the effects of an e-book dictionary with static or dynamic visuals with or without printed focal words on the vocabulary attainment of 250 second graders in Israel. While all of the types of visuals and printed focal words were successful in helping students attain vocabulary, the most successful was the use of animations and focal words together.

Technology can be presented in a variety of platforms, including interactive whiteboards, television, e-books, and smartphones. The previous articles discussed the use of technology platforms as a means to enhance vocabulary learning. The next section discusses the use of technology programs to increase vocabulary acquisition.

Technology Programs. Technology programs are a type of interactive learning that can include games and are designed with a specific goal or population in mind. The following articles discuss the use of specific programs to increase vocabulary using multimedia shared stories and applications. It is imperative that language educators continue to determine the effectiveness of language learning utilizing these programs (Terantino, 2016).

Multimedia Shared Stories. Multimedia shared stories use technology to facilitate reading between adults and students using a program to enhance the e-book that may include animation, sound, or video. These stories are well suited to help educators with

early literacy instruction to develop vocabulary by highlighting connections between words and images (Zhou & Yadav, 2017). The following presents the current research on multimedia shared stories for early childhood students.

Zhou and Yadav (2017) found that five-year-old preschool students' participation in an intervention utilizing multimedia stories with questioning led to an increase in vocabulary achievement, hypothesizing that it may be due to the connection between the auditory and visual image that the multimedia provided. Teepe et al. (2017) found that the use of storytelling supported by visual, auditory, and textual prompts on a tablet computer, assisted by a parent, led to increased expressive vocabulary for 3-year-old children.

Applications. An application refers to a specific program or software that is developed for use on an iPad or tablet. Often these applications are interactive and can include multiple forms of multimedia, such as videos, sound, text, and animation. As vocabulary words are embedded in the application, children are engaged by selecting pictures and associations of vocabulary words, thus providing an auditory and visual definition of the vocabulary at the same time (Vatalaro et al., 2018). Since this type of technology program needs little teacher support, iPads or tablets may be a helpful tool for providing students opportunities to learn new vocabulary (Dennis et al., 2016).

Vatalaro et al. (2018) examined the effects of utilizing mobile apps for early childhood students ages 3 through 5 from economically disadvantaged communities to increase their expressive and receptive vocabularies. Results indicated that the children who used the scaffolded vocabulary applications performed higher on their receptive

skills than those who used open ended apps. Dennis et al. (2016) found success with an iPad-based application intervention for preschool at-risk students to increase students' expressive and receptive vocabulary. Walter-Laager et al. (2017) studied the effects of an interactive word learning application for the vocabulary acquisition of 2-year-olds. They found that children who used the tablet increased their vocabulary attainment, and that when adult accompaniment was added, their vocabulary learning was further increased. Dennis et al. (2016) investigated the use of iPad applications to increase preschool children's vocabulary instruction and found that expressive verb knowledge was increased.

As discussed in the current section, multimedia in technology has been proven to be an effective strategy for early childhood students based on the current literature. In the following section, the current literature for multimedia in technology for DLLs is discussed.

Multimedia in Technology for DLLs

The current research for multimedia in technology for DLLs is very limited, as few articles address the use of this strategy for early childhood-aged students who are learning an additional language. Due to this lack of evidence in this specific field, the areas of multimedia in technology for ELLs and early childhood students must be bridged and then combined with the current literature in order to have a comprehensive view of the current state of this field.

Bridging Multimedia in Technology for ELLs and Early Childhood-Aged Students

While the literature for multimedia in technology for ELLs is currently vast and fragmented, it does suggest several specific aspects of multimedia that are effective for ELLs. In contrast, while the current literature for multimedia in technology for early childhood students is fairly limited, it is concentrated around four specific aspects: e-books, multimedia shared stories, videos, and applications. E-books, multimedia shared stories, and applications are also noted in the ELL literature, indicating their potential for being successful strategies for DLLs. Additionally, while videos are not directly studied for ELLs, they are often embedded within the other aspects, indicating their use as part of the success. And since several early childhood studies examined videos solely and found their use to be a successful strategy, this also indicates their potential as a successful strategy for DLLs. Although these conclusions are only hypothetical, the few studies from the current literature on multimedia in technology for DLLs also support the use of these aspects.

Current Literature

Little evidence is present in the current literature that makes a strong case for any specific aspect of multimedia in technology as a successful strategy for DLLs. However, the research presented below addresses e-books, videos, multimedia shared stories, and applications that show promise for use of multimedia as a strategy to increase the vocabulary acquisition of DLLs.

The use of multimedia as a strategy for DLLs is vaguely noted in the literature, as there is very little evidence currently available. The most limited evidence is for e-books

and videos, as only one study specifically targeted vocabulary for DLLs. The use of e-books for DLLs was studied by Verhallen and Bus (2010), who found that the use of digital storybooks increased DLLs' vocabulary both expressively and receptively. The use of videos was studied by Silverman and Hines (2009), who found that the use of multimedia to aid in science instruction increased DLL students' vocabularies in target words, general knowledge, and content.

Multimedia shared stories have slightly more evidence for their success with DLLs, although it is still extremely limited. Tsou et al. (2004) found that using multimedia for storytelling increased students' language proficiency, as DLLs retained more words, phrases, and sentences, which resulted in greater sentence complexity and language proficiency. Another study also found that using multimedia for storytelling was successful, as it increased students' abilities to comprehend the story as well as their vocabularies without direct instruction (Verhallen et al., 2006).

Applications also have slightly more evidence for their success with DLLs, although it is still extremely limited. Foster et al. (2018) examined the use of a specific software program on math vocabulary acquisition of kindergarten DLLs. Results indicated that English and Spanish vocabulary scores were increased, indicating that this software could serve as a supplemental method to increase language and vocabulary. Terantino (2016) examined the use of iPad applications to increase preschool children's second language vocabulary for animals. This case study found that students who participated in 15 minutes per day of application free play increased their vocabulary knowledge in the target language.

This research corroborates the findings from the literature for multimedia in technology for ELLs and early childhood-aged students, thus making a case for the potential promise of multimedia for the vocabulary learning of DLLs.

Problem Statement

The NAEYC calls for strategies that reduce learning gaps in language development (2009). Native language supports have been shown to increase vocabulary, thus increasing language proficiency. Foster et al. (2018) recommends that DLLs participate in supplemental interventions that target language proficiency in both English and Spanish, as DLLs need high-quality learning experiences with enhancements in their home languages (Nemeth & Simon, 2013).

As evident from the literature, there is little research regarding the use of multimedia in technology for DLLs. When used intentionally, multimedia in technology is an effective tool to support learning (Donahue & Schomburg, 2017); however, research is behind with the current practice of using multimedia in technology in the classroom, as there is almost no empirical evidence on the short- and long-term effects of using applications (Walter-Laager et al., 2017). Smaller-scale studies are needed in order to examine the separate impacts of multimedia components to build a theoretical base for embedding multimedia in instruction (Cambers et al., 2006). If researchers and educators are able to maximize the design capabilities of multimedia, it may offer an important additional scaffold to facilitate children's vocabulary development (Neuman et al., 2018).

The current study seeks to expand the current literature, as it will utilize iPads with a multimedia-based application that includes native language supports in order to

increase the expressive and receptive vocabulary of DLLs. This study is supported by the current literature, as using technology to bridge language barriers in early childhood education can help broaden views of how to use technology to meet the needs of all children (Nemeth & Simon, 2013). Additionally, the use of word learning applications has the potential to be meaningful and motivating, as they are a good way for young children to learn new words and remain motivated (Walter-Laager et al., 2017). This research has the potential to assist many DLLs, as the use of iPads offers language-learning opportunities if others are not available or if programs have limited resources (Terantino, 2016). Using multimedia enhancements for DLLs is one way that educators can meet their goal of vocabulary attainment and close the gap between DLLs' and non-DLLs' knowledge of instructional words, as well as narrow general vocabulary knowledge (Silverman & Hines, 2009).

Pilot Study

A pilot study was conducted in the spring of 2018 to examine the procedures, protocols, and assessments for their ease of use and effectiveness. A modified version of the current study was employed in this pilot study. This pilot study utilized a three-week intervention with seven participants, age 4, at the same location as this dissertation study. It included only the researcher-created targeted vocabulary measures. The following will describe the procedures, results, discussion, and limitations, as well as the implications for the current dissertation study.

Procedures. Students participated in a three-week teacher directed supplementary intervention. Participants received the supplementary intervention three times per week at

30 minutes per session. 15 targeted vocabulary words from the current curriculum were chosen as the focus, with preference given to science as the selected content area. Scripted lesson plans were implemented, with a focus on five vocabulary words per week. Each lesson included components; 1) vocabulary review utilizing research based strategies, 2) a read aloud that incorporates the use of the target words, and 3) the implementation of the selected multimedia. This multimedia selected for this intervention will be in the form of the iPad application, Pocoyo. These procedures included the same components as the current study, but with different targeted vocabulary words, and more words per week, due to the age of the participants and the time of year.

Results. Four two-way mixed Analyses of Variance (ANOVAs) were conducted to analyze the results of this pilot study, with one per assessment type (Receptive English, Receptive Spanish, Expressive English, and Expressive Spanish). This method was selected due to the small sample size (N=7) in order to not diminish power of the statistical analysis. The results of the ANOVAs are presented below.

Receptive English. The results of the two-way mixed ANOVA indicated that there was no significant main effect of control/treatment group on overall vocabulary word attainment ($F(1,5)=0.86$, $p=.781$, $\eta p^2=.017$), with control ($M=13.75$, $SD=0.55$) and treatment ($M=13.5$, $SD=0.64$) groups performing similarly overall.

In addition, there was no significant interaction between pre/post-test scores and control/treatment groups ($F(1,5)=1.13$, $p=0.33$, $\eta p^2=.185$). Descriptive statistics showed that both groups gained more words from pre- to post-test, with the control group gaining more vocabulary words in post-test ($M=14.5$, $SD=0.22$) than pre-test ($M=13$, $SD=1.0$),

and the treatment group gaining more vocabulary words in post-test (M=15.0, SD=0.25) than pre-test (*M*=12.0, *SD*=1.15), suggesting that both forms of interventions were effective.

In contrast, there was a significant main effect on pre/post-test scores on overall vocabulary word attainment ($F(1,5)= 10.21$, $p=.024$, $\eta p^2 = .671$), with the pre-test scores slightly lower (*M*=12.5, *SD*=0.76) than the post-test scores (*M*=14.75, *SD*=0.17). Partial Eta Squared found these effects to be the medium range, indicating that there was a medium effect size on vocabulary word attainment from pre- to post-test.

Receptive Spanish. The results of the two-way mixed ANOVA indicated that there was no significant main effect of control/treatment group on overall vocabulary word attainment ($F(1,5)=.05$, $p=.825$, $\eta p^2=.011$), with control (*M*=12.25, *SD*=1.17) and treatment (*M*=11.88, *SD*=1.35) groups performing similarly overall.

In addition, there was no significant interaction between pre/post-test scores and control/treatment groups ($F(1,5)=0.06$, $p=.814$, $\eta p^2=.012$). Descriptive statistics showed that both groups gained more vocabulary words from pre- to post-test, with the control group gaining more vocabulary words in post-test (*M*=14.5, *SD*=0.53) than pre-test (*M*=10.0, *SD*=1.82), and the treatment group gaining more vocabulary words in post-test (*M*=14.33, *SD*=0.61) than pre-test (*M*=9.33, *SD*=2.10), suggesting that both forms of interventions were effective.

In contrast, there was a significant main effect on pre/post-test scores on overall vocabulary word attainment ($F(1,5)= 22.10$, $p=.005$, $\eta p^2= .816$), with the pre-test scores fairly lower (*M*=9.66, *SD*=1.39) than the post-test scores (*M*=14.41, *SD*=0.40). Partial Eta

Squared found these effects to be the medium range, indicating that there was a medium effect size on vocabulary word attainment from pre- to post-test.

Expressive English. The results of the two-way mixed ANOVA indicated that there was no significant main effect of control/treatment group on overall vocabulary word attainment ($F(1,5)=3.24$, $p=.131$, $\eta p^2=.394$), with control ($M=11.62$, $SD=0.43$) and treatment ($M=12.83$, $SD=0.50$) groups performing similarly overall.

In addition, there was no significant interaction between pre/post-test scores and control/treatment groups *(*F $(1,5)=0.53$, $p=.496$, $\eta p^2=.097$). Descriptive statistics showed that both groups gained more vocabulary words from pre- to post-test, with the control group gaining more vocabulary words in post-test ($M=13.75$, $SD=0.41$) than pre-test ($M=9.50$, $SD=0.59$), and the treatment group gaining more vocabulary words in post-test ($M=14.66$, $SD=0.47$) than pre-test ($M=11.0$, $SD=0.68$), suggesting that both forms of interventions were effective.

In contrast, there was a significant main effect on pre/post-test scores on overall vocabulary word attainment ($F(1,5)= 99.17$, $p=.000$, $\eta p^2= .952$), with the pre-test scores fairly lower ($M=10.25$, $SD=0.45$) than the post-test scores ($M=12.83$, $SD=0.50$). Partial Eta Squared found these effects to be the medium range, indicating that there was a medium effect size on vocabulary word attainment from pre- to post-test.

Expressive Spanish. The results of the two-way mixed ANOVA indicated that there was no significant main effect of control/treatment group on overall vocabulary word attainment ($F(1,5)=0.12$, $p=.738$, $\eta p^2=.024$), with control ($M=6.50$, $SD=1.54$) and treatment ($M=7.33$, $SD=1.78$) groups performing similarly overall.

In addition, there was no significant interaction between pre/post-test scores and control/treatment groups *(F* (1,5)=.616, *p*=.468, ηp^2=.110). Descriptive statistics showed that both groups gained more vocabulary words from pre- to post-test, with the control group gaining more vocabulary words in post-test (*M*=7.25, *SD*=1.40) than pre-test (*M*=5.75, *SD*=1.74), and the treatment group gaining more vocabulary words in post-test (*M*=7.66, *SD*=1.62) than pre-test (*M*=7.00, *SD*=2.01), suggesting that the control form of the interventions was more effective than the treatment form.

There was no significant main effect on pre/post-test scores on overall vocabulary word attainment (*F*(1,5)= 4.16, *p*=.097, ηp^2= .454), with the pre-test scores (*M*=6.37, *SD*=1.33) fairly similar to the post-test scores (*M*=7.45, *SD*=1.07).

Discussion. Results of this study indicated that both control and treatment group interventions were successful in all four areas. This was to be expected, as both forms of the interventions used research-based strategies to teach vocabulary. In addition, three of the areas (receptive English, receptive Spanish, and expressive English) found significant main effects from pre- to post-test in the small to medium range, also indicating that the interventions were successful. Although the Expressive Spanish component did not find a significant effect, this was not surprising, as the goal of the intervention was to increase English vocabulary utilizing Spanish as a native language support. Since Spanish vocabulary was not directly and explicitly taught, but instead used as a catalyst to help students transfer language from their first to second language, this result was to be expected. It was, however, interesting that the participants increased their receptive

Spanish vocabulary skills, as this shows that these interventions may also be beneficial to some development of the participants' first language.

None of the areas found a statistically significant main effect for control/treatment group, indicating that the treatment group (which used the addition of multimedia) did not have any stronger effect than the control group. This result was difficult to interpret, as it may have been due to any number of factors. The strongest possibility was that limited attendance may have influenced the treatment group's performance level. The control group had a total of four absences over the three-week period, while the treatment group had a total of nine absences over the four-week period, which is more than double the control. In addition, one participant was dropped from the treatment group halfway through the process, as they moved to another school (this participant's absence was not included in the total absences previously mentioned). It is not possible to know if these factors influenced the treatment groups' performance for certain without performing an additional study.

Limitations. The results of this pilot study need to be interpreted very cautiously, as there were several limitations to the study with regard to participants and time. As this was a pilot study, it was only designed to be a three-week intervention, and therefore may not have yielded enough time to find significant results. In addition, there were only seven participants, making the sample very small and uneven in group sizes. Finally, these seven participants were often absent due to illness, which made the attendance of the groups very inconsistent. Future work needs to be done in order to address these limitations to develop more valid and reliable results.

Implications for Dissertation. Some areas for improvement were discovered from conducting the pilot study. These areas for improvement included materials, procedures, and assessments. These areas are described in detail below, as well as the way they have been remediated for the current study.

Materials. The majority of the materials were well thought out and incorporated items that were both engaging and interactive in each of the three components. However, one area for improvement was Component Three of the control group. In this pilot study, the control group simply repeated the same activities from Component One, which led to difficulty keeping the students engaged. For the current study, activities completely different from Component One are employed for Component Three for the control group.

Procedures. Most of the procedures went as planned. However, some room for improvement was noted. The director of the center was the communication link between the researcher and the teachers, who were ultimately communicating with the parents of the participants. This made things a bit difficult, as at times, the teachers were unaware of exactly what was happening with the study, and therefore so were the parents. To remedy this for the current study, the researcher communicated directly with the teachers in addition to the director, so that all involved parties understood what was going on. Additionally, direct contact with the researcher for the parents of the participants was provided, as well as a specific schedule for each participant. Introductory lessons were also included in the current study for the participants to become acquainted with the researcher and feel comfortable completing the first set of assessments, to ensure that the most reliable results could be gained.

Assessments. The researcher created a targeted vocabulary assessment, which was used for this pilot study. The majority of images shown in the assessment were found to target what the researcher intended; however, it was determined that there was a need to include some clarifying questions for more difficult Tier 2 vocabulary words that were harder to distinguish among the four images. Additionally, some of the images have been changed based on the feedback from the participants.

Finally, the order in which the assessments were given also needed to be adjusted, as it was unclear if the participants were simply selecting the same image on the receptive test in both English and Spanish, due to the positive feedback provided. In order to remedy this for the current study, the order in which the words were presented was altered on the English and Spanish versions to avoid this potential issue.

In Chapter Two, I reviewed the current literature from the field, to include vocabulary's effect on language achievement and moving into vocabulary intervention strategies for both ELLs and DLLs. Then I discussed the specific strategies being examined in this study, native language supports and multimedia in technology, as they pertain to DLL achievement. A statement of the problem supported by the current literature was presented, and finally, the results of a pilot study were described and analyzed. In Chapter Three, I discuss the methods for the current study to include the setting, participants, procedures, and measures.

CHAPTER THREE

Methods

In Chapter Two, I discussed the current literature from the field, which builds the case for the current study. In Chapter Three, I describe the methods of the current study to include the design, participants, setting, procedures, and measures. An experimental crossover research design was utilized to investigate the effects of multimedia-enhanced instruction on the vocabulary acquisition of DLLs. An intervention that investigated the use of the combined strategies of multimedia with native language supports was examined for effects on vocabulary attainment in the areas of expressive and receptive language. This eight-week intervention consisted of three components in a small group setting. Pre-, mid-, and post-assessment measures were given to assess the effectiveness of the intervention in both generalized and targeted vocabulary areas. Table 1 lists the research questions and corresponding method and data sources for this study. This study had full approval from the Internal Review Board, as seen in Appendix H.

Table 1

Research Questions, Method, and Data Sources

Research Question	Method	Data Sources
1. What effect does an intervention utilizing the strategies of multimedia with native language supports have on the vocabulary attainment of dual language learners in the areas of receptive and expressive vocabulary?	1. Quantitative Intervention Study • AB/BA Crossover Design	1. Pre/Mid/Post Norm-Referenced Assessments • Peabody Picture Vocabulary Test-5 (PPVT-5) • Expressive Vocabulary Test-3 (EVT-3) 2. Researcher-Created Assessments • Targeted Vocabulary Assessment (TVA)
a. Does the intervention have varying effects on receptive and expressive vocabulary based on DLLs language proficiency?	a. Data disaggregated by language level	a. Pre-Norm-Referenced Assessment • Pre-Idea Proficiency Test (Pre-IPT)

Design

A crossover design is a repeated measures design where each participant receives both the control and treatment intervention over different periods (Piantadosi, 2005). This design was selected due to its ability to support fewer participants while attaining an acceptable level of statistical power (Piantadosi, 2005).

In a crossover design, it is important that there is uniformity within the sequences and periods (Piantadosi, 2005). For this study, an AB/BA design was utilized, as each participant group received both the control and treatment interventions for the same

amount of time, in the same order. This specific design enables the period and sequence effects to be removed, as the two-sequence, two-period design is uniform and balanced (Piantadosi, 2005). Table 2 shows the Latin Square design with the included time period schedule for each treatment group, as well as the included assessment periods.

Table 2

Study Design

Treatment Groups	Pre-Assessments (3 weeks)	Treatment Period 1 (4 weeks)	Mid-Assessments (1 week)	Treatment Period 2 (4 weeks)	Post-Assessments (2 weeks)
AB	Pre-IPT		PPVT-5		PPVT-5
(Groups 1, 3, 5)	PPVT-5	A	EVT-3	B	EVT-3
	EVT-3		TVA		TVA
	TVA				
BA	Pre-IPT		PPVT-5		PPVT-5
(Groups 2. 4. 6)	PPVT-5	B	EVT-3	A	EVT-3
	EVT-3		TVA		TVA
	TVA				

Note: A= treatment intervention, B= control intervention

When using this design, it is important to be aware of and account for there are some limitations to be aware of and accounted for. Carryover effect is when the effect of the treatment from the previous time period affects the response on the current time period (Piantadosi, 2005). Washout periods diminish this effect, and therefore, a washout period of one week was included to minimize the carryover effect, which coincides with the assessment time (Piantadosi, 2005). Additionally, the carryover effect is also

minimized by the selection of different vocabulary words for each period, helping to pinpoint exactly which intervention components were successful in the acquisition of vocabulary.

Participants

This experimental study consisted of a total of 16 participants from three different classrooms in grade pre-kindergarten. Participants ranged in age from approximately 3 years and 3 months to 4 years and 4 months old. One hundred percent of the participants had a native language of Spanish. Table 3 includes additional demographic information for the participants, broken down by treatment group. Originally, 18 participants were recruited for the study; however, one participant was dropped from the study due to moving halfway through, and another was dropped due to issues with assent throughout the first few days of the intervention. The results of these two students' assessments are not included in the final data set.

Table 3

Participant Demographic Characteristics

Characteristic	Full Sample (*n*=16)	Group AB (*n*=8)	Group BA (*n*=8)
Gender (%)			
Male	8 (50)	4 (50)	4 (50)
Female	8 (50)	4 (50)	4 (50)
Age			
M	3.79	3.9	3.68
SD	.28	.26	.27
Min-Max	3.34-4.25	3.50-4.25	3.34-4.20
Pre-IPT Level (%)			
Beginner	4 (25)	1 (12)	3 (37)
Early Intermediate	4 (25)	3 (37)	1 (12)
Intermediate	3 (18)	2 (25)	1 (12)
Early Advanced	5 (31)	2 (25)	3 (37)

Due to the crossover design utilized for this study, each student is counted twice in the control and treatment groups, thereby creating 16 participants total for each condition. Each of the six groups was assigned to a condition; group "AB" received the treatment in the first period, and control in the second period, while group "BA" received the control in the first period, and the treatment in the second period. Refer to Table 2 in the previous section to review the conditions, periods, and sequence of the intervention design.

Assignment to Condition. Participants were randomly assigned to a control and treatment group by classroom with three students per group, for a total of six groups. Participants were stratified as best as possible within the control and treatment groups

based on DLL level to produce more equally spread conditions. Additionally, teacher input was gathered when creating the groups for best mix of personality and ability.

Participants were given an assessment to determine their initial English language abilities. The Pre-Idea Proficiency Test (Pre-IPT) from Ballard and Tighe was administered in order to develop a baseline for the language proficiency level of the participants. This instrument has been designed specifically for preschool-aged children who have no experience with taking tests and are written and normed according to the American Psychological Association standards, as well as TESOL standards (Ballard & Tighe, 2018). The Pre-IPT was piloted and field tested with participants from a broad range of backgrounds, socio-economic status, and language abilities (Ballard & Tighe, 2018). The Pre-IPT reports reliability and validity coefficient alphas of .95 and above. Participants were placed into different levels of English language ability based on how they scored on this assessment. This assessment includes five different levels based on oral scores only: beginner, early intermediate, intermediate, early advanced, and advanced. Refer to Table 3 for the breakdown of these data for the sample.

Inclusion Criteria. To qualify for the study, each participant needed to be identified as a DLL with a native language of Spanish. This was determined by a Home Language Survey supplied by the researcher. Parents/guardians of the participants filled out this survey about their child and family in order to determine if the participants qualified as a DLL. The survey asked the following questions: (1) Do you (the parent) speak a language other than English? If so, what language?, (2) Does your child speak a language other than English? If so, what language?, and (3) Do you speak to your child in

a language other than English? If so, what language? A response of "yes" to any of the survey questions, along with the notation of Spanish as the native language spoken, qualified the student to be identified as a DLL for the purposes of this study. Please refer to Appendix A and Appendix B for the Home Language Survey in English and Spanish.

Consent/Assent. Consent from the participants' parents/guardians took place at the daycare facility and was facilitated by the researcher and translator (if needed), with the assistance of the classroom teacher, curriculum director, and program director. The researcher ensured that the participants and their parents/guardians understood the nature of the research; this was an intervention-based study intended to increase the vocabulary of those who are learning English as a second language in the early childhood age range. The benefits of the study included direct instruction from a licensed ESOL teacher (the researcher) in a small group setting using research-based strategies that would increase the English vocabulary of the participants. Risks were minimal, in that the only foreseeable risk was missed participation in the classroom teacher's instruction. To ensure participants did not lose this instructional time from their classroom teacher, the researcher accommodated the classroom teacher's schedules when creating the intervention schedule, to be sure that pertinent instructional time was not missed by the participants in the intervention. The intervention took place during free group center times, so as to avoid missing the most essential times of direct instruction, outdoor activity, breakfast/snack/lunch, or nap times.

Participants and their parents/guardians were invited to review one of the sample lesson plans per their request. Participants' parents/guardians voluntarily decided if they

wanted their child to participate, and those who agreed to the study signed an informed consent form. Please refer to Appendix C, Appendix D, Appendix E, and Appendix F for the informed consent form and recruitment letter in both English and Spanish.

Additionally, child assent was also gained from the participants themselves. This was completed through an in-person assent script, with the help of a translator as needed. This script used kid-friendly terms to describe what would happen during the study and provided answers to typically asked questions. These questions included (1) Will anything bad happen?, (2) Will anything good happen?, (3) What if I do not want to do this?, (4) Who can I talk to about this study?, and (5) Would you like to participate?. Refer to Appendix G for the Child Assent Script.

Setting

The study took place at an early childhood education center outside of Washington, DC that has been providing high-quality, bilingual early childhood education to low-income children and their families for over 30 years. This facility has four major locations, with 532 children ages 0 through 5, and 380 children ages 6 through 17. Eighty-one percent of these children have a primary language other than English, with the majority identifying Spanish as their native language. The majority of the center's revenue comes from grants and contribution at 77.9%. The additional money comes from parent fees (5.8%), rental income (6.3%), net investment gains (6.2%), and catering service fees (3.8%). The current study took place at one of the locations of this facility, which houses 173 children—77 three-year-olds, 80 four-year-olds, and 16 two-year-olds.

Procedures

Participants engaged in an eight-week researcher-directed intervention. Participants received the intervention three times per week, for 15 minutes per session, for a total of 45 minutes per week. Thirty-two vocabulary words that coincided with the current curriculum were selected as the target vocabulary. Lesson plans included three components with a focus on four vocabulary words per week. The researcher conducted this intervention, in order to ensure reliability and fidelity of the procedures.

As shown in Table 4, each lesson included three components: *Introduction*, *Read Aloud*, and *Activities*. The first two components, *Introduction* and *Read Aloud*, included the same elements for both the control and treatment groups, in terms of teaching strategy, procedures, and materials. Component Three, *Activities*, included elements that varied for the intervention groups, depending on the instructional period they were currently in (A=treatment, B=control). The intervention lasted for a total of 45 minutes—15 minutes per day, 3 days per week. Refer to Table 5 for the specific differentiating elements of the intervention based on weekly theme and targeted vocabulary.

Table 4

Daily Intervention Component Schedule

Component	Duration Per Lesson	Treatment Group (A) Lesson Elements	Control Group (B) Lesson Elements
One: Introduction	3 minutes	• Total Physical Response • Realia	• Total Physical Response • Realia

Two: Read Aloud	2 minutes	• Read Aloud	• Read Aloud
Three: Activities	10 minutes	• iPad App	• Matching • Game

Table 5

Intervention Themes and Corresponding Materials by Week

Week	Target Vocabulary	Read Aloud	iPad Application
Week 1: *Winter*	• snowy/ neveoso • cloudy/ nublado • cold/ frío • winter/ invierno	*In the Winter/En el Invierno*	Pocoyo Seasons • Season Explorer
Week 2: *Movements*	• hopping/ saltando • walking/ caminando • swimming/ nadando • running/ corriendo	*How Winter Animals Move/ Cómo se mueven los animals de invierno*	Pocoyo Let's Move • Get Moving
Week 3: *Colors*	• red/ rojo • black/ negro • brown/ café • yellow/ amarillo	*Colors of Winter Clothes/ Colores de ropa de invierno*	Pocoyo Colors • Color Bot
Week 4: *2D Shapes*	• square/ cuadrado • triangle/ triángulo • rectangle/ rectángulo • circle/ circulo	*Shapes of Winter Clothes/ Formas de ropa de invierno*	Pocoyo 2D Shapes • Shape Drop
Week 5: *Community Helpers*	• veterinarian/ veterinario • sick pet/ mascota enferma • paramedic/ paramédico	*Medics in the Community/ Medicos en la comunidad*	Pocoyo Community Helpers • Help the Helpers

Week	Target Vocabulary	Read Aloud	iPad Application
	• ambulance/ ambulancia		
Week 6: *Community Helpers*	• teacher/ maestra • book/ libro • crossing guard/ el guardia de cruce escolar • whistle/ silbar	*Educators in the Community/ Educadores en la comunidad*	Pocoyo Community Helpers • Community Explorers
Week 7: *Community Helpers*	• construction worker/ el obrero de la construcción • hard hat/ casco de seguridad • sanitation worker/ trabajador de sanidad • garbage truck/ camión de la basura	*Workers in the Community/ Trabajadores en la comunidad*	Pocoyo Community Helpers • Help the Helpers
Week 8: *3D Shapes*	• sphere/ esfera • cylinder/ cilindro • cone/ cono • cube/cubo	*3D Shapes/ Formas 3d*	Pocoyo 3D Shapes • Toy Workshop

Component One. Component One, *Introduction*, included two elements to introduce the targeted vocabulary words in both English and Spanish. These elements include Total Physical Response (TPR) and realia. TPR, developed by James Asher, incorporates the use of movements with verbal expression, which aided participants in learning the new word (Asher, 1966). Realia is the use of real-life objects as instructional support for language, which aided with the content learning of the vocabulary word, as

well as with visualization and understanding (WIDA, 2013). Table 6 denotes the specific instructions, as well as an example, for each element of Component One. The picture cards and realia corresponding to the example in Table 6 are shown in Figure 7. These two elements were repeated for every day of the intervention for both groups (A and B) at 3 minutes per day— a total of 9 minutes per week for the four targeted words.

Table 6

Component One Elements in Detail

Element	Lesson Instructions	Lesson Examples
Total Physical Response	• Teacher models motions while displaying picture card with text. • Teacher says words first while holding picture card, then invites students to repeat. This continues for each word.	• *sphere:* pretend to throw ball • *cylinder:* pretend to drink from cup • *cone:* pretend to eat ice cream • *cube:* pretend to roll dice
Realia	• Teacher displays picture card with text while allowing students to investigate the realia presented. • Teacher engages students in a conversation about each word and the corresponding realia.	• *sphere:* plastic figurine • *cylinder*: plastic figurine • *cone*: plastic figurine • *cube*: plastic figurine

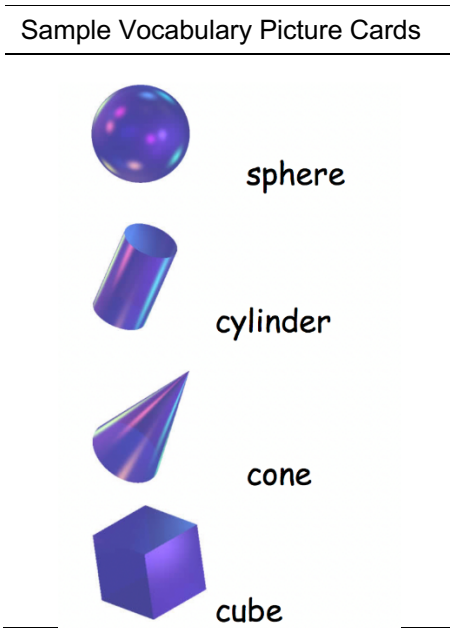


Figure 7: Sample Vocabulary Picture Cards

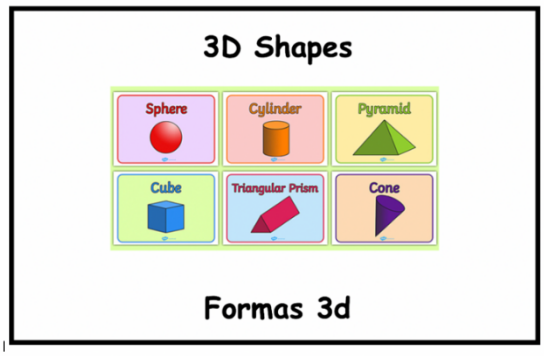
Component Two. Component Two, *Read Aloud*, included one element to engage with the target words in both English and Spanish in context. This element, an interactive read aloud, incorporated the use of the targeted words with oral rehearsal. The books used for these read alouds were created by the researcher to coincide with the visual vocabulary cards from the introduction. An interactive read aloud is a form of whole-group instruction in which a book is read aloud and allows for the selective pause to engage in conversation about the text to encourage readers and listeners to be active in the process (Fountas and Pinnell Literacy, 2020). Table 7 denotes the specific instructions, as well as an example, for this element of Component Two. This element was repeated for every day of the intervention for both groups (A and B) at 2 minutes per day—a total of 6 minutes per week for the four targeted words.

Table 7

Component Two Elements in Detail

Element	Lesson Instructions	Lesson Example
Interactive Read Aloud	• Teacher points out vocabulary words in the story and invites students to engage in TPR for each vocabulary word. • Teacher hands out realia for students to hold up when the appropriate word is seen/heard. • Teacher stops to ask questions and engage students in conversation about the topic. • Teacher invites students to read together chorally.	• *3D Shapes/ Forma 3d*

The books created for the interactive read aloud had the following characteristics: (1) a repetitive grammatical structure, (2) were presented in both English and Spanish, (3) incorporated the use of the targeted vocabulary words, and (4) possessed pictures that matched the text. Refer to Figure 8 for an example of the researcher-created book. The book was first read aloud by the researcher, then read together as a whole group with the participants, then finally individually by taking turns. Each student received an individual copy of the books which they were able to take home on the last day of the study.



Page 1

Page 2

Page 3

Page 4

Page 5

Figure 8: Sample Intervention Book

Component Three. Component Three, *Activities*, included the varying elements of games and matching, or the iPad app to reinforce the targeted vocabulary words. These activities provided meaningful independent/guided practice time, which varied for the control and treatment groups. Table 8 denotes the specific instructions, as well as an example, for these elements of Component Three. These elements were repeated for every day of the intervention for the groups, depending on treatment or control (A or B), at 10 minutes per day—a total of 30 minutes per week for the four targeted words.

Table 8

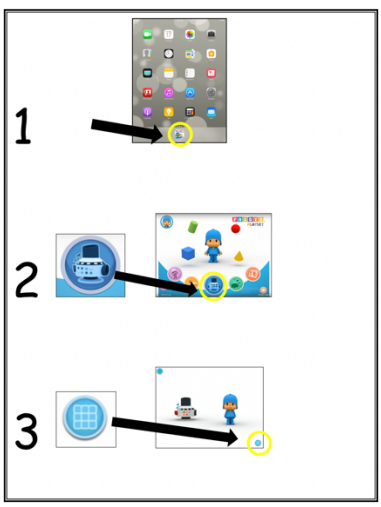
Component Three

Element	Lesson Instructions
Game	• Teacher invites students to play "Simon Says" to guess the vocabulary word that matches the TPR motion and/or realia. • Teacher leads the game at first, then invites students to take turns leading the game.
Matching	• Teacher invites students to match picture cards to each other while they are turned upside down. • Teacher invites students to say the word as they turn over each card.
iPad App	• Teacher models how to use app on iPad with students and invites students to use app as a group, using a gradual release approach (as needed), before allowing students to play individually. • *Word Machine*: Students will play this game every day, following a picture card checklist to ensure each vocabulary word is selected. • *Toy Workshop*: Students will play this game after Word Machine (as time allows).

The control group participated in games and matching activities that incorporated the targeted vocabulary words for the week. Participants played memory, where they attempted to memorize the images from the vocabulary cards flipped upside down and match them while orally repeating the name with the TPR movement. They also participated in "Simon Says", where they practiced guessing and demonstrating the targeted vocabulary based on the previously learned TPR movements.

The treatment group used the multimedia in the form of an iPad application. The selected application, Pocoyo Playsets, included a variety of themed applications based on an animated bilingual 4-year-old boy and his friends, which coincided with the content curriculum and targeted the vocabulary words for the week. Participants were directed in the use of the application using a gradual release approach, as necessary. Participants used two functions of the application: (1) Word Machine, and (2) a game (these vary from version to version). The Word Machine feature of the application allowed participants to touch to select a word from images, and then presented a mini animation with narration in both English and Spanish. Participants had to complete the Word Machine activity for all targeted words before they were allowed to move on to the game, where they were able to engage in free play that still focused on these words. In order to promote independence and ensure participants were watching the animations for all of the targeted vocabulary words, visual directions with images to be crossed off for each vocabulary word were provided to the participants, as seen in Figure 9.

Sample Visual Directions



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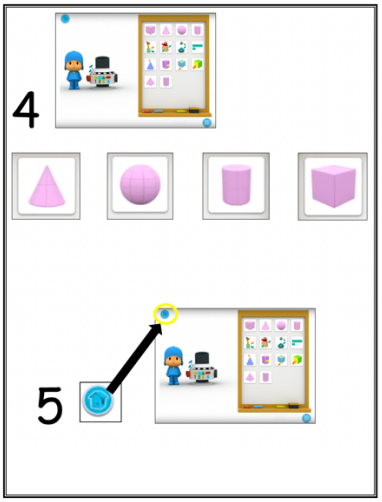

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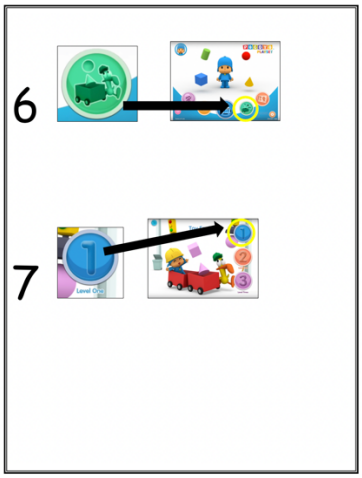

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Figure 9: Sample iPad Visual Directions

Measures

Pre-, mid-, and post-assessments were given to evaluate the participants' growth in vocabulary attainment both expressively and receptively. The researcher implemented

norm-referenced and researcher-created assessments that measured the overall and targeted vocabulary gains. The researcher conducted all of the assessments using the available iPad applications for these assessments. Table 9 outlines the assessment schedule for the study.

Table 9

Assessment Schedule

Assessment	Duration	Norm-Referenced	Researcher-Created
Pre-Assessments	3 weeks	Pre-IPT	TVA
		PPVT-5	
		EVT-3	
Mid-Assessments	2 weeks	PPVT-5	TVA
		EVT-3	
Post-Assessments	1 week	PPVT-5	TVA
		EVT-3	

Generalized Measures. Vocabulary development was assessed in the areas of expressive and receptive using the Peabody Picture Vocabulary Test (PPVT-5) and Expressive Vocabulary Test (EVT-3) for overall gains in English, as the current study targets gains in English vocabulary. These measures will be administered both pre- and post-intervention.

The PPVT-5 is a norm-referenced instrument that assesses receptive vocabulary of children and adults utilizing the selection of photos. This instrument was standardized on a national sample of more than 5,500 individuals ages 2 through 90 with approximately 3,500 subjects used for the normative scores (Pearson Clinical, 2018b).

The sample used matches from the U.S. Census for gender, race/ethnicity, region, socioeconomic status (SES), and clinical diagnosis or special education placement (Pearson Clinical, 2018b). The PPVT-5 has reliability and validity coefficients in the .90s range (Pearson Clinical, 2018b).

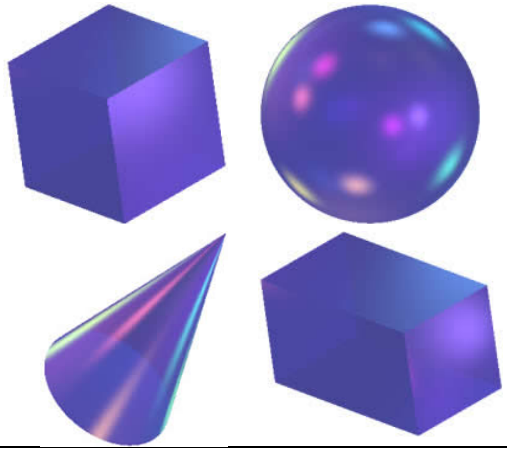
The EVT-3 is a norm-referenced instrument that assesses expressive vocabulary of children and adults utilizing photo prompts. The EVT-3 was co-normed along with the PPVT-5 test using the same population as described above for the PPVT-5 (Pearson Clinical, 2018a). The EVT-3 has reliability coefficients in the .90s for almost every age or grade (Pearson Clinical, 2018a).

Targeted Measures. A TVA created by the researcher assessed the expressive and receptive vocabulary of the 32 targeted words in both English and Spanish. This measure was administered pre-, mid-, and post-intervention. The TVA was created by the researcher and based on the PPVT-5 and EVT-3, utilizing the same format and directions. It had been piloted in order to assess validity. Refer to Figure 10 for samples of this instrument's English version. The Spanish version mimics the English version, with the exception that the order of the presented words and arrangement of the photos vary from the English version, and the directions and target vocabulary are assessed in Spanish.

Sample Item for Receptive Vocabulary

Give directions in English and allow time for student response.

- Point to teach of the four pictures and say, “Look at the pictures on this page.”
- Say “Put your finger on the sphere.”
  - *Correct Response:*
    - Say “Good!”
  - *Incorrect Response:*
    - If the examinee answers incorrectly, say “Good! Let’s continue.”
    - If the examinee does not respond, say “You may not be sure, but put your finger on the one you think is right.”



Sample Item for Expressive Vocabulary

Give directions in English and allow time for student response.

- Point to the picture of the sphere, and say, “What do you see?”
  - *Correct Response:*
    - Say “Good!”
  - *Incorrect Response:*
    - If the examinee answers incorrectly, say “Good! Let’s continue.”
    - If the examinee does not respond, say “You may not be sure, but answer what you think is right.”

Figure 10: Sample TVA Items for Receptive and Expressive Vocabulary

In this chapter, I described the methods of the current study to include the design, participants, setting, procedures, and measures. In the next chapter, I analyze the data and present the results of the findings of this intervention study.

CHAPTER FOUR

Results

In this chapter, I discuss the quantitative data sources that were analyzed for this study, as well as the results of the findings. Data preparation, data cleaning, the statistical model, and assumptions will be described. Results will then be presented in terms of the research questions. Information regarding the research questions and data analysis is shown in Table 10.

Table 10

Research Questions, Data Sources, Comparisons, and Analysis

Research Question	Data Sources	Comparisons	Analysis
1. What effect does an intervention utilizing the strategies of multimedia with native language supports have on the vocabulary attainment of dual language learners in the areas of receptive and expressive vocabulary?	1. Pre/Mid/Post-Norm-Referenced Assessments • Peabody Picture Vocabulary Test-5 (PPVT-5) • Expressive Vocabulary Test-3 (EVT-3) 2. Researcher-Created Assessments • Targeted Vocabulary Assessment (TVA)	1. Pre/Post-repeated measures vs. control/ treatment groups	1.a. Three-Way Repeated Measures ANOVAs for • PPVT-5 • EVT-3 • TVA RE • TVA RS • TVA EE • TVA ES
a. Does the intervention have varying effects on receptive and expressive vocabulary based on DLLs language proficiency?	a. Pre-Norm-Referenced Assessment • Pre-Idea Proficiency Test (Pre-IPT)	a. vs. language proficiency levels	

Data Preparation

The data for the current study were examined prior to conducting the statistical analysis. Data sources included the pre-test and post-test scores for control and treatment groups from the PPVT-5, EVT-3, and TVAs in the areas of expressive English, expressive Spanish, receptive English, and receptive Spanish. Additionally, the Pre-IPT was used to identify the language proficiency level of the participants. All data were

entered in SPSS by participant, with two entries per participant (one for control and one for treatment) due to the crossover design of the study.

Data Cleaning

Data were screened before they were analyzed in order to check for any errors, inconsistencies, missing data, or outliers. Once the data were screened and entered into SPSS, a visual examination was conducted. Any anomalies that were noted from the visual inspection were compared to the original data sources, and changed if necessary, to ensure that all data entry was accurate.

Missing data. In the original data set, the cases for the two participants who were recruited but ultimately cut from the study (due to moving and consent issues) were deleted. Descriptive statistics were run to check for additional missing data and none were found within the data set.

Univariate outliers. Univariate outliers were examined by translating the raw data scores into *z* scores and checking for values larger than 3 or smaller than -3, equal to three standard deviations above or below the mean.

Two univariate outliers were detected (Pre-test receptive English, $z = -3.03$, Post-test receptive Spanish, $z = 3.10$) in the entire data set; however, due to small sample size, and the relative proximity of the outliers to third standard deviation, these outliers were examined further for their impacts on the data set. Additional evidence, including comparison of the trimmed means and means of the dependent variables, as well as histograms and boxplots (pre- and post-deletion of the outliers), were examined. These additional sources indicated that the outliers were not impactful on the data set. The

analyses were run with and without these outliers in an abundance of caution to see if they posed any significant impacts on the results. The test results showed that the outliers did not affect the overall outcomes when left in or out of the data set, so, no cases were deleted from the data set, in order to maintain as many participants as possible due to the small sample size of the study.

Multivariate outliers. Multivariate outliers were examined by running a linear regression to examine Mahalanobis Distance. Since the maximum value of Mahalanobis was 20.286, and the critical value for 12 degrees of freedom is 32.9, this indicated that no multivariate outliers existed within the data set, and therefore, no cases were deleted from the data set.

Statistical Model

Results were analyzed using a series of three-way repeated measures ANOVAs with one within-subjects factor and two between-subjects factors. The within-subjects factor of time included the two repeated levels of pre-test and post-test. The between-subjects factor of group included two levels of control and treatment, and the other between-subjects factor of language proficiency level included four levels—beginning, early intermediate, intermediate, and early advanced. Each assessment—PPVT-5, EVT-3, TVA expressive English, TVA expressive Spanish, TVA receptive English, and TVA receptive Spanish—utilized an individual three-way repeated measures ANOVA with the same within-subjects and between-subjects factors previously discussed, for a total of 6 three-way repeated measures ANOVAs. While the researcher notes that a mixed Multivariate Analysis of Variance (MANOVA) would have provided more statistical

power and less Type I error, this analysis could not be utilized with this data set due to violations of the assumption of multicollinearity within the correlations and covariance matrices.

Assumptions

In order to utilize a three-way repeated measures ANOVA model, several assumptions about the data had to be met. The data set had to include a within-subjects factor with at least two levels and a between-subjects factor with at least one independent level with two or more groups. This assumption was met utilizing the within-subjects factor of time with pre- and post-tests (two levels), and the between-subjects factors of group with control and treatment groups (two levels), and a language proficiency level with beginning, early intermediate, intermediate, and advanced (four levels). Additionally, the dependent variables had to be measured at the continuous level, which was the case for all of the assessments in the data set. Therefore, the assumptions about the data were met for all three-way repeated measures ANOVAs performed.

Additionally, there were several other assumptions that had to be met for each three-way repeated measures ANOVA. These included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity. These assumptions are reported with each individual three-way repeated measures ANOVA in the following sections. The majority of the data set met these assumptions. However, there were times where homogeneity of variance and normality assumptions were violated. Since the three-way repeated measures ANOVA test is robust to these violations when the sample sizes are equal or nearly equal (treatment/control groups $N = 16$, pre/post test groups $N =$

32, language levels $N = 6, 8, 8, 10$), the analysis was continued (Lomax & Hahs-Vaughn, 2012; Pituch & Stevens, 2016).

Attempts were made to transform the data to achieve normality; however, they were unsuccessful. As mentioned previously, the three-way repeated measures ANOVAs were run with and without univariate outliers, to see if improvements were made to these violations of assumptions. At times, violations were resolved; however, results of significance of main, within, and between factors remained the same, regardless of these adjustments to violations. Therefore, the researcher left the violations as they were, since there was no difference in the outcome.

Alpha levels were set to .01 as an added safeguard to these violations. Therefore, significance was only assumed with more conservatively interpreted p value of $< .01$. Additionally, results were examined with caution and these violations were declared as a limitation of the study.

Results

Results were analyzed in terms of the research questions that guided the study. Three null hypotheses were examined by conducting a series of three-way repeated measures ANOVAs. Several null hypotheses were examined using this approach:

1. There is no significant difference in vocabulary achievement based on pre/post-test scores.
2. There is no significant difference in vocabulary achievement based on control/treatment groups.

3. There is no significant interaction effect between the control/treatment groups and pre/post-test scores on vocabulary achievement.
4. There is no significant difference in vocabulary achievement based on language levels.
5. There is no significant interaction effect between language levels and control/treatment groups on vocabulary achievement.
6. There is no significant interaction effect between pre/post-test scores and language levels on vocabulary achievement.
7. There is no significant interaction effect between control/treatment groups, pre/post-test scores, and language levels on vocabulary achievement.

Each three-way mixed ANOVA is presented separately, with reference to receptive vocabulary first, followed by expressive vocabulary. After the presentation of each three-way mixed ANOVA, results are compiled to give a comprehensive overview of the results of all measures with regard to the research questions.

Receptive Vocabulary. Receptive vocabulary was assessed in the generalized and targeted areas using three different assessments. Generalized measures were examined using the PPVT-5, and targeted measures were examined using the researcher-created TVA for both receptive English and receptive Spanish vocabulary. The results of these individual assessments are presented in the subsequent three sections.

PPVT-5. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment groups and language proficiency levels on the generalized English vocabulary attainment

of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that all dependent variables met the assumption of normality, with pre-tests for treatment group, W (16) =.952, $p > .05$, pre-tests for control group, W (16) =.972, $p > .05$, post-tests for treatment group, W (16) =.923, $p >.05$, and post-tests for control group, W (16) =.964, $p > .05$. Normality was also met for the pre-tests and post-tests for language level, with pre-tests for beginners, W (8) = .942, $p > .05$, early intermediates, W (8) = .883, $p > .05$, intermediates, W (6) = .892, $p > .05$, and early advanced, W (10) = .917, $p > .05$, and post-tests for beginners, W (8) = .947, $p > .05$, early intermediates, W (8) = .932, $p > .05$, intermediates W (6) = .830, $p > .05$, and early advanced, W (10) = .907, $p > .05$.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that one group met this assumption, with pre-test scores from the PPVT-5, F (1, 24) = 3.86, p = .006, and post-test scores from the PPVT-5, F (1, 24) = 1.35, p = .270.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p = .357), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 11, the results of the three-way repeated measures ANOVA for generalized receptive vocabulary using the PPVT-5 indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 40.98, p =.000, $\eta p2$ = .631). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 11. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 11

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for PPVT-5

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
Between Subjects						
Group	1	4.508	4.508	.022	.883	.001
Language Level	3	1725.08	575.02	2.89	.060	.261
Group x Language Level	3	247.09	82.36	.405	.751	.048
Error	24	4878.75	203.28			
Within Subjects						
Time	1	1271.08	1271.08	40.98	.000*	.631
Time x Group	1	1.41	1.41	.046	.833	.002
Time x Language Level	3	62.09	20.69	.66	.580	.077
Time x Group x Language Level	3	49.33	16.44	.53	.666	.062
Error	24	744.25	31.01			

*p < .01.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 12. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was 1.24, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 11 and Figure 12, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 12

Mean Scores and Standard Deviations for PPVT-5

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				
Beginner	28.25	10.81	38.00	9.96
Early Intermediate	37.50	8.34	45.25	14.15
Intermediate	43.33	2.08	50.66	9.07
Early Advanced	42.80	11.51	54.00	3.93
Total	38.12	10.25	47.18	10.79
Treatment				
Beginner	33.75	7.63	46.00	10.86
Early Intermediate	35.75	5.05	39.75	6.70
Intermediate	39.33	5.03	51.33	12.85
Early Advanced	45.00	15.34	54.20	18.26

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Total	38.81	10.25	48.00	13.33

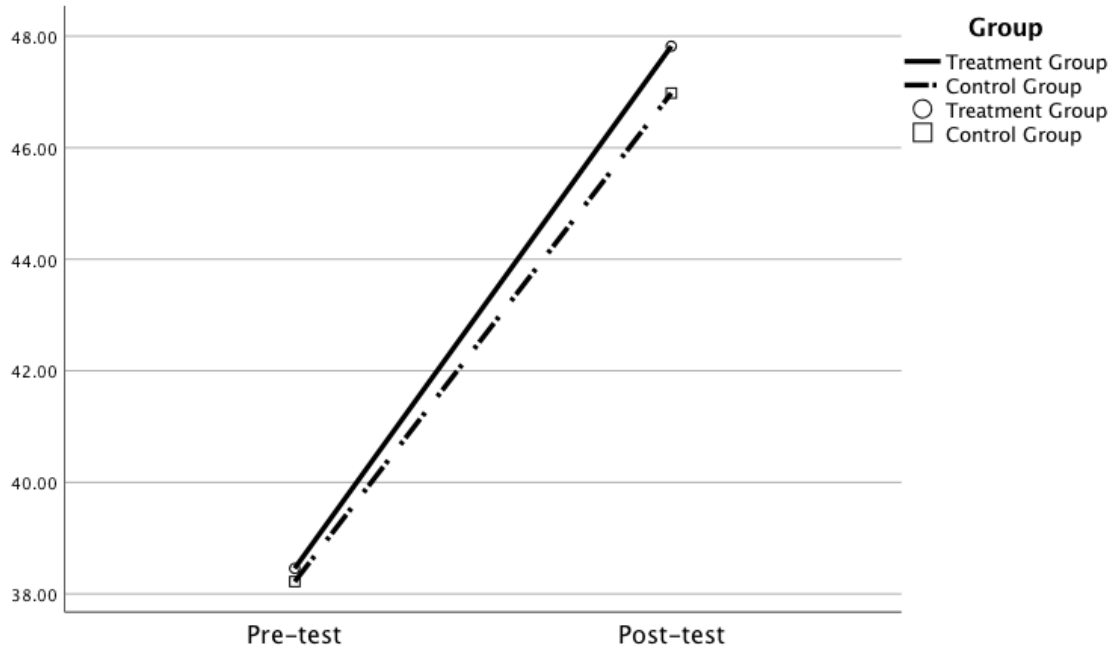


Figure 11: Estimated Marginal Means of PPVT-5 on Groups

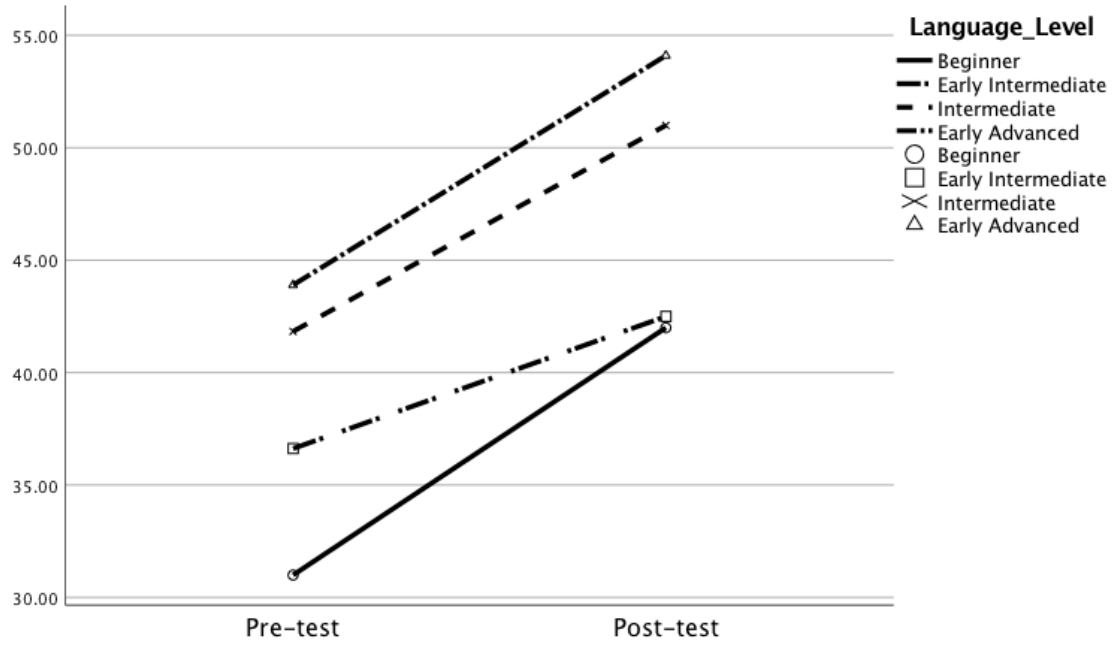


Figure 12: Estimated Marginal Means of PPVT-5 on Language Levels

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores (M = 38.43) significantly increased (p = .000) to post-test scores (M = 47.40), with a 99% confidence interval of 5.10 to 13.01 points, and a mean difference of 9.06.

Receptive English TVA. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment groups and language proficiency levels on the targeted English vocabulary attainment of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that the control/treatment groups did not meet the assumption of normality, with pre-tests for treatment group, W (16) =.881, p =.040, pre-tests for control group, W (16) =.879, p = .038, post-tests for treatment group, W (16) =.828, p = .006, and post-tests for control group, W (16) =.027 , p = .027). Normality was met for the majority of the pre-tests and post-tests for language level, with pre-tests for beginners, W (8) = .886, p > .05, early intermediates, W (8) = .919, p > .05, intermediates, W (6) = .853 p = > .05, and early advanced, W (10) = .820, p = .025, and post-tests for beginners, W (8) = .931, p > .05, early intermediates, W (8) = .920, p > .05, intermediates, W (6) = .958 p > .05, and early advanced, W (10) = .805, p = .017.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that one group met this assumption, with pre-test scores from the receptive English TVA, F (1, 24) = 4.73, p = .077, and post-test scores from the receptive English TVA, F (1, 24) = 3.36, p = .038.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p =.021), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 13, the results of the three-way repeated measures ANOVA for receptive vocabulary using the receptive English TVA indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 72.59, p =.000, $\eta p2$ = .752). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 13. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 13

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for Receptive English TVA

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
Between Subjects						
Group	1	4.508	4.508	.022	.883	.001
Language Level	3	1725.08	575.02	2.89	.060	.261
Group x Language Level	3	247.09	82.36	.405	.751	.048
Error	24	4878.75	203.28			
Within Subjects						
Time	1	242.09	424.09	72.59	.000*	.752
Time x Group	1	.329	.329	.09	.756	.004
Time x Language Level	3	17.32	5.77	1.73	.187	.178
Time x Group x Language Level	3	4.33	1.44	.433	.731	.051
Error	24	80.33	3.33			

*p < .01.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 14. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was 1.65, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 13 and Figure 14, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 14

Mean Scores and Standard Deviations for Receptive English TVA

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				
Beginner	9.00	4.83	13.75	1.50
Early Intermediate	7.50	2.38	13.25	2.06
Intermediate	11.66	.57	13.00	2.00
Early Advanced	9.40	2.07	12.80	.83
Total	9.25	3.00	13.18	1.47
Treatment				
Beginner	8.50	1.00	12.75	1.25
Early Intermediate	8.50	1.29	13.25	.95
Intermediate	10.33	.57	13.33	1.15
Early Advanced	8.60	1.94	13.00	1.00
Total	8.87	1.45	13.06	.99

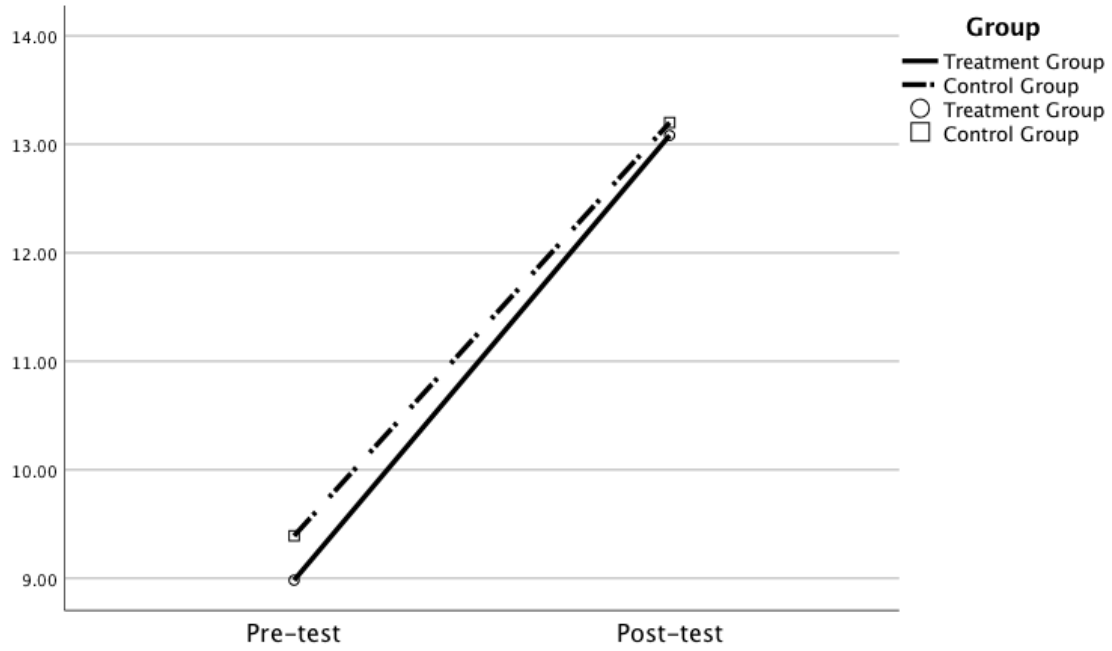


Figure 13: Estimated Marginal Means of Receptive English TVA on Groups

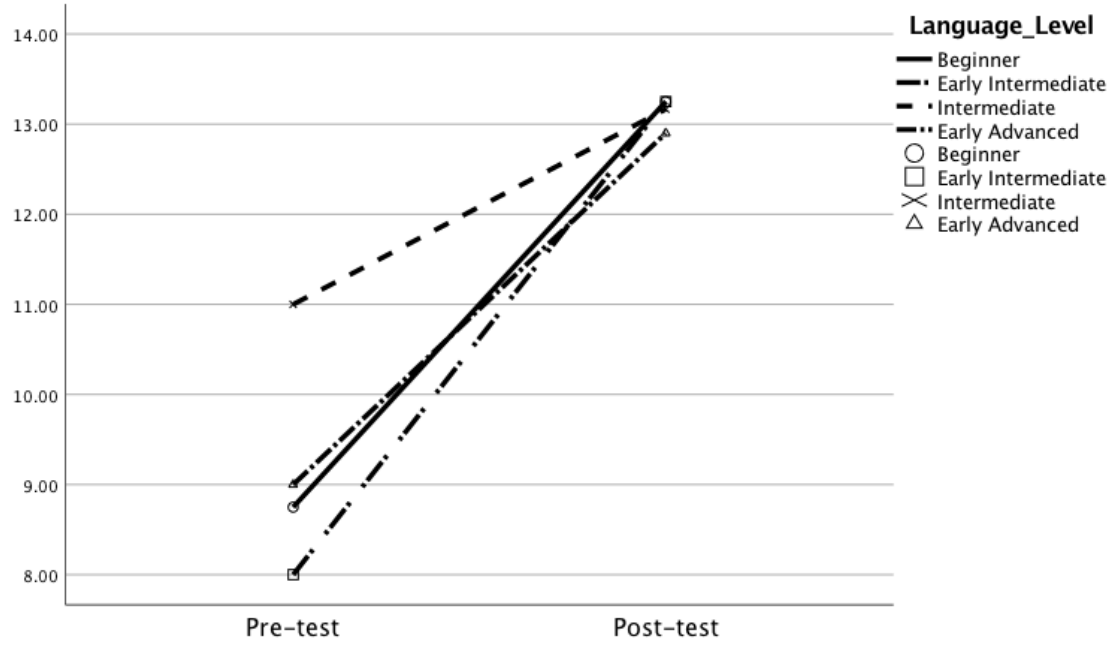


Figure 14: Estimated Marginal Means of Receptive English TVA on Language Levels

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores (M = 9.18) significantly increased (p = .000) to post-test scores (M = 13.14), with a 99% confidence interval of 8.02 to 12.45 points, and a mean difference of 3.95.

Receptive Spanish TVA. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment groups and language proficiency on the targeted Spanish vocabulary attainment of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that all dependent variables did not meet the assumption of normality, with pre-tests for treatment group, W (16) =.877, p =.035, pre-tests for control group, W (16) =.920, p > .05, post-tests for treatment group, W (16) =.920, p > .05, and post-tests for control group, W (16) =.856, p = .016. Normality was met for the majority of the pre-tests and post-tests for language level, with pre-tests for beginners, W (8) = .885, p > .05, early intermediates, W (8) = .788, p = .021, intermediates, W (6) = .940 p = > .05, and early advanced, W (10) = .901, p > .05, and post-tests for beginners, W (8) = .933, p > .05, early intermediates, W (8) = .782, p = .018, intermediates, W (6) = .701 p = .006, and early advanced, W (10) = .886, p > .05.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that both groups met this assumption, with pre-test scores from the receptive Spanish TVA, F (1, 24) = .332, p = .932, and post-test scores from the receptive Spanish TVA, F (1, 24) = 2.18, p = .073.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p =.486), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 15, the results of the three-way repeated measures ANOVA for receptive vocabulary using the receptive Spanish TVA indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 61.32, p =.000, $\eta p2$ = .719). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 15. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 15

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for Receptive Spanish TVA

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
	Between Subjects					
Group	1	4.508	4.508	.022	.883	.001

Language Level	3	1725.08	575.02	2.89	.060	.261
Group x Language Level	3	247.09	82.36	.405	.751	.048
Error	24	4878.75	203.28			
		Within Subjects				
Time	1	164.38	164.38	61.32	.000*	.719
Time x Group	1	.182	.182	.068	.797	.003
Time x Language Level	3	29.89	9.96	3.71	.025	.317
Time x Group x Language Level	3	1.99	.664	.248	.862	.030
Error	24	64.33	2.68			

*$p < .01$.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 16. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was 1.52, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 15 and Figure 16, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 16

Mean Scores and Standard Deviations for Receptive Spanish TVA

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				

Beginner	10.00	3.74	11.50	4.12
Early Intermediate	8.00	2.16	12.50	1.00
Intermediate	9.00	3.00	12.00	1.00
Early Advanced	7.20	2.38	13.00	1.30
Total	8.43	2.78	11.62	2.39
Treatment				
Beginner	10.25	2.87	11.25	1.50
Early Intermediate	7.00	2.00	12.00	.81
Intermediate	10.33	3.05	13.00	.00
Early Advanced	8.40	1.81	13.20	4.12
Total	8.87	2.55	12.37	1.31

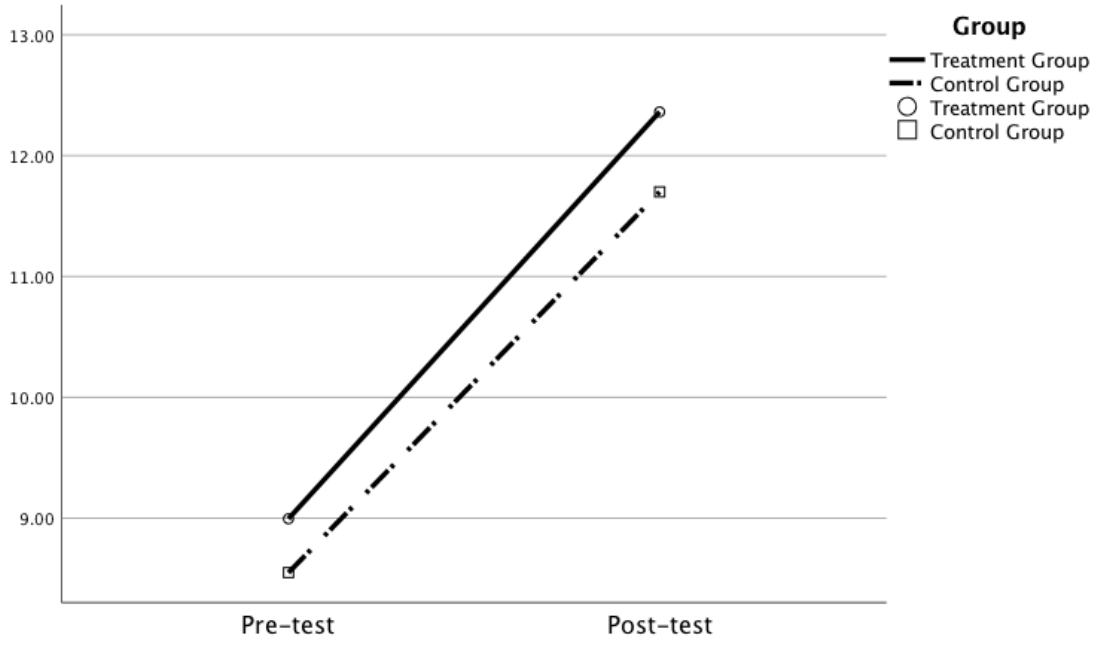


Figure 15: Estimated Marginal Means of Receptive Spanish on Groups

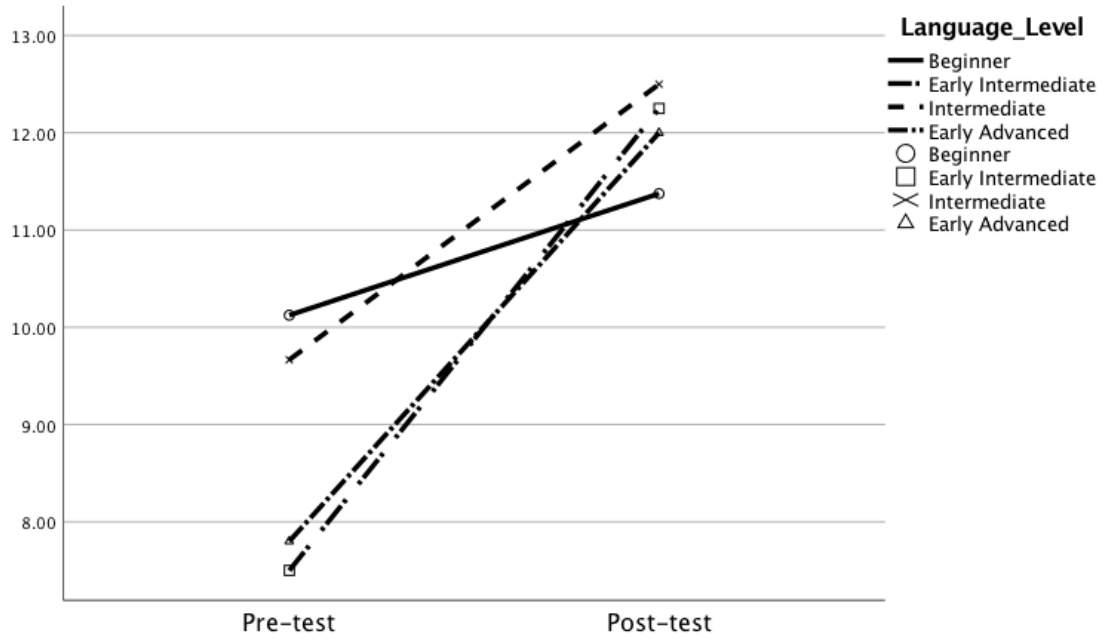


Figure 16: Estimated Marginal Means of Receptive Spanish TVA on Language Level

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores (M = 8.77) significantly increased (p = .000) to post-test scores (M = .356), with a 99% confidence interval of 2.09 to 4.42 points, and a mean difference of 3.25.

Expressive Vocabulary. Expressive vocabulary was assessed in the generalized and targeted areas using three different assessments. Generalized measures were examined using the EVT-3, and targeted measures were examined using the researcher-created TVA for both receptive English and receptive Spanish vocabulary. The results of these individual assessments are presented in the subsequent three sections.

EVT-3. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment

groups and language proficiency levels on the generalized English vocabulary attainment of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that all dependent variables did not meet the assumption of normality, with pre-tests for treatment group, W (16) =.959, $p > .05$, pre-tests for control group, W (16) =.963, $p > .05$, post-tests for treatment group, W (16) =.928, $p > .05$, and post-tests for control group, W (16) =.904, $p > .05$. Normality was met for all of the pre-tests and post-tests for language level, with pre-tests for beginners, W (8) = .990, $p > .05$, early intermediates, W (8) = .858, $p >.05$, intermediates, W (6) = .905, $p = > .05$, and early advanced, W (10) = .928, $p > .05$, and post-tests for beginners, W (8) = .960, $p > .05$, early intermediates, W (8) = .832, $p >.05$, intermediates W (6) = .828 $p > .05$, and early advanced, W (10) = .907, $p > .05$.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that neither group met this assumption, with pre-test scores from the EVT-3, F (1, 24) = 2.59, p = .038, and post-test scores from the EVT-3, F (1, 24) = 3.36, p = .000.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p =.160), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 17, the results of the three-way repeated measures ANOVA for expressive vocabulary using the EVT-3 indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 13.00, p =.001, $\eta p2$ = .351). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 17. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 17

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for EVT-3

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
		Between Subjects				
Group	1	7.27	7.27	.031	.862	.001
Language Level	3	2084.19	694.73	2.92	.054	.268
Group x Language Level	3	42.78	14.26	.060	.980	.007
Error	24	5693.45	237.27			
		Within Subjects				
Time	1	187.65	187.65	13.00	.001*	.351
Time x Group	1	1.11	1.11	.078	.783	.003
Time x Language Level	3	22.70	7.56	.525	.670	.062
Time x Group x Language Level	3	125.01	41.67	2.88	.056	.265
Error	24	346.22	14.42			

*p < .01.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 18. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was .351, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 17 and Figure 18, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 18

Mean Scores and Standard Deviations for EVT-3

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				
Beginner	22.00	6.59	22.75	4.19
Early Intermediate	22.25	18.8	19.75	20.30
Intermediate	28.00	8.18	37.00	1.00
Early Advanced	30.40	9.78	35.00	6.96
Total	25.56	11.78	28.5	12.52
Treatment				
Beginner	23.00	4.54	26.75	4.57
Early Intermediate	16.25	14.10	22.50	18.55
Intermediate	32.66	4.04	33.66	3.21
Early Advanced	31.40	9.76	35.40	11.67
Total	25.75	10.85	28.50	12.52

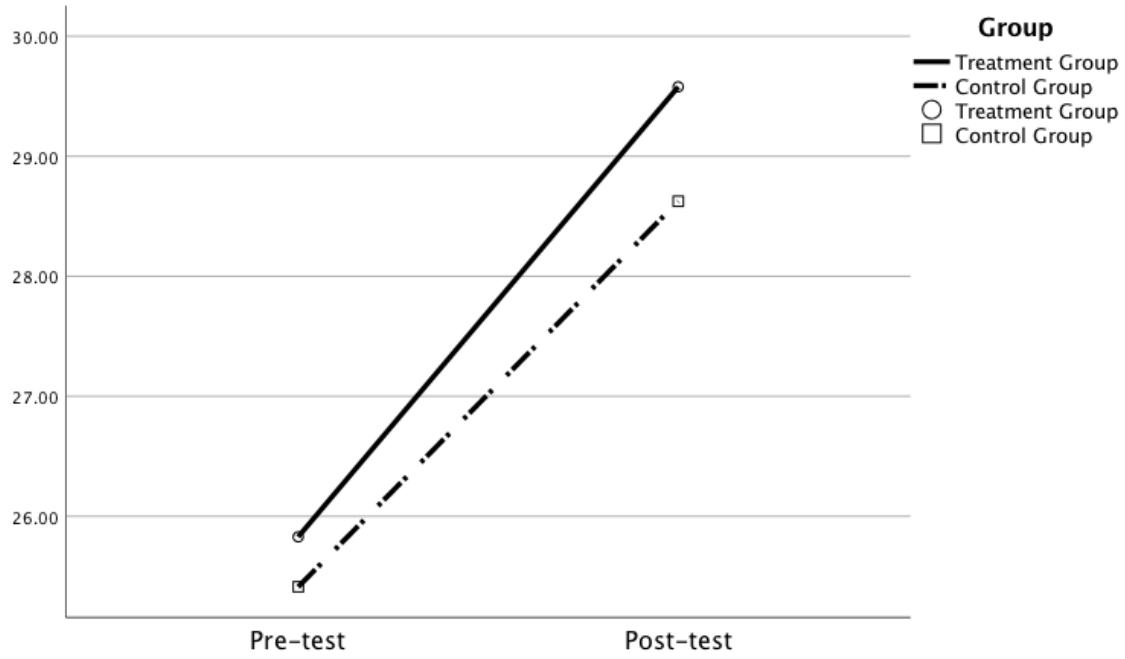


Figure 17: Estimated Marginal Means of EVT-3 on Groups

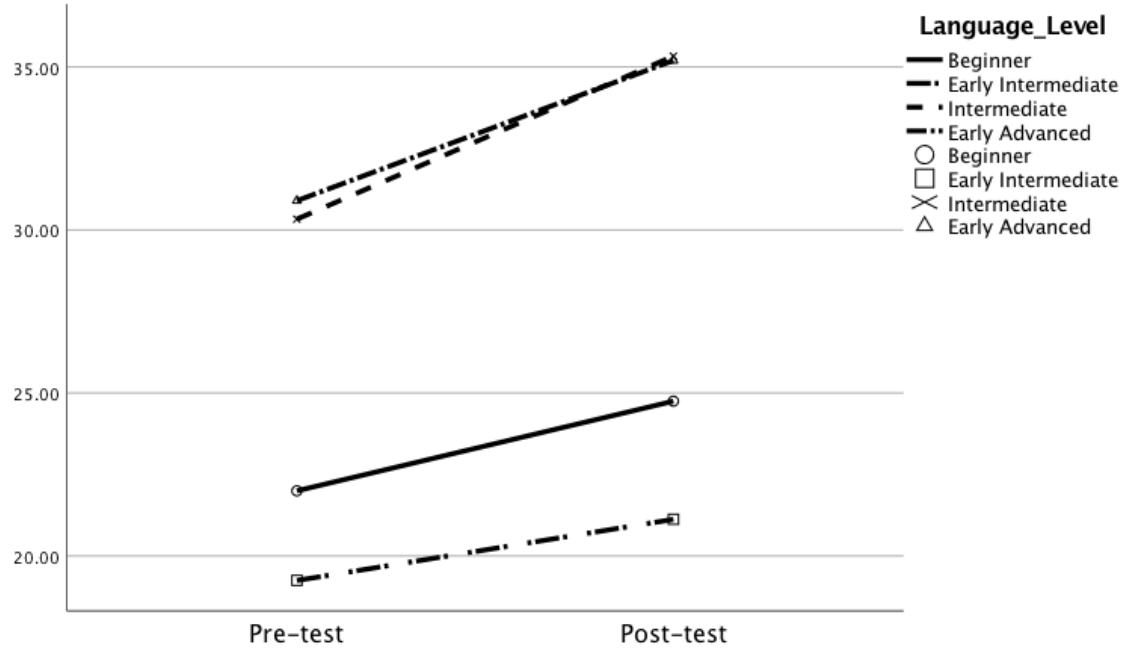


Figure 18: Estimated Marginal Means of EVT-3 On Language Level

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores ($M = 25.62$) significantly increased ($p = .001$) to post-test scores ($M = 29.10$), with a 99% confidence interval of .782 to 6.18 points, and a mean difference of 3.48.

Expressive English TVA. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment groups and language proficiency levels on targeted English vocabulary attainment of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that all dependent variables did not meet the assumption of normality, with pre-tests for treatment group, $W(16) = .870$, $p = .027$, pre-tests for control group, $W(16) = .567$, $p > .05$, post-tests for treatment group, $W(16) = .879$, $p = .038$, and post-tests for control group, $W(16) = .932$, $p > .05$. Normality was met for the majority of the pre-tests and post-tests for language level, with pre-tests for beginners, $W(8) = .918$, $p > .05$, early intermediates, $W(8) = .949$, $p > .05$, intermediates, $W(6) = .753$, $p = .021$, and early advanced, $W(10) = .900$, $p > .05$, and post-tests for beginners, $W(8) = .937$, $p > .05$, early intermediates, $W(8) = .789$, $p = .022$, intermediates, $W(6) = .925$ $p > .05$, and early advanced, $W(10) = .852$, $p > .05$.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that both groups met this assumption, with pre-test scores from the expressive English TVA, F (1, 24) = .928, p = .503, and post-test scores from the PPVT-5, F (1, 24) = .786, p = .606.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p =.860), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 19, the results of the three-way repeated measures ANOVA for expressive vocabulary using the expressive English TVA indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 110.53, p =.000, $\eta p2$ = .822). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 19. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 19

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for Expressive English TVA

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
	Between Subjects					
Group	1	.904	.904	.082	.777	.003

Language Level	3	26.28	8.76	.794	.509	.090
Group x Language Level	3	60.64	20.21	1.83	.168	.186
Error	24	264.66	11.02			
	Within Subjects					
Time	1	242.09	242.09	110.53	.000*	.822
Time x Group	1	1.76	1.76	.805	.378	.032
Time x Language Level	3	1.61	.539	.246	.863	.030
Time x Group x Language Level	3	19.03	6.34	2.89	.056	.266
Error	24	52.56	2.19			

*$p < .01$.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 20. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was 2.05, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 19 and Figure 20, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 20

Mean Scores and Standard Deviations for Expressive English TVA

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				

Beginner	3.25	2.06	9.75	2.75
Early Intermediate	2.75	2.21	6.75	1.50
Intermediate	3.33	2.30	7.00	3.60
Early Advanced	5.80	2.77	8.80	2.94
Total	3.93	2.51	8.18	2.76
Treatment				
Beginner	2.75	.95	5.25	3.94
Early Intermediate	5.50	3.31	9.00	2.44
Intermediate	5.00	1.73	7.00	3.60
Early Advanced	4.20	2.48	8.80	2.94
Total	4.31	2.35	8.00	2.96

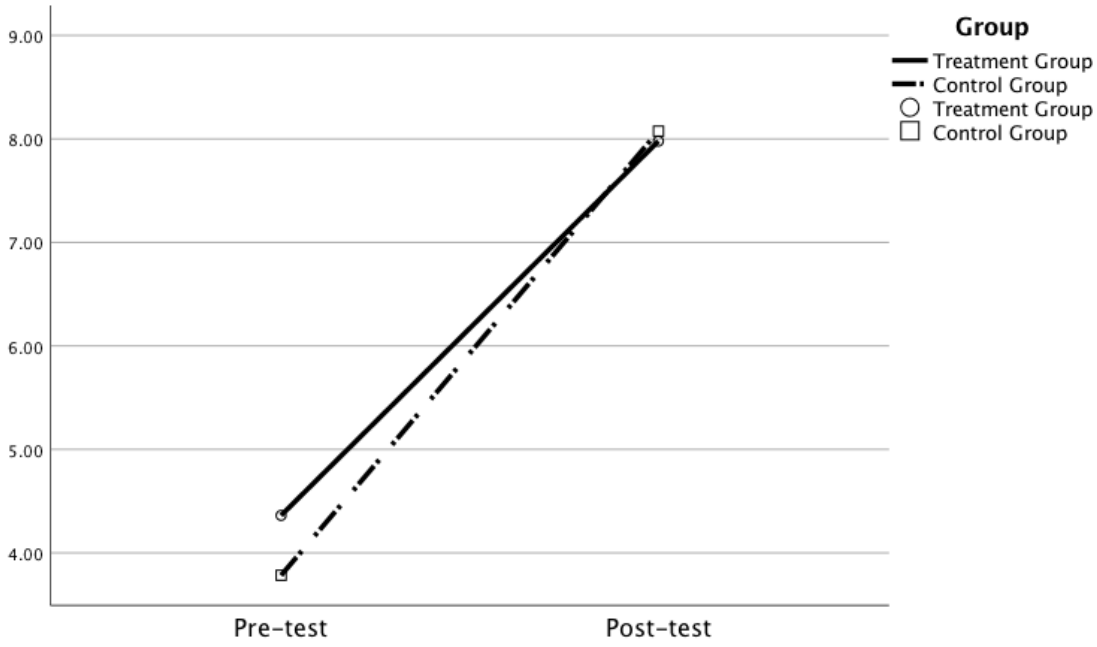


Figure 19: Estimated Marginal Means of Expressive English TVA on Groups

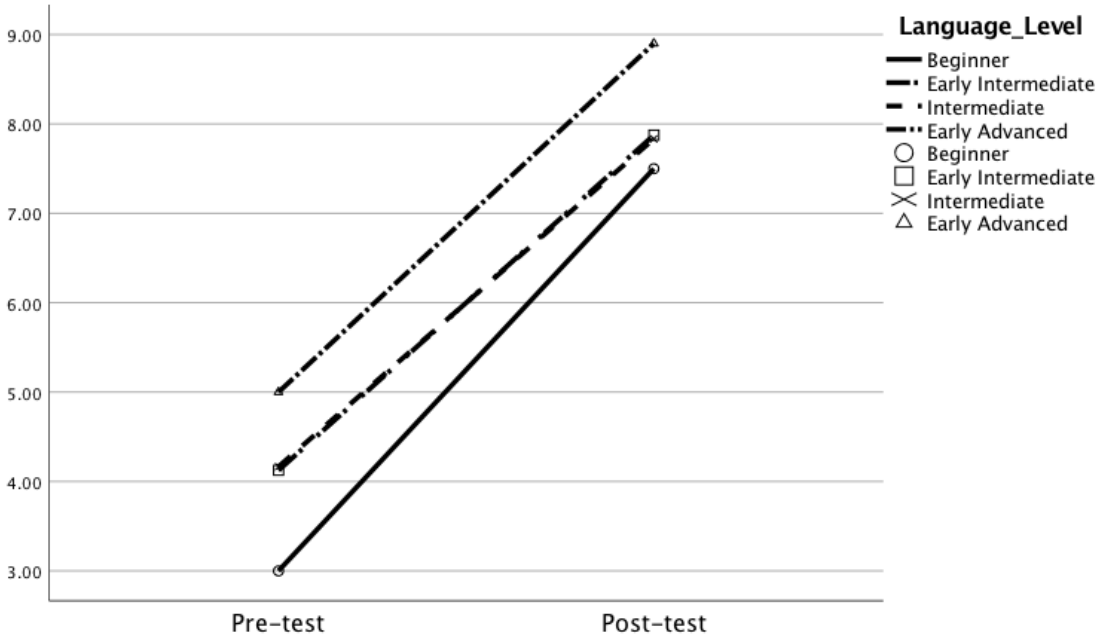


Figure 20: Estimated Marginal Means of Expressive English TVA on Language Levels

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores ($M = 4.07$) significantly increased ($p = .000$) to post-test scores ($M = 8.02$), with a 99% confidence interval of 2.90 to 5.00 points, and a mean difference of 3.95.

Expressive Spanish TVA. A three-way repeated measures ANOVA was utilized to examine the effects of the intervention using pre-test and post-test measures with control/treatment groups and language proficiency levels on targeted Spanish vocabulary attainment of DLLs. Several assumptions had to be met to run this analysis, which included normality, homogeneity of variance, homogeneity of covariance matrices, and sphericity.

Normality. To test for normality, Shapiro-Wilk's significance levels were examined for each dependent variable at all levels of the independent variable. Results indicated that all dependent variables did not meet the assumption of normality, with pre-tests for treatment group, W (16) =.920, $p > .05$, pre-tests for control group, W (16) =.768, $p = .001$, post-tests for treatment group, W (16) =.964, $p > .05$, and post-tests for control group, W (16) =.860, $p = .019$. Normality was met for the majority of the pre-tests and post-tests for language level, with pre-tests for beginners, W (8) = .835, $p > .05$, early intermediates, W (8) = .882, $p >.05$, intermediates, W (6) = .859, $p > .05$, and early advanced, W (10) = .822, $p = .026$, and post tests for beginners, W (8) = .871, $p > .05$, early intermediates, W (8) = .939, $p > .05$, intermediates, W (6) = .896 $p > .05$, and early advanced, W (10) = .967, $p > .05$.

Homogeneity of variance. To test for homogeneity of variance, Levene's test was examined. Results indicated that one group met this assumption, with pre-test scores from the expressive Spanish TVA, F (1, 24) = 4.68, $p = .002$, and post-test scores from the expressive Spanish TVA were significant, F (1, 24) = 1.027, $p = .438$.

Homogeneity of covariance matrices. To test for homogeneity of covariance matrices, Box's M test was examined. As the significance level was not significant (p =.478), this indicated that the assumption had been met.

Sphericity. To test for sphericity, Mauchly's test was examined. Since the repeated measures factor being examined only had two levels, this test did not need to be run, as the assumption had been met under this condition.

Results. As shown in Table 21, the results of the three-way repeated measures ANOVA for expressive vocabulary using the expressive Spanish TVA indicated that there was a significant main effect of time for pre/post-test scores on overall vocabulary word attainment (F (1, 24) = 26.40, p =.000, $\eta p2$ = .524). No other significant main or interaction effects existed for the remaining between- and within-subjects factors, as also shown in Table 21. Thus, the null hypotheses must be accepted for all of the remaining main and interaction effects.

Table 21

Three-Way Repeated Measures ANOVA Results for Time, Group, and Language Levels for Expressive Spanish TVA

Source	*df*	*SS*	*MS*	*F*	*p*	*ηp2*
		Between Subjects				
Group	1	5.11	5.11	.304	.586	.013
Language Level	3	30.01	10.00	.595	.624	.069
Group x Language Level	3	69.43	23.14	1.37	.274	.147
Error	24	403.51	16.81			
		Within Subjects				
Time	1	42.15	42.15	26.40	.000*	.524
Time x Group	1	3.93	3.93	2.46	.129	.093
Time x Language Level	3	4.65	1.55	.973	.422	.108
Time x Group x Language Level	3	2.11	.706	.442	.725	.052
Error	24	38.31	1.59			

*p < .01.

Descriptive statistics showed that both control and treatment groups, as well as all levels of language proficiency, gained vocabulary words from pre-test to post-test, which suggested that both forms of interventions were effective, as shown in Table 22. Partial Eta Squared for the main effect of time was transformed into Cohen's f to evaluate effect size. Cohen's f value was .988, which indicated that there was a large effect size on vocabulary word attainment from pre-test to post-test, as also shown in Figure 21 and Figure 22, therefore rejecting the null hypothesis that the means of this within-subjects factor are equal.

Table 22

Mean Scores and Standard Deviations for Expressive Spanish TVA

Group	Pre-Test		Post-Test	
	M	*SD*	*M*	*SD*
Control				
Beginner	5.00	4.69	5.50	5.44
Early Intermediate	2.25	.50	3.00	1.63
Intermediate	3.66	2.88	5.00	4.35
Early Advanced	2.20	3.27	4.20	3.63
Total	3.18	3.14	4.37	3.66
Treatment				
Beginner	2.00	1.41	3.00	2.16
Early Intermediate	4.00	.81	6.75	2.75
Intermediate	5.00	2.64	7.66	3.51
Early Advanced	2.40	1.94	4.60	2.70
Total	3.18	1.97	5.31	3.04

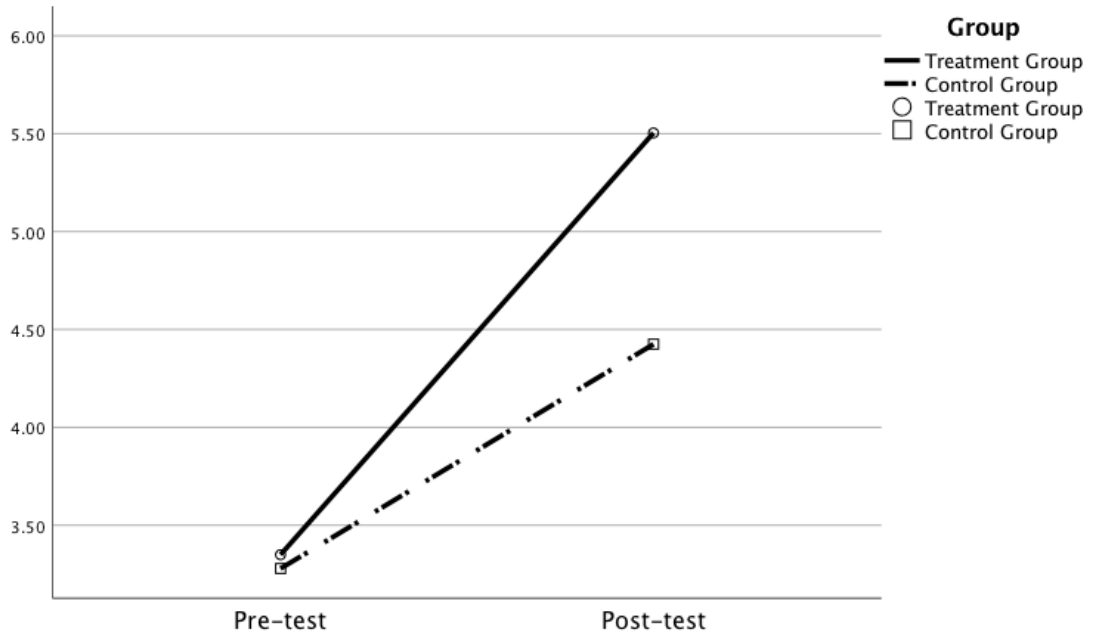


Figure 21: Estimated Marginal Means of Expressive Spanish TVA on Groups

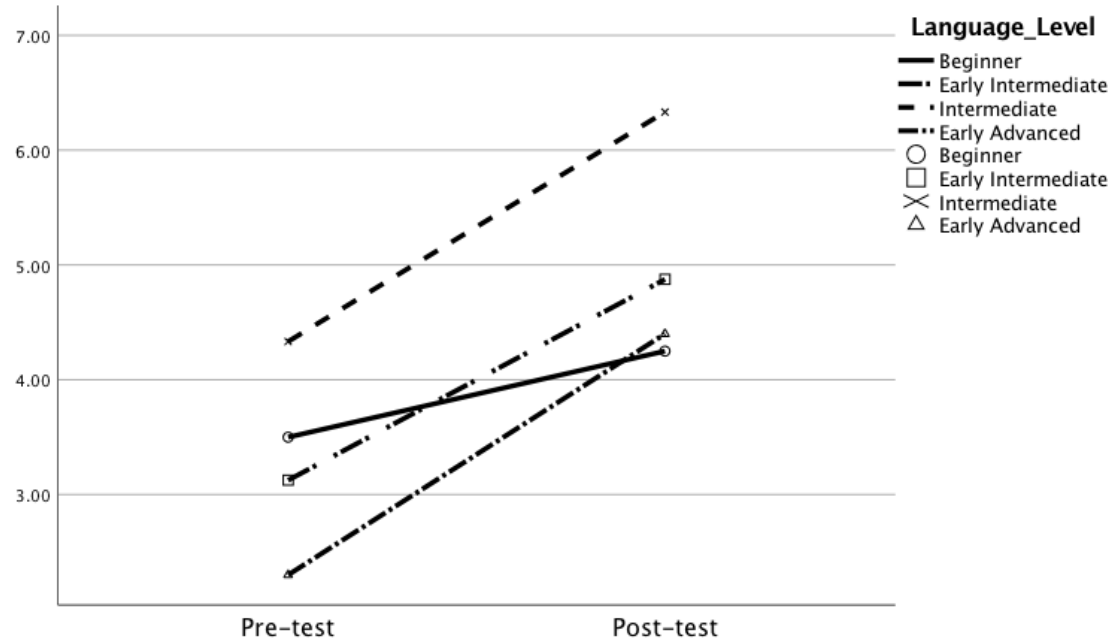


Figure 22: Estimated Marginal Means of Expressive Spanish TVA on Language Level

Pairwise comparisons of the means for pre-test and post-test using Bonferroni post hoc tests indicated that pre-test scores ($M = 3.31$) significantly increased ($p = .000$)

to post-test scores (M = .612), with a 99% confidence interval of .752 to 2.54 points, and a mean difference of 1.65.

Primary Research Question

To answer the question of what effect does an intervention utilizing the strategies of multimedia with native language supports have on the vocabulary attainment of DLLs in the areas of receptive and expressive vocabulary, results of the three-way repeated measures ANOVAs were compiled for the only identified significant effect, time, with regard to control/treatment groups. As shown in Table 23, all measures for receptive language, including the PPVT-5, TVA receptive English, and TVA receptive Spanish, showed increases from pre-test to post-test score. Gain scores shown in Table 23 demonstrated that an increase from pre-test to post-test were nearly identical across control and treatment group conditions. As shown in Table 24, all measures for expressive language, including the EVT-5, TVA expressive English, and TVA expressive Spanish, showed increases from pre-test to post-test score. Gain scores shown in Table 24 demonstrated that an increase from pre-test to post-test were similar across control and treatment group conditions.

Table 23

Observed Pre-tests, Post-tests, and Pre-test/Post-test Gain Scores for Receptive Language by Control/Treatment Groups

Measure	Treatment						Control					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
PPVT-5	38.81	10.25	48.00	13.33	9.18	7.65	38.12	10.69	47.18	10.79	9.06	7.45
TVA RE	8.87	1.45	13.06	.99	4.18	1.93	9.25	3.00	13.18	1.47	3.93	3.12
TVA RS	8.87	2.55	12.37	1.31	3.50	2.78	8.43	2.78	11.62	2.39	3.18	2.25

Table 24

Observed Pre-tests, Post-tests, and Pre-test/Post-test Gain Scores for Expressive Language by Control/Treatment Groups

Measure	Treatment						Control					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EVT-3	25.75	10.85	29.68	11.86	3.93	4.99	25.56	11.78	28.50	12.52	2.93	6.39
TVA EE	4.31	2.35	8.00	2.96	3.68	2.21	3.93	2.51	8.18	2.76	4.25	2.20
TVA ES	3.18	1.97	5.31	3.04	2.12	1.78	3.18	3.14	4.37	3.66	1.18	1.68

Secondary Research Question

To answer the secondary research question of if the intervention has varying effects on receptive and expressive vocabulary based on DLLs' language proficiency, results of the three-way repeated measures ANOVAs were compiled for the only identified significant effect, time, with regard to language proficiency level. As shown in Table 25, all measures for receptive language, including the PPVT-5, TVA receptive English, and TVA receptive Spanish, showed increases from pre-test to post-test score for all language proficiency levels. While gain scores shown in Table 25 show variance across proficiency levels, results of the three-way repeated measures ANOVA found that these were not significant. As shown in Table 26, all measures for expressive language, including the EVT-5, TVA expressive English, and TVA expressive Spanish, showed increases from pre-test to post-test score. Gain scores shown in Table 26 demonstrated that an increase from pre-test to post-test were fairly similar across control and treatment group conditions.

Table 25

Observed Pre-tests, Post-tests, and Pre-test/Post-test Gain Scores for Receptive Language by Language Level

Measure	Beginner						Early Intermediate					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
PPVT-5	31.00	9.14	42.00	10.55	11.00	6.09	36.62	6.45	42.50	10.66	5.87	5.74
TVA RE	8.75	3.24	13.25	1.38	4.50	2.87	8.00	1.85	13.25	1.38	5.25	2.60
TVA RS	10.12	3.09	11.37	2.87	1.25	1.66	7.50	2.00	12.25	.88	4.75	1.98
Measure	Intermediate						Early Advanced					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
PPVT-5	41.83	4.40	51.00	9.95	9.16	9.90	43.90	12.84	54.10	12.45	10.20	8.20
TVA RE	11.00	.89	13.16	1.47	2.16	1.47	9.00	1.94	12.90	.87	7.80	2.09
TVA RS	9.66	2.80	12.50	.83	2.83	2.99	7.80	2.09	12.00	2.21	4.20	2.14

Table 26

Observed Pre-tests, Post-tests, and Pre-test/Post-test Gain Scores for Expressive Language by Language Level

Measure	Beginner						Early Intermediate					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EVT-3	22.00	6.59	24.75	4.59	2.75	3.84	19.25	15.75	21.12	18.06	1.87	8.20
TVA EE	3.00	1.51	7.50	3.96	4.50	3.42	4.12	2.99	7.87	2.23	3.75	1.90
TVA ES	3.50	3.58	4.25	4.06	.75	1.58	3.12	1.12	6.33	3.82	1.75	2.31
Measure	Intermediate						Early Advanced					
	Pre-Test		Post-Test		Gain		Pre-Test		Post-Test		Gain	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EVT-3	30.33	6.31	35.33	2.80	5.00	6.78	30.90	9.23	35.20	9.06	4.30	4.02
TVA EE	4.16	2.04	7.83	2.78	3.66	1.75	5.00	2.62	8.90	2.42	3.90	1.59
TVA ES	4.33	2.58	6.33	3.82	2.00	1.54	2.30	2.54	4.40	3.02	2.10	1.52

In this chapter, I presented the results of the analysis of the quantitative data sources for this study, as well as the results of the findings. In the next chapter, I discuss the findings of the study, their implications for current practice, limitations, and recommendations for future research.

CHAPTER FIVE

Discussion

In Chapter Four, I presented the results of the analysis of the data for the study. In this chapter, I lead a discussion on the findings of the study, the implications for current practice, limitations, and recommendations for future research.

Findings

The results of the data analysis showed that pre-test and post-test scores increased for both control and treatment groups across all measures, which makes the case that both forms of intervention, with and without the use of native language supports and multimedia, are effective tools for instructing receptive and expressive vocabulary to DLLs. It is not surprising that both types of intervention are effective, as both utilized research-based strategies. However, this study builds on the use of native language supports for DLLs to increase academic outcomes (Cardenas-Hagan et al., 2007; Restrepo et al., 2010; Rodriguez et al., 2012; Spencer et al., 2019) and vocabulary (Guiberson & Ferris, 2019; Leacox & Jackson, 2014; Lugo-Neris et al., 2010; Mendez et al., 2015). In addition, this study adds to the limited field of research for multimedia for DLLs (Foster et al., 2018; Silverman & Hines, 2009; Terantino, 2016; Tsou et al., 2006; Verhallen & Bus, 2010; Verhallen et al., 2006), providing evidence that the use of

multimedia is an effective strategy to increase the expressive and receptive vocabulary skills of DLLs.

Results indicated that there are no differences between language proficiency levels or control/treatment groups. This offers evidence that the use of this intervention is impactful across all language groups, indicating that it holds benefits for any language proficiency level DLL. The results of this finding are preliminary and should be regarded with caution, as described in the limitations section.

An interesting finding from the study is that there were no measurable differences between control and treatment groups on any outcome measure. Both groups performed nearly identically on both forms of intervention, according to mean and gain scores presented in Chapter Four. While this finding should be evaluated with caution, as discussed in the limitations section, this does make a case that multimedia and native language supports can be used in place of teacher-led activities, as both groups performed nearly equally on all measures. These findings will be discussed in terms of their potential uses and impacts on current practice.

Current Practice

The use of multimedia and native language supports demonstrated that they were effective forms of intervention for the vocabulary attainment of DLLs in both expressive and receptive language areas and on both generalized and targeted areas in English and Spanish. This indicates that there are many implications for current practice with regard to community agencies, public education, higher education, and post-COVID-19.

Community Agencies. The use of this intervention would benefit community agencies, such as Head Start, as this study was completed with 3-year-old DLLs and could be easily translated to different contexts within the same or similar age group. This intervention model could allow for family engagement and involvement, if the follow-up multimedia time were to be completed at home with family. This fun and interactive approach would engage parents/guardians to bridge the divide between home and school. Family members may feel more comfortable having their native language represented and supported, and they would be able to utilize this as a teaching platform for their own children. Additionally, children would enjoy sharing their school experiences, and teaching their families what they learned at school. In this way, families and children could learn from each other and together, in a low stress, fun, and interactive way. This supports Second Language Acquisition Theory, as it states that when input is comprehensible with the use of pictures, realia, movement and interesting activities, language acquisition occurs subconsciously and involuntarily, which aligns with my theoretical framework as described in Chapter 1 (Krashen, 2013). This would be a great tool to engage families and bridge the divide between home and school. This also supports Sociocultural Theory, as this theory states that learning language is social practice that is used for communication purposes, which aligns with my theoretical framework as described in Chapter 1 (Vygotsky, 1978).

Public Education. This intervention could also be useful for pre-kindergarten to Grade 2 and potentially even higher grades, in public school settings. While the previously mentioned family engagement version could be utilized, this intervention

would also work well in a specialist or classroom context. For example, during the literacy block in a kindergarten classroom, a classroom teacher could rotate the students through centers, as is commonly done in schools with guided or small group reading. Teachers could plan to do a vocabulary lesson during their small group lesson, such as the one from this study, and then instead of completing the follow-up activities with a teacher, students could take responsibility for their own learning, and complete the activities on the iPad application. This would enable the teacher to have more time to work with small groups, while also ensuring that students are effectively working on their new vocabulary skills. Additionally, this would allow the teacher to target the needs of specific groups of students, or even individuals.

The same scenario could work well for a specialist, such as an ESOL teacher, who may be working with a variety of language proficiency levels at the same time. The teacher could also rotate through students, teaching a brief vocabulary lesson targeted to their specific level and needs, before having them work on the iPad individually to continue to practice and reinforce the new vocabulary words.

This is just one possibility of how this intervention could be applied to a classroom or specialist setting. This intervention model is supportive of teachers' time and resources, while still being an effective practice for DLLs. There are many variations for how this could be used in this setting, varying from subject-matter to context, that would prove to be beneficial for both teachers and students. The use of this intervention supports the tenants of Second Language Acquisition Theory and Sociocultural Theory,

in order to support the language learning of DLLs, which aligns with my theoretical framework as described in Chapter 1 (Krashen, 2013; Vygotsky, 1978).

Higher Education. The implications for the intervention also apply to schools of education and teacher training. While technology has been incorporated into teacher preparation programs, more is needed with regard to providing prospective teachers with specific contexts, programs/applications, and sample lessons. The use of technology must be deliberately planned and well thought out as it was for this intervention study. Simply handing a student an iPad is not enough, as is often the strategy employed by unsuspecting teachers. The instruction must still be directed, even from a distance, to ensure that students are getting what they need from the technology experience. Higher education educators should utilize this study as an example of how deliberate planning and incorporation of technology into a lesson can be beneficial for both the teacher and their students. The use of Dual Coding Theory, Cognitive Theory of Multimedia Learning, and Universal Design should be considered when creating these learning opportunities for future educators, as these theories help to provide a guideline for how to effectively utilize technology in meaningful way, which aligns with my theoretical framework as described in Chapter 1 (Clark & Paivio, 1991; Mayer, 2009; Rose & Meyer, 2006).

Opportunities for curriculum re-design utilizing technology should be considered. Incorporating the use of technology into everyday lessons can not only help to provide more opportunities for differentiation and scaffolding needed by DLLs/ELLs, but also enable the classroom teacher to free up time to work in more small groups to target

instruction based on specific student needs. Teacher education programs need to utilize technology as a tool for instruction and teach prospective teachers the most appropriate and beneficial ways to incorporate a multitude of technological tools into instruction. The benefits of teaching prospective teachers how to best apply these skills in their classrooms will greatly impact the success of many different students, including DLLs/ ELLs. Theories such as Dual Coding Theory, Cognitive Theory of Multimedia Design, and Universal Design, that best support these practices, should also be incorporated into the curriculum, which aligns with my theoretical framework as described in Chapter 1.

Additionally, more in-depth training is needed for working with DLLs/ELLs in order to prepare prospective teachers for the reality of their future classrooms. As the population of DLLs/ELLs grows, so does the need for educators to be knowledgeable and skillful in how best to meet the needs of these students. Technology is just one avenue by which teacher education programs can provide tools that engage, differentiate, and support prospective teachers on working with their DLL/ELL populations.

This study adds evidence to the need for varied opportunities in field experience for teacher education programs so that prospective teachers can practice applying technological tools that would enable them to work with a variety of language and ability-leveled students. Giving prospective teachers the opportunity to engage with DLLs/ELLs in the field and practice their new-found knowledge in real life experiences would allow them to become more comfortable working with this population, thus enabling them to be more successful and capable educators.

Given the current COVID-19 climate, opportunities for in-person field experiences are not enough. Prospective teachers need to have opportunities for varied online field experiences as well. Now more than ever, the use of technological tools, including engaging students in asynchronous and synchronous online formats, is something that must be incorporated into current teacher education programs. The current study adds to the evidence that there are meaningful ways to use technology to teach content that enable all students to be successful.

Post-COVID-19. The current COVID-19 pandemic has impacted education greatly, as classrooms have been moved to partial or entire virtual models for now and the foreseeable future. These virtual models require the use of technology, by both educators and students, in order to increase academic outcomes. The current study makes a case for the use of direction instruction coupled with multimedia, as both forms of intervention (with and without the multimedia strategy) were nearly identical in terms of effectiveness.

This model could and should be used in the current climate, as it would allow for a teacher to work with multiple small groups of students, differentiating and targeting their instruction based on individual needs. This maximizes the teacher's use of time and resources, as the student would be able to work independently to follow up on the direct instruction using the selected iPad application, instead of needing to continue instruction with the teacher. As this could be accomplished without risk to loss of academic outcomes, as shown in the current study, this intervention is proven to be a valuable and beneficial option for both teachers and students.

Limitations

Several limitations must be noted about the current study. These include sample size and its effect on statistical power, as well as violations of assumptions for the data set. While these limitations were remedied to the best of the researcher's abilities, they must be acknowledged and discussed in order for future research to benefit from the current study's shortcomings.

Sample Size. This study was limited by the small sample size. An *a priori* power analysis conducted by the researcher using G Power, based on moderate effect sizes of .25, correlation values of 0.5, an alpha level of .05, and a power level of .80, indicated that the sample size for this study would need to be slightly increased in order to obtain an F value large enough to reject the null hypothesis for both between-subjects factors (control/treatment groups: $N = 34$, language proficiency levels: $N = 48$, actual sample size: $N = 32$).

While post-hoc tests for observed power indicated that statistically significant reported results met an acceptable power level, non-significant results did not reach an acceptable level of power. Observed power levels of the completed analysis indicated that pre/post tests were at an acceptable level for all dependent variables, as the observed power level was 1.0, with the exception of the EVT-3 at .782, and the TVA ES at .986. Within-subjects interaction effects observed power levels ranging from .011 to .468. Between-subjects main and interaction effects observed power levels ranging from .011 to .348. As the current study had a limited number of participants due to time, resources,

logistics, and ethical responsibilities, the results should be interpreted with caution, specifically those without an acceptable level of power.

Violations of Assumptions. This study was limited by the violation of assumptions for some of the dependent variables in the data set. While this was remedied in a variety of ways as discussed in Chapter Four—including attempts at transformation, removal of outliers, multiple analyses examined using varying versions of the data set, and applied conservative *p* values—this still must be stated as a limitation of the current study, and therefore, results should be interpreted with caution.

Recommendations for Future Research

This study adds to the field of research and would benefit from additional future research in order to remedy limitations, as well as to explore a wider variety of populations, settings, and materials, in both empirical and longitudinal research.

Limitations. Remedying the limitations of the current study for future research would be most beneficial. A larger sample size would help to eliminate the shortcomings of the current study with regard to normality, homogeneity of variance, and power. Additionally, while the 2x2 AB/BA crossover design was a balanced design uniform with sequence and periods, the use of a 4x4 ABBA/BAAB/AABB/BBAA crossover design would be more strongly balanced and could lead to more statistically sound results.

Empirical. As the current study's outcomes showed that utilizing technology in the form of an iPad application was as effective as teacher-led instruction, it is critical that additional research be conducted. This study has the potential to open the door for a greater range of uses, should it be researched further and found to be successful in the

terms of subject areas, populations, and settings. Research to expand on the current study is necessary in order to examine all of the potential possibilities of how this technology can be used to support DLLs/ELLs and their academic success.

Additional research to examine a variety of populations should be considered, as this study focused only on 3-year-olds in preschool. Additional research is needed to examine the effects on a wider variety of ages that fall into the early childhood age range, ages 2 through 7, in order to identify the effects of this intervention on all DLLs. Future research should also examine the intervention's effect using varying native languages, as the current study focused on a native language of Spanish, and many more languages are represented in the DLL population across the country. Additionally, research should also examine this intervention with socioeconomically disadvantaged students, as well as students with disabilities.

A variety of settings should be examined in future research, as the current study focused on a private early childhood education center. Expanding the research to examine the effects of this intervention on include public education facilities, including elementary schools and Head Start programs, would be beneficial to understanding how this intervention could be utilized across a variety of settings.

The iPad application for the current study, Pocoyo, was selected due to its thematic-based vocabulary selections and featured technology features. Expansion on the current research to include other available applications, as well as a means for evaluating the effectiveness of these applications, would be highly valuable for future research.

Longitudinal. In addition to the previously mentioned considerations for future research, the current study would also benefit from the expansion of an empirical design to a longitudinal design, in order to examine the long-term effects on vocabulary attainment for DLLs. Follow-up measures should be administered both short-term and long-term, in order to evaluation the intervention's lasting effect on vocabulary achievement.

Conclusions

This study sought to find out if the use of multimedia and native language supports increased the expressive and receptive vocabularies of DLLs, and if any differences existed in these results by language proficiency level. Results indicated that this form of intervention was successful, with control and treatment groups performing similarly overall on all measures, from pre-test to post-test. These results are important given the current climate with COVID-19 and increase in need for effective uses of technology to teach academic content. Additionally, the results of this intervention have possibilities for current practice in multiple settings, including community, public education, and higher education. The results of this study add to the current literature and are especially important, considering the minimal existing research on the topic in the field. The use of this intervention can go far beyond what was examined in the current study and could be used in countless ways to effectively increase the language abilities and academic outcomes for DLLs in varying contexts. Multimedia with native language supports should be studied in both empirical and longitudinal research, as well as

implemented within multiple contexts, as it is a proven intervention that has endless possibilities both for current practice and future research.

Preparing, conducting, and analyzing this study has been one of the most rewarding and challenging experiences of my life. I learned not only about the outcomes of my research, but also about myself. I found that I am not only capable of conducting a study from start to finish on my own, but that I can conclude meaningful and important effects that have the potential to have significant impact on the lives of others. The field of language acquisition needs more studies that incorporate technological tools, especially for young DLLs, as the world is changing to insert more and more technology into everyday use. Research in this field is critical in order to understand both the benefits and challenges of technology as it relates to second language acquisition, examining both the short- and long-term effects in academic outcomes.

DLL/ELL students deserve to have the same educational opportunities as others, and should be taught by educators who are confident, capable, and knowledgeable in their abilities. I would like to share what I have learned from the current study with current and prospective educators and help them to develop ways to use technology in their own classrooms in meaningful ways with their DLLs/ELLs. This research has the potential to assist teachers in becoming more knowledgeable and comfortable with providing meaningful and appropriate strategies to DLLs/ELLs. This study could open a door for teachers who feel incapable of working with DLLs/ELLs and help them to see that there are ways to help their students that are more attainable than they may seem. I hope to continue to study ways that technology and other strategies could be used to

teach vocabulary in effectives ways for DLLs/ELLs, and to then share what I have learned with prospective and current educators, in order to help improve the academic, and ultimately life, outcomes of as many students as possible.

Appendix A. Home Language Survey English

A Vocabulary Intervention Utilizing Multimedia and Native Language Supports for Dual Language Learners
Principal Investigator: Dr. Marjorie Haley
Student Researcher: Chelseann Christopher
IRB Package #: 1354336-1

HOME LANGUAGE SURVEY

1) Do you (the parent) speak a language other than English? If so, what language?

---

2) Does your child speak a language other than English? If so, what language?

---

3) Do you speak to your child in a language other than English? If so, what language?

_____

Parent/Guardian Name

_____

Name of Child

Appendix B. Home Language Survey Spanish

Una intervención de vocabulario que utiliza soportes multimedia y de lenguaje nativo para estudiantes de lenguaje dual
Investigador principal: Dr. Marjorie Haley
Estudiante investigador: Chelseann Christopher
Paquete IRB #: 1354336-1

ENCUESTA SOBRE EL IDIOMA QUE SE HABLA EN CASA

1) ¿Usted (padre/madre) habla un idioma que no sea inglés? Si la respuesta es afirmativa, ¿qué idioma habla?

---

2) ¿Su hijo/a habla un idioma que no sea inglés? Si la respuesta es afirmativa, ¿qué idioma habla?

---

3) ¿Habla con su hijo/a en un idioma que no sea inglés? Si la respuesta es afirmativa, ¿en qué idioma?

_____
Nombre del padre/madre/tutor

_____
Nombre del hijo/a

Appendix C. Informed Consent Form English

A Vocabulary Intervention Utilizing Multimedia and Native Language Supports for Dual Language Learners
Principal Investigator: Dr. Marjorie Haley
Student Researcher: Chelseann Christopher
IRB Package #: 1354336-1

INFORMED CONSENT FORM

RESEARCH PROCEDURES
This research is being conducted to investigate the effects of multimedia enhanced instruction on the vocabulary acquisition of Dual Language Learners in the early childhood age range. If you agree to allow your child to participate, your child will be asked to participate in an eight week long intervention, with three twenty minute sessions per week for a total of 480 minutes. This intervention will consist of specialized vocabulary instruction with the incorporation of a read aloud and multimedia in the form of videos and apps. Parents will be asked to complete a home language survey and a parent questionnaire about their child.

RISKS
There are no foreseeable risks to participating in this study. Students will not be missing primary instruction time for the study as the researcher will be coming in during their play/free choice time at the end of the day.

BENEFITS
The potential benefits to you/your child include direct instruction from a licensed ESOL teacher in a small group setting using research based strategies that will increase the English language vocabulary of the participants. In addition, the potential benefits to the field of language development include the enhancement of the understanding of multimedia's effect on language acquisition of students in the early childhood age range.

CONFIDENTIALITY
The data in this study will be confidential. All data sources will be kept on a secure and locked external hard drive device. This device will be kept locked in the researcher's office when not in use. Student names will be changed to numbers so that the identifying information is unknown to any others who may review the data. Only the primary investigator and student researcher will have access to the identification key, which will be destroyed immediately following the data analysis process, not to exceed one month from the final assessment date.

PARTICIPATION
Your child's participation is voluntary, and you may withdraw your child from the study at any time and for any reason. If you or your child decide not to participate or if you or your child withdraw from the study, there is no penalty or loss of benefits to which you or your child are otherwise entitled. There are no costs to you or any other party. Students will be included in this study if they 1) range in age from three to six, 2) are students in the chosen setting facility, and 3) are identified as ELL via the Home Language Survey completed by the parents or guardians.

CONTACT
This research is being conducted by Chelseann Christopher at George Mason University. She may be reached at for questions or to report a research-related problem. The faculty advisor for this study is Dr. Marjorie Haley at George Mason University, who may be reached at You may contact the George Mason University Institutional Review Board office at if you have questions or comments regarding your or your child's rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your or your child's participation in this research.

CONSENT
I have read this form, all of my questions have been answered by the research staff, and I agree to allow my child to participate in this study.

_____
Parent/Guardian Name

_____
Date of Signature

_____
Name of Child

Appendix D. Informed Consent Form Spanish

Una intervención de vocabulario que utiliza soportes multimedia y de lenguaje nativo para estudiantes de lenguaje dual
Investigador principal: Dr. Marjorie Haley
Estudiante investigador: Chelseann Christopher
Paquete IRB #: 1354336-1

FORMULARIO DE CONSENTIMIENTO INFORMADO

PROCEDIMIENTOS DE INVESTIGACIÓN
Esta investigación se está llevando a cabo para investigar los efectos de la instrucción enriquecida por contenido multimedia en la adquisición del vocabulario de estudiantes de inglés en la primera infancia. Si usted está de acuerdo en permitir que su hijo/a participe, su hijo/a deberá participar en una intervención de tres semanas de duración, con ocho sesiones de veinte minutos por semana por un total de 480 minutos. Esta intervención consistirá en una instrucción especializada de vocabulario, con la incorporación de lectura en voz alta y de contenido multimedia en forma de videos y aplicaciones. Los padres deberán completar una encuesta sobre la lengua nativa y un cuestionario para padres sobre su hijo/a.

RIESGOS
No existen riesgos previsibles por participar en este estudio. Los estudiantes no perderán el tiempo de instrucción primaria para el estudio ya que el investigador vendrá al fin del día cuando los estudiantes tienen centros de juego y exploración libre.

BENEFICIOS
Los beneficios potenciales para usted/su hijo/a incluyen la instrucción directa de un profesor licenciado en ESOL en un pequeño grupo con estrategias basadas en estudios que aumentarán el vocabulario en inglés de los participantes. Además, las ventajas potenciales en el campo del desarrollo de la lengua incluyen la mejoría en la comprensión del efecto de los contenidos multimedia en la adquisición del idioma en estudiantes en la primera infancia.

CONFIDENCIALIDAD
Los datos en este estudio serán confidenciales. Todas las fuentes de datos serán guardadas en un disco duro externo seguro y bloqueado. Este dispositivo permanecerá bloqueado en la oficina del investigador cuando no esté siendo utilizado. Los nombres de estudiantes serán intercambiados por números para que cualquier otro que pudiese examinar los datos no conozca la información identificatoria| Solo el examinador principal e investigador de los alumnos tendrá acceso a la clave de identificación, que será destruida inmediatamente después del proceso de análisis de datos, a no más de un mes de la fecha final de evaluación.

PARTICIPACIÓN
La participación de su hijo/a es voluntaria y usted puede retirar a su hijo/a del estudio en cualquier momento y por cualquier razón. Si usted o su hijo/a deciden no participar o si usted o su hijo/a se retiran del estudio, no recibirán ninguna sanción ni perderán beneficios que usted o su hijo/a hayan recibido. No existen costes para usted o cualquier tercera parte. Los estudiantes serán incluidos en este estudio si 1) tienen de tres a seis años de edad, 2) son estudiantes en las

instalaciones elegidas, y 3) son identificados como estudiantes de inglés como segunda lengua a través de la Encuesta sobre la Lengua Nativa realizada por los padres o tutores.

CONTACTO
Esta investigación es conducida por Chelseann Christopher de la Universidad George Mason. Ella puede ser contactada al 412-877-3542 si tiene alguna pregunta o desea informar sobre un problema relacionado con la investigación. La consejera de facultad para este estudio es la Dra. Marjorie Haley de la Universidad George Mason, quien puede ser contactada al 703-993-8710. Usted puede comunicarse con la oficina del Consejo Evaluador Institucional de la Universidad George Mason al 703-993-4121 si tiene preguntas o comentarios con respecto a sus derechos o los de su hijo/a en la investigación.

Esta investigación ha sido evaluada según los procedimientos de la Universidad George Mason que rigen su participación o la de su hijo/a en esta investigación.

CONSENTIMIENTO
He leído esta formulario, todas mis preguntas han sido contestadas por el personal de investigación, y estoy de acuerdo en permitir que mi hijo/a participe en este estudio.

_____
Nombre del padre/madre/tutor

_____
Fecha de la firma

_____
Nombre del hijo/a

Appendix E. Recruitment Letter English

A Vocabulary Intervention Utilizing Multimedia and Native Language Supports for Dual Language Learners
Principal Investigator: Dr. Marjorie Haley
Student Researcher: Chelseann Christopher
IRB Package #: 1354336-1

RECRUITMENT LETTER

Dear parents/guardians,

My name is Chelseann Christopher, and I am a PhD student at George Mason University where I study Multilingual/Multicultural Education and Special Populations. I am also a licensed ESOL teacher who has seven years teaching experience in the public school system. I am passionate about learning how to best help English Language Learners develop their vocabulary so that they can be successful in language and academics.

I am looking to recruit volunteer student participants for a study on the effects of a multimedia intervention on the vocabulary achievement of early childhood ELLs. This study would include small group instruction from me using research based strategies, a read aloud, and multimedia in the form of games and apps to help your child learn English words that coincide with what they are currently learning in the classroom. This study will take place for a total of eight weeks, with three 20 minute lessons per week, for a total of 480 minutes.

There are no significant risks to this study. Students will not be missing primary instruction time for the study as the researcher will be coming in during their play/free choice time at the end of the day. Student participants can expect to gain an increase in vocabulary word attainment in a small group setting from a licensed ESOL teacher. All student information will be secured and kept confidential.

This study is expected to enhance the understanding of multimedia's effect on language acquisition of students in the early childhood age range, and will help build the pathway for future research in this field.

I hope you will consider letting your child participate in this study. Please feel free to contact me with any questions or concerns.

Thank you.

Chelseann Christopher
412-877-3542

Appendix F. Recruitment Letter Spanish

Una intervención de vocabulario que utiliza soportes multimedia y de lenguaje nativo para estudiantes de lenguaje dual
Investigador principal: Dr. Marjorie Haley
Estudiante investigador: Chelseann Christopher
Paquete IRB #: 1354336-1

CARTA DE RECLUTAMIENTO

Estimados padres/encargados,

Mi nombre es Chelseann Christopher, y soy una estudiante de doctorado (PhD) en la universidad George Mason, donde estudio Educación Multilingüe/Multicultural y Poblaciones Especiales. También soy profesora licenciada ESOL (inglés como idioma secundario o extranjero) que tiene siete años de experiencia docente en el sistema escolar público. Me apasiona conocer la manera de ayudar mejor a los aprendices del idioma inglés (ELL) para que desarrollen su vocabulario de manera que sean exitosos en el idioma y en la escuela.

Busco reclutar estudiantes voluntarios para un estudio en los efectos de una intervención multimedia en el aprendizaje de vocabulario en la infancia temprana ELL. Este estudio incluiría un pequeño grupo de instrucción de mi parte utilizando estrategias basadas en la investigación, una lectura en voz alta, y material multimedia en forma de juegos y aplicaciones para ayudar a su niño a que aprenda palabras en inglés que coincidan con lo que aprenden en ese momento en el salón de clase. Este estudio se llevará a cabo en tres semanas, con 3 lecciones por semana de 30 minutos, para un total de 270 minutos.

No hay riesgos significativos en este estudio. Los estudiantes no perderán el tiempo de instrucción primaria para el estudio ya que el investigador vendrá al fin del día cuando los estudiantes tienen centros de juego y exploración libre. Los participantes pueden esperar una mejora en su aprendizaje de vocabulario en un pequeño grupo administrado por una maestra ESOL. Toda la información de los estudiantes estará segura y será confidencial.

Del estudio se espera mejorar el entendimiento del impacto de los elementos multimedia en la adquisición del lenguaje en estudiantes en infancia temprana, y ayudará a construir un camino para investigaciones futuras en este campo.

Espero que consideren dejar a sus niños participar en este estudio. Por favor contáctenme con cualquier duda o pregunta.

Gracias.

Chelseann Christopher
412-877-3542

Appendix G. Child Assent Script

A Vocabulary Intervention Utilizing Native Language Supports and Multimedia for Dual Language Learners
Principal Investigator: Dr. Marjorie Haley
Student Researcher: Chelseann Christopher
IRB Package #: 1088232-1

ASSENT SCRIPT

My name is Chelseann Christopher and I am from George Mason University.

I want to talk to you about a research project I am doing. I am trying to learn more about how kids learn new words and I would like for you to participate. Your parents have already agreed to allow you to talk to us, but you can talk with them about it at any time.

If you would like to help me with my project, you will be asked to work with me and a group of your friends to practice your English by reading stories and playing games.

Will anything bad happen?
It is not likely that something bad will happen to you. If you feel uncomfortable at all, you should tell me or your parents.

Will anything good happen?
Yes, you will learn some new words so that you can speak more in English.

What if I do not want to do this?
You do not have to be in this study. It is up to you. You can say "no" now, or you can change your mind later. All you have to do is tell us. You will not be in trouble for saying "no" or changing your mind.

Who can I talk to about this study?
If you have questions about the study or have any problems, please let me or your parents know, and they can get in touch with us.

Would you like to participate?

If you would like to participate in our project, please say "yes".

If you would not like to participate, please say "no" at this time.

Appendix H. IRB Approval Letter

Office of Research Development, Integrity, and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE:	January 24, 2019
TO:	Marjorie Haley, PhD
FROM:	George Mason University IRB
Project Title:	[1088232-3] The Effects of a Multimedia Based Supplementary Intervention on the Vocabulary Attainment of Early Childhood ELLs
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	January 24, 2019
REVIEW TYPE:	Expedited Review

Thank you for your submission of Amendment/Modification materials for this project. The George Mason University IRB has APPROVED your submission. This submission has received Expedited Review based on applicable federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form unless the IRB has waived the requirement for a signature on the consent form or has waived the requirement for a consent process. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by the IRB prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to the IRB office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed (if applicable).

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the IRB.

This study does not have an expiration date but you will receive an annual reminder regarding future requirements.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

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BIOGRAPHY

Chelseann Christopher received her Bachelor of Science from Slippery Rock University in 2009, and her Master of Science from Duquesne University in 2011. She was employed as an ESOL teacher in Prince William County, Virginia for four years, where she served as team lead, teacher trainer, curriculum writer, and cooperating teacher, in addition to many service-oriented projects for students and staff. She was employed as an ESOL teacher in Montgomery County, Maryland for three years, where she helped developed curriculum for a variety of departments, and also led professional development. She has presented at local, state, and national conferences in her field, and has taught at the university level as a graduate lecturer for the early childhood department at George Mason University.