

A META-ANALYSIS OF THE RELATIONSHIP BETWEEN
LEARNING A FOREIGN LANGUAGE IN ELEMENTARY
SCHOOL AND STUDENT ACHIEVEMENT

by

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ABSTRACT

Understanding mathematics is an essential part of everyday life and can range from simple tasks such as using basic math skills to more complex tasks. Success in mathematics is a requirement for success in today's modern world. A lack in developing mathematical skills can create complications and interfere with job opportunities. Another basic essential for success in society is reading. There are intense problems associated with students who cannot read successfully, such as higher dropout rates. Studies have shown that learning a foreign language during elementary school increases a child's ability to develop cognitive skills, and research has shown that proper development of cognitive skills improves a student's ability to read and perform mathematical skills successfully. Research studies involving dual-language/two-way immersion schools suggest that students at these schools obtain higher scores on achievement tests in both mathematics and reading. This study is a meta-analysis of studies involving dual-language/two-way immersion schools in an effort to confirm the hypotheses that (1) there are differences in student performance when comparing students who learn foreign language in elementary school versus those who don't, and (2) students score higher in reading, vocabulary, and/or mathematics if they learn foreign language in elementary school when compared to those who don't. The meta-analysis began with 51 quantitative research studies but was narrowed down to 17 after categorizing the studies. Using weighted effect sizes and Cohen's d , the results for the d values were .64 (medium) for vocabulary, .22 (small) for reading, and .11 for mathematics. Only homogeneity tests were calculated in each category. The Q values indicated

homogeneity for the category of mathematics only. Therefore, additional research is suggested, beginning with heterogeneity testing.

DEDICATION

I dedicate this dissertation to the following people: Rev. Billy Joe Butler (deceased July 7, 2008), Emily M. Butler, and to all my relatives and friends, especially to my son Aaron C. Stewart for whom I hope this dissertation will serve as an inspiration to him to complete his college career as well.

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CHAPTER 1

INTRODUCTION

The results of standardized achievement tests across the nation have suggested that students struggle with mastering basic educational skills such as reading and mathematics. Several innovative approaches have been tried to help students achieve these goals. Nevertheless, students have continued to score below average on such tests, including students of low socioeconomic status as well as students of African-American and Latino cultures (Fryer & Levitt, 2004; Duncan & Brooks-Gunn, 2000; Becerra, 2012).

Statement of the Problem

According to Cowan Pitre (2014), the National Center for Educational Statistics defines the educational achievement gap as the results when “one group of students outperforms another group, and the difference in average scores for the two groups is statistically significant” (Cowan Pitre, 2014, p. 209). The National Assessment of Educational Progress continues to show an unquestionable discrepancy in student achievement with African American, Latino, and American Indian student outcomes at the lowest levels of achievement. The achievement gap between these students and their White and Asian peers has been consistent since the 1960s. The U.S. Department of Education reports that the National Assessment of Educational Progress is the largest national, continuous educational assessment of student progress (Cowan Pitre, 2014). Jeynes (2015) takes this one step further and specifies the achievement gap by saying that every aspect of student achievement is included in this gap including grade point average, standardized tests, drop-out rate, and the extent to which students are retained. African American children

actually begin school about one-half of a standard deviation behind Caucasians on standardized reading and mathematics tests. This increases by about one tenth of a standard deviation per school year causing the achievement gap to widen (Burchinal, et. al., 2011). In fact, Olneck claims the achievement gap is about two years by the time students reach the eighth grade (Olneck, 2005).

Hartney and Flavin (2014) argued that the achievement gap either became stagnant or increased slightly since the 1990s, although they also reported that research in psychology claimed there are no cognitive differences between White and African American infants. For example, Fryer and Levitt (2013) showed this in their research when they studied children of different ages. Fryer and Levitt (2004) also showed there was a difference between Caucasians and African Americans as early as only 2 years of schooling when they tested for age appropriate measures. Jencks and Phillips (1998) claimed the achievement gap remains statistically significant even when controlling the variables of socioeconomic status and family background.

Cooper and Schleser (2006) also studied issues related to the achievement gap and concluded the gap in mathematics actually begins as early as kindergarten. A study by Hill and Craft (2003) showed that Caucasian kindergartners outperformed African Americans on mathematical quantitative concepts. Others who were investigating and comparing the progress of children at an early age were Entwisle and Alexander (1990). Their study involved testing first graders at the beginning of the school year. At that time, they found that Caucasian students scored significantly higher on mathematics concepts but not on mathematics computation. The students were retested at the end of the school year when Entwisle and Alexander (1990) found that Caucasians were outperforming African Americans on both mathematical concepts and computation tests. According to Cooper and Schleser (2006), these differences continue to

follow African American students causing a long-term impact on their mathematical skills. In fact, Barth (2001) claimed that by the end of high school, most African American students demonstrated mathematics skills that were equivalent to the skills of most eighth grade Caucasian students. Researchers have studied different variables such as socioeconomic status, home activities, and parental education in an effort to find reasons for the achievement gap. Although these variables may have some impact on education, results of further studies have revealed that “these variables are not the key to understanding the achievement gap” (Cooper & Schleser, 2006, p. 302). Cooper and Schleser went beyond these variables and included the cognitive developmental level in their study as they claimed this concept had not been considered previously.

Latino students are also a part of this achievement gap. According to the United States Bureau of Census in 2012, almost 50 million Hispanics currently live in the United States, a number showing continuous increases. In fact, people of the Latino culture belong to the fastest growing linguistic group of English Language Learners (ELLs) in America, consisting of 65% of immigrants (Jackson, Schatschneider & Leacox, 2014). Many of the Hispanic children who enter the nation’s schools come from homes where Spanish is the dominant language. Limited English speaking skills often affect their education negatively, with one result being lower test scores on standardized tests (Koo & Becker, 2014). Crosnoe used data from a longitudinal study completed in 2002 not only showing the same results, but also confirming this problem has been in existence for years (Crosnoe, 2007). Even though Congress first addressed this issue when it passed the Bilingual Education Act of 1968, with additional amendments offering hope for people with limited English skills (Stroller, 1976), finding workable solutions for problems resulting from a lack of English speaking skills has been a challenge for educators. Nevertheless,

the proportion of White youth has been declining in the U.S. since 1980 while nonwhite youth continue to increase. The U.S. must find ways to improve the educational outcomes of nonwhites, such as African Americans and Latinos, in order to continue graduating large numbers of highly educated and skilled workers (Riegle-Crumb & Grodsky, 2010).

Significance of the Problem

A number of different program designs have been implemented in an effort to determine the best approach for learning a foreign language in elementary school. One of the main variations in these foreign language programs was the amount of time children spent in a foreign language classroom setting. The least amount of time occurred when students were pulled out of their regular classroom several times per week for a minimum of 20 minutes each day. The greatest amount of time occurred in programs where complete instruction was given in a foreign language all day. Other programs fell in between these two designs, where they allowed more than an hour per week of foreign language study but not to the extent of learning everything in a foreign language all day. In the early designs, the main idea was to help Hispanic children develop their English language skills. However, research has shown these programs accomplished more than just assistance with the development of their English speaking skills, including an increase in student achievement as well (Strasheim, 1969; Nakamoto, Lindsey & Manis, 2012).

According to Fisher and Ivey (2006), the number of students considered as low achievers who struggle with reading has increased; data have shown that 67% of eighth graders and 64% of twelfth graders performed below the “proficient” level. By the turn of the twenty-first century, low achievement across the nation was already considered a crisis by some (Fisher & Ivey, 2006). Others claim these students never really develop their reading skills which then interfere

with developing their mathematical skills (Devault & Joseph, 2004). Some have taken this research further and shown that reading, mathematics, and developmental skills are inter-correlated (Son & Meisels, 2006). Researchers have connected more behavioral and emotional difficulties to students with poor reading skills (Daniel, et al, 2006). According to Landry (1974), learning a foreign language in elementary school has positive effects on the development of cognitive and divergent thinking skills (Landry, 1974). Hence, some have argued that increasing students' abilities to develop their cognitive and motor skills may increase their reading and mathematical skills. Therefore, it seems more reasonable to think that learning a foreign language in elementary school may increase reading and mathematical skills. Because nonwhite students graduate with their mathematical skills much lower than Caucasians (Cooper & Schleser, 2006), a solution to the achievement gap is critical. Riegle-Crumb and Grodsky (2010) argue the U.S. will not be able to produce enough highly educated and skilled workers needed to meet the demands of America if the achievement gap crisis is not solved.

One might question if this teaching strategy would still work in the 21st century. Thomas and Collier were hired by the North Carolina Department of Education to complete a longitudinal study throughout the state of North Carolina. They reported the results at a conference in 2012 (<http://www.ncpublicschools.org>). Their three-year longitudinal study was during the school years of 2008, 2009, and 2010. It confirmed that dual-language students score higher in mathematics and reading regardless of ethnicity, socioeconomic status, LEP (English learners), or special education status. Not only did the students score higher, but a very important fact that Thomas and Collier showed was the difference in the achievement gap. All groups of students, including English learners, African Americans, special education, and those of low socioeconomic status, narrowed their achievement gaps when compared to the same groups who

did not participate in a dual-language program. It should be noted that Thomas and Collier were not allowed to publish their findings in a journal since it was considered private information paid for by the state of North Carolina. However, while some information regarding it can be found on the state's website, a full report of the study may be obtained through the North Carolina Education System.

In summary, an achievement gap exists in the United States between Caucasian students and most nonwhite students to the point that some consider it to be critical (Cooper & Schleser, (2006). In fact, Riegle-Crumb and Grodsky (2010) argue that if the achievement gap is not fixed it will create a crisis at some point. Thomas and Collier (2012) showed there is hope for closing the achievement gap for students regardless of race, ethnicity, or socioeconomic status when students learn a foreign language in elementary school. The reason foreign language in elementary school (FLES) is important is that it increases cognitive skills that are necessary for reading comprehension and high level mathematical skills. In fact, research showed that these skills are all inter-correlated (Son & Meisels, 2006). Statistics show that low achievement and the number of students struggling with reading continue to increase (Fisher & Ivey, 2006). Hence, a different approach, namely FLES, is needed to not only stop this increase but also close the achievement gap as well.

Research Questions

Foreign language can be taught at different levels arranging from attending a foreign language class for a limited time per week versus attending a dual-language school where foreign language is used at least equally or possibly the majority of the time. Considering these differences in the level of foreign language that students receive, a question arises, what are the differences in student performance when comparing students who learn differing amounts or

proficiencies in a foreign language in elementary school? In particular, this study is trying to determine if students score higher in reading and/or mathematics if they learn a foreign language in elementary school when compared to students who don't. Therefore, two questions are hypothesized as follows:

H₁: Elementary school students learning a foreign language have higher mathematics scores than students who are not learning a foreign language.

H₂: Elementary school students learning a foreign language have higher reading scores than students who are not learning a foreign language.

H₃: Elementary school students learning a foreign language have higher vocabulary scores than students who are not learning a foreign language.

These hypotheses guided the analysis of this study to determine if research has shown that learning foreign language in elementary school appears to be related to student performance in reading and mathematics. The meta-analytic review of research studies found that foreign language and student performance were related, causing the null hypothesis to be rejected, for reading and vocabulary but not mathematics. Additional research is needed using these results to determine which type of foreign language program is best in order to possibly determine if a recommendation can be made to policy developers about teaching foreign language at the elementary school level.

Definitions of Terms

FLES – abbreviation for foreign language in elementary school.

Effect Size – a measure that indicates the degree of departure from the null hypothesis in standard units (Cohen, 1977). More important, it reflects the strength of a relationship between two variables (Borenstein, Hedges, Higgins, Rothstein, 2009).

Meta-analysis – a statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the overall findings (Glass, 1976).

Assumptions of this Study

The following assumptions were considered by the researcher to constitute the basis for data collection and analysis of the data:

1. There exist a number of previous research studies comparing student achievement of students taking foreign language in elementary school to those who do not.
2. Previous studies exist that compared the same age group as well as the same skills.
3. A meta-analysis of the previous research studies had not been conducted within the past 10 years.

Limitations of this Study

There were several limitations when considering this study. First, when compared to the number of elementary schools that do not have a foreign language program, only a small percentage of elementary schools actually have such a program in place. The schools having such programs across the nation are dispersed based on the population types within certain regions. This makes it difficult to conduct studies comparing such programs. Therefore, the number of studies that have been completed may be a limitation for this study.

Second, the region where the study was conducted created possible limitations. Researchers questioned if the same results would be found in other regions of the nation, implying that their work was limited because of the area where studies were conducted. In other words, some researchers questioned whether or not the same results would be found if conducting the study in the northern part of the United States versus the southern part, or if comparing the east to the west (Taylor & Lafayette, 2010; Lopez & Tashakkori, 2004).

Interestingly, this was a common concern no matter where the study was conducted and it left researchers with that unanswered question. Based on the location of the school, the same test may not have been administered in all studies. While researchers claimed tests were comparable, one might argue there could be a slight difference based on the test administered (Taylor & Lafayette, 2010).

Also, age was a factor of concern for researchers as they each conducted their own study within one age group. As researchers introduced findings of their individual studies, they considered age a limitation because they tested students within one age group instead of considering students in all grades K–12. They considered this limitation as justification for the need for more studies to determine if the same results would be obtained in other age groups. However, age was considered a limitation in this study for a different reason. There are a limited number of studies available for each age group and, hence creates a limitation on this study.

Finally, more statistics could be calculated from the data, such as heterogeneity testing. Additional research is intended to extend this further including collecting more data, possibly conducting more studies, as well as more statistical calculations. A more in-depth look at individual student test scores could provide more information needed to produce more accurate results. Limiting these statistical calculations can also be considered a limit to this study.

Significance of the Research

There appears to be a rapid growth in the number of Latino students, yet only 35% of all ELL students are actually foreign born. In fact, 80% of these students have been in the United States for more than five years (Han, 2012). The latest report from the United States Bureau of Census was made available in 2012 and can be found on the website <https://www.census.gov/>. According to that report, 49.9 million Hispanics live in the United States and 36% were foreign

born. The census showed 35.7% of Hispanics age 25 or above do not have a high school education or equivalency. The number of Hispanics considered to be of school age, ranging from five years to 19, was more than 1.3 million. The report divided the nation into four regions and provided population data for each region. The Midwest had the fewest number of Hispanics with 4.2 million, followed by the Northeast with 6.9 million. However, most Hispanics lived either in the South, 18.1 million, or the West with 20.6 million. Nearly 80% of Hispanic children attending schools are Spanish speakers as they come from homes where Spanish is the dominant language, with very little English spoken, causing them to enter schools with limited English speaking skills, if any at all (Cobb, Vega, & Kronauge, 2006; Nakamoto, Lindsey, & Manis, 2012). Because limited English speaking skills can affect their ability to participate fully in society or interfere with success in school, No Child Left Behind (NCLB) requires schools to assist these students in reaching a level of proficiency in English as soon as possible. With the number of Hispanic students continuing to rise and the requirements of NCLB, it is evident there is a growing need for bilingual education programs (Cobb, Vega, & Kronauge, 2006). As of 2012, there were 31 states actively participating in dual-language programs providing a total of 422 programs throughout the United States (<http://www.cal.org>), representing a 38% increase in one decade alone.

There are three different approaches to bilingual education. The first approach is transitional and this is the type of program which the majority of United States schools use. The primary goal of transitional programs is fluency in the second language, English. Some examples of a transitional program are early-exit transitional, English-as-a-second-language, and structured or sheltered English immersion. Second, bilingual education programs can be categorized as a maintenance approach. The primary goal in this type of program is to develop both English and

the students' primary language as well as maintain the primary language. However, fluency in English is not considered as a goal. This type of program usually lasts at least four years. The third approach can be categorized as enrichment approaches. The primary goal of these programs is bilingualism for both the language minority students and the native English speaking students. Enrichment approaches usually last at least six years and are more commonly known as two-way immersion or dual-language instruction programs (Cobb, Vega, & Kronauge, 2006; Stewart, 2005; Nakamoto, Lindsey & Manis, 2010).

The history of foreign language instruction in U.S. schools is instructive in regard to the instructional approaches. While foreign language was offered in some public schools prior to World War II, it was not considered a part of the curriculum in most public schools. The United States recognized the importance of foreign language during World War II and began encouraging classroom instruction of foreign languages as early as elementary school (Beardsley, 1942). This idea grew at such a fast pace that by 1948 some elementary schools were operating programs similar to those of dual-language schools today (Pei, 1948). However, several controversial issues arose with the program. The age at which students should learn a foreign language was in question as well as the extent of the language to be learned. Penfield determined the best age to study foreign language depended on the development of the brain and thus recommended elementary school to be the best time to begin (Pelora, 1957). Most programs teaching foreign language in elementary school, e.g. FLES, allow the students to leave their regular classroom for 15 to 20 minutes, 3 to 5 days per week, to attend a foreign language class during that time. FLES created controversy because everyone did not agree with the program, but despite this, by the late 1950s and early 1960s, FLES had grown so much that the supply of foreign language teachers couldn't meet the demand (Kettlekamp, 1961). Cobb, Vega, and

Kronauge claimed there were less than 100 two-way bilingual programs in the United States prior to 1995, which increased to more than 260 programs in 2002 (Cobb, Vega, & Kronauge, 2006). The rise of FLES sets one important context for this study; U.S. elementary schools can and have committed to such instruction, indicating support for the idea that foreign language instruction enriches the student.

Cognitive and Mathematics Skills

FLES faced controversial issues such as interfering with learning in other subjects or simply being irrelevant to the learning needs. Through decades of controversy, FLES has managed to survive and still exists today. Due to the fact that some oppose the idea of dual-language programs, deciding whether FLES has positive or negative effects is one of the most controversial issues. Those who opposed such programs considered the programs to be failures, claiming too many participants failed to become fluent in English (Lopez & Tashakkori, 2004). The opposition claimed FLES would interfere with student achievement in other subject areas, but research has shown that is not the case (Landry, 1974; Johnson, Flores, & Ellison, 1963; Johnson, 1961; Taylor & Lafayette, 2010). Many researchers concluded FLES contributed to the cognitive development of children which had positive effects on their divergent thinking skills (Landry, 1974; Johnson, Flores, & Ellison, 1963; Johnson, 1961). Several researchers confirmed Penfield's work (1963), who reported that the best time to teach foreign language was during the development of the brain skills which was at the elementary school level (Landry, 1974; Larew, 1961; Pelora, 1957; Stewart, 2005). Son and Meisels (2006) showed developmental motor skills in reading and mathematics were inter-correlated. Vukovic (2012) suggested that the difficulties that students experienced in mathematics stemmed from deficits in reading-related processes.

Since these skills are inter-correlated, based on Vukovic's findings, they apparently can affect each other.

A Reading Deficit

The United States Department of Education reported that more than 8 million students in grades 4 through 12 struggled with reading in the year 2003 alone (Fisher & Ivey, 2006). According to Fisher and Ivey (2006) that number is now considered a crisis. Additional funding has been provided to help Hispanic and non-Hispanic students reach a level of proficiency in reading (Fisher & Ivey, 2006). Nevertheless, while waiting to achieve these levels, the deficiency in reading may have caused additional problems for schools. Students who have reading problems also tend to have more behavioral and emotional difficulties (Daniel, et al. 2006). Such students are more likely to drop out of school and have higher suicide rates as well (Daniel, et al. 2006). Reading programs have been implemented at the high school level to help students overcome the problem of illiteracy. One suggested solution at this level is to provide reading selections that are of interest to the students in an attempt to motivate them (Thompson, et al. 2008; Warrican, 2006). Some have argued that in order to address the reading problem, it must be tackled at the elementary level. The reading problem begins often with students not being able to develop reading skills such as reading comprehension (Devault & Joseph, 2004), which is related to developing mathematical skills. The argument also exists that learning a foreign language in elementary school helps children develop their cognitive skills (Landry, 1974). Researchers then concluded that the reading problem could be fixed by helping students develop the necessary cognitive skills needed for reading comprehension which could be done through a FLES program (Landry, 1974; Johnson, Flores, & Ellison, 1963; Johnson, 1961).

In summary, illiteracy has risen to such a high level that it has become a crisis in the United States (Fisher & Ivey, 2006). Illiteracy can cause additional problems such as behavioral and emotional difficulties which can lead to higher drop-out rates and higher suicide rates (Daniel, et al., 2006), thus creating a greater urgency to solve the illiteracy problem. Some researchers not only believe that a solution exists, but that they have found the answer to the problem, namely teaching FLES. Researchers believe FLES is the solution to illiteracy because students are not developing their cognitive skills to the highest potential, and FLES helps students develop these skills that are considered necessary for reading comprehension (Landry, 1974; Johnson, Flores, & Ellison, 1963; Johnson, 1961).

Purpose

Han (2012) summarized previous studies that showed successful use of bilingual education and made two important points. First, only those students who received strong, grade-level cognitive and academic support for many years were considered successful at the end of high school. He considered students to be successful if they achieved as well as, or better, than their native-English-speaking peers. The second point he made was that students who received 4 to 7 years of bilingual instruction outperformed in all subjects those students who received monolingual instruction in English (Han, 2012). Students outperforming others indicate positive effects of learning a foreign language in elementary school as researchers compared students who participated in an elementary foreign language program to those who did not learn a foreign language. The purpose of this study is to determine if research conducted to date has shown that learning any foreign language in elementary school may affect or influence the performance in reading and mathematics, using a meta-analysis of previous studies. This is important so that policy developers can determine if a recommendation can be made to implement programs for

teaching foreign language at the elementary level in public schools. One can't consider the purpose of this study without reflecting on how it can affect public schools. While research has shown dual-language schools produce the best results for Latino children, those schools are considered to be charter schools because they operate differently than general public schools. For example, a teacher is only allowed to teach core classes in the English language in the general public school. With Alabama being in its beginning phases of charter schools, a dual-language school doesn't appear to be as feasible at this point, but a FLES program is. Because of the achievement gap between Caucasian and African American children, it is my intention to target schools where the majority of the school population is African American, hoping to implement a foreign language program in an effort to decrease the achievement gap.

CHAPTER 2

LITERATURE REVIEW

The literature review consists of five different sections, Student Achievement in Mathematics, Reading Impairment and its Problems, Connection of Reading Difficulty with Mathematics Difficulty, Development of Cognitive Skills, FLES, and Two-Way Immersion Programs. The review will show that the seriousness of reading impairment has been shown to be highly correlated with high school dropouts and student suicide. Reading impairment is also correlated with mathematics achievement. Higher development of cognitive skills has been shown to have a positive impact on student achievement, and learning a foreign language in elementary school has been shown to affect the development of cognitive skills. Often the debate is about the amount of foreign language an elementary student should learn. Studies have examined a range of language learning programs from FLES, from schools where students receive the least amount of foreign language instruction, where students are sent to a foreign language class for 20 to 30 minutes per day 3 to 5 days per week, to immersion schools, where students receive the greatest amount of foreign language instruction.

Student Achievement in Mathematics

Interest in academic subjects tends to be relatively high when students enter school but has the tendency to decline during primary grades (Jogi, Kikas, Lerkkanen & Magi, 2015). By definition interest value refers to both liking being engaged in the activity and being interested in

the subject matter as well. Therefore, one can perceive interest as “doing something because of liking and enjoyment, as it is accompanied by attention, concentration, and positive affect” (Jogi, Kikas, Lerkkanen & Magi, 2015, p. 106). Supporting children’s interest and task-focused goals enhances mathematics achievement. One study controlled for previous achievement and analyzed student interest and achievement together. It was found that student interest was a predictor of mathematics achievement beyond intelligence. It has also been shown that supporting children’s interest enhances mathematics achievement especially in children with lower previous mathematics skills (Jogi, Kikas, Lerkkanen, & Magi (2015).

Based on expectancy value theory, an individual’s performance can be explained by their beliefs about how well they will do on an activity and the extent to which they value the activity (Simzar et al. 2015). Research strongly suggests that positive expectations are needed in order to motivate behavioral engagement in students. This implies that students’ confidence in their mathematics abilities and the value they attach to doing well in their mathematics class will predict their performance on a standardized test. Simzar et al. (2015) showed that early arithmetic skills are important for later achievement in mathematics. For example, it was shown that kindergarteners who were behind in basic math skills such as number reading and number comparison later became at risk for math learning disability. Booth and Siegler (2006) showed that the basic mathematics skills pertaining to number line performances are also correlated with later mathematics achievements.

Mohd, Mahmood, and Ismail (2011) confirmed previous studies showing student attitude affects mathematics achievement. Furthermore, relations between attitude or motivation and student achievement may actually differ in groups of students (Jogi, Kikas, Lerkkanen & Magi, 2015). Researchers have shown that academic pursuits were not as valuable to African American

students as other areas of interest such as sports. One explanation offered was students are trying to live like a certain stereotype based on their conceptualization of “acting Black.” According to Darensbourg and Blake (2013), this concept has been shown by several researchers, namely Ford, Grantham and Whiting (2008) and Peterson-Lewis and Bratton (2004). In other words, it’s more important to be street-smart and disengaged from school by underachieving and not attending class (Darensbourg & Blake, 2013). Osborne (1995, 1997) found that African American students’ self-esteem was not impacted by low school performance and concluded that they devalued achievement as defined by schools. It was also shown that African American males don’t value achievement because they wish to become like peers who are not achieving (Darensbourg & Blake, 2013; Taylor & Graham, 2007).

Noble and Morton suggest further research is needed to explore the factors that affect African American student interest. They cited the work of several researchers who have studied this in the past. Ladson-Billings (1997) suggested several issues with African American students and mathematics: they don’t embrace mathematics, they devalue it as a necessary skill, and they consider it to be unattainable or undesirable. Based on the work of Powell (1990), Noble and Morton said some African American children “consider mathematics insignificant and meaningless to their lives” (Noble & Morton, 2013, p. 35). Nevertheless, the fact remains that African American students are not performing at an adequate level in mathematics (Noble & Morton, 2013).

Reading Impairment and its Problems

The United States Department of Education reported that more than eight million students in grades 4 through 12 struggled with reading in the year of 2003 (Fisher & Ivey, 2006).

According to Fisher and Ivey (2006), an overwhelming amount of data showed major difficulties exist in reading at all levels, including students at the secondary level. This has reached a point where “it has created a sense of crisis in adolescent literacy that begs for immediate solutions” (Fisher & Ivey, 2006, p. 180). The United States Department of Education collects data from many sources, one of which is the National Center for Educational Statistics, which indicates that more than 66% of eighth-grade students and more than 50% of 12th grade-students score below proficiency in reading, thus creating a need to actually teach reading fluency (Denti, 2004; Ransinski, Homan, & Biggs, 2009). There was an initiative called Striving Readers that was first federally funded in 2005 with a beginning allowance of \$25 million (Fisher & Ivey, 2006). However, after the National Center for Educational Statistics reported the urgent need for the program, the 2006 federal budget included \$200 million to be used to improve reading skills of high school students (Fisher & Ivey, 2006).

Poor reading skills create many more significant problems than low test scores.

According to Daniel, et al. (2006), “adolescents with significant reading problems are at higher risk for behavioral and emotional difficulties than adolescents with typical reading ability” (p. 507). Poor readers are at significant risk for dropping out of high school (Daniel, et al.).

According to Fisher and Ivey (2006), more than 3,000 students drop out of high school every day. Daniel, et al. (2006) reported a study comparing school dropout, suicide rates, and reading problems. They confirmed previous studies as they concluded that students with reading problems have higher dropout rates as well as higher suicide rates.

Higher dropout and suicide rates usually begin with students being frustrated due to their difficulties with school experiences as well as negative self-evaluations, both of which are associated with reading problems (Daniel, et al. 2006). These problems occur because students

don't properly develop reading skills in elementary school and the skills aren't taught in secondary school. Instead, secondary teachers expect students to use reading as a learning tool in all content area classes. "Using the skill of reading to learn content is critical as more and more states implement content area tests for high school graduation" (Dieker & Little, 2005, p. 276). In fact, high school textbooks are written at the tenth through twelfth grade levels and some U.S. government textbooks are written at the seventeenth level (Denti, 2004). "High school students who are very low readers often cannot read passages beyond first and second grade levels" (Devault & Joseph, 2004, p. 22). Therefore, when attempting to read textbooks written at the tenth grade level or higher, frustration often occurs.

Another major problem begins with a lack of developing reading skills. Many students do not master these skills in elementary school and currently, the skills are not taught at the secondary level. Students in this category do not possess word identification strategies and they read at very slow rates, which prevent them from establishing deeper comprehension levels (Devault & Joseph, 2004). One major conflict contributing to the reading comprehension problem is the inability to use levels of vocabulary higher than early elementary level. This occurs because first and second grade reading material is very predictable and students can understand the passage based on general knowledge or common sense. In other words, the "passages do not demand higher levels of inference" (Devault & Joseph, 2004, p. 22). Because these skills have not been developed, "the actual act of reading comprehension needs to be emphasized across the curriculum" (Ediger, 2005, p. 34) at the secondary level.

The inability to read can often be associated with the lack of reading and vice versa. "Once students with reading difficulties enter junior high and high school, their motivation to read and reread has often diminished" (Sample, 2005, p. 243). Allington questioned the lack of

reading as he entitled his study “If they don’t read much, how they ever gonna get good?” (Allington, 1977). Graves and Philippot agreed with Allington, saying that “students need to read material that they *can* read, understand, and enjoy if they are to become competent lifelong readers and learners” (Graves & Philippot, 2002, p. 179). These authors stated that high-interest, easy to read books can help struggling readers become competent readers. One of their main ideas is to provide books that are of high-interest to the age group of the students. The other task to accomplish is to provide books on a lower reading level than the targeted age group. A reading series was developed that relates to current lifestyles of the targeted group and includes nine books. The books are written at the fourth to sixth-grade reading level but intended for students in grades seven through twelve. For example, one of the books in this series covers topics related to the joining of two families such as divorce, death, and step-siblings which are very common topics among students, making it a book of high interest (Graves & Philippot, 2002). Graves and Philippot (2002) provided a list of books which were considered easy-reading based on 12 factors. These factors affect student reading. Some of those factors are sentence structure, vocabulary, and elaboration. Studies have been done to prove such factors affect reading skills, such as the ability to comprehend what was read (Graves & Philippot, 2002).

In order for students to become competent readers, they must be able to read fluently. Sample (2005) defined fluency as one having the ability to read with proper speed, accuracy, and expression. In fact, the National Reading Panel (Sample, 2005) claimed fluency is an essential ingredient in successful reading development. Because students are highly influenced and motivated by the music industry, Sample (2005) suggested using song lyrics to help increase fluency. Song and rap lyrics provide extensive exposure to high-frequency words and many common vowel patterns (Sample, 2005). All songs should be approved by the teacher for

appropriate content and level of difficulty. Sample's suggestion of using song lyrics is another example of reading material that may be of high interest to students.

“Creating interest in reading among students is no doubt one of the greatest desires of educators, because they rightfully recognize its importance in a literate society” (Warrican, 2006, p. 33). If this is going to be accomplished, then educators must listen to student comments related to reading selections. Although several approaches have been used in the past, some educators reach the same conclusion that students did not enjoy the book selections offered to them (Thompson et al, 2008). For example, in one school library most of the books were classics or novels, and there were no magazines. According to Warrican, studies have shown that unmotivated readers will read magazines when they won't read books. “It was clear that this facility was not catering [to] students with reading difficulties or those who were unmotivated readers” (Warrican, 2006, p. 36). In order to improve reading, Warrican (2006) argued that time must be allotted daily for students to engage in leisurely reading activities.

The inability to read has impacted students across all courses (Dieker & Little, 2005). Fisher and Ivey (2006) studied research-based principles for developing and evaluating instructional frameworks at the secondary level. The article summarized five basic principles necessary when implementing a reading program in high schools. However, the authors pointed out two aspects that needed to be in place before implementing a reading program. The first is to provide students with significant opportunities for wide reading such as having access to a substantial number of readable and interesting books for student selection. The second aspect is that the entire school is focused on literacy achievement and that “teachers use content literacy approaches to ensure that their students are engaged in meaningful curriculum” (Fisher & Ivey, 2006, p. 181). According to the authors, this would include history, science, mathematics,

English, art, music, and other areas to ensure students are developing strategic reading skills. In addition to reading across the curriculum, this would include reading articles of student choice in all classrooms. According to Fisher and Ivey (2006), these two components are nonnegotiable features or otherwise any intervention program will make little difference.

Connection of Reading Difficulty with Mathematics Difficulty

Many mathematics educators do not believe a diagnosis of mathematics difficulty exists provided proper instruction is given. Research related to mathematics difficulty doesn't indicate "whether struggling mathematics learners experience difficulty with mathematics because of underlying mathematical deficits or whether their difficulties with mathematics actually reflect low levels of reading-related skills, including language" (Vukovic, 2012, p. 295). In fact, for the majority of mathematics education researchers, "there is insufficient empirical evidence that students have mathematics difficulty in face of high quality mathematics instructions, particularly in the elementary grades" (Vukovic, 2012, p. 295). Vukovic completed a four-year longitudinal study which included students who were categorized as having mathematics difficulty. Her study differed from previous studies in that she separated students into two groups, students who experienced reading difficulty and those who did not. The results indicated deficits in early numerical skills were a defining feature of mathematics difficulty in both groups of students. Vukovic defined these numerical skills as the ability to rapidly and accurately perceive small numerosities, to compare numerical magnitudes, and to comprehend simple arithmetic operations. In addition to numerical skills, a most important discovery was the fact that phonological processing influenced the development of mathematics skills. This suggests that "mathematics problems may, in part, stem from deficits in reading-related processes" (Vukovic, 2012, p. 295). Vukovic did not include all possible cognitive skills in her study and,

therefore, acknowledged the fact that further research was needed. However, it is obvious that her study was a major breakthrough and opened the door for additional possibilities on what truly affects the learning abilities of students.

A four-year longitudinal study (Vukovic & Siegel, 2010) was conducted with students who were identified as having persistent mathematics difficulty. Students ranged from first through fourth grades and the study compared their academic skills with their cognitive characteristics. One of the findings of Vukovic's and Siegel's (2010) study indicated that students who had persistent mathematics difficulty knew fewer mathematical concepts and thus performed at a lower level on phonological decoding than other students. This finding further supports the idea that mathematics deficits and reading deficits are related. As hypothesized by Geary, mathematics deficits in students experiencing both mathematics difficulty and reading difficulty are actually reflected as a phonological processing deficit (Vukovic & Siegel, 2010).

Ashkenazi et al. (2013) highlighted current research and theories to describe the neurobiological basis for deficiencies in mathematics, reading, or both. Their research indicated several reading-related deficits that can affect mathematics abilities. They first noted the work of Zebian and Ansari (2012) who claimed poor reading can impair basic phonological representation and mapping of numerical quantity. Second, they noted students had difficulty solving problems in a number-word format as indicated by numerous researchers (Compton, Fuchs, Fuchs, Lambert & Hamlet, 2012; Fuchs, et al., 2010; Fuchs & Fuchs, 2002; Powell, Fuchs, Fuchs, Cirano & Fletcher, 2009). The third mathematics deficiency that Ashkenazi, et al. (2013) noted was phonological awareness deficits, associated with difficulties in memorizing and retrieving basic arithmetic facts from long-term memory (De Smedt, Taylor, Archibald &

Ansari, 2010; Geary, 2004). According to Ashkenazi, et al. (2013), this was especially noticed when verbal retrieval was the optimal strategy based on the work of Boets and De Smedt (2010).

Development of Cognitive Skills

Considering the work of Geary (Vukovic & Siegel, 2010) and the longitudinal study of Vukovic and Siegel (2010), looking at the results, and working backward to the beginning where children enter school may provide a new perspective for finding solutions for many of the problems in education. From this perspective, a better development of phonological processing skills, part of the cognitive skills, will have a positive impact on student achievement and help increase test scores (Vukovic & Siegel, 2010).

Ellis looked further into cognitive skills and, according to Son & Meisels (2006), Ellis proposed a cognitive neuropsychological model claiming reading and writing systems are from other cognitive capabilities such as visual, phonological, and semantic systems. It has been suggested that the development of motor skills is associated with the development of cognitive skills (Son & Meisels, 2006). Although gross motor skills have significant correlations with reading and mathematics achievement, according to Son and Meisels, visual motor skills have even higher correlations. Their study showed two important implications. First, motor performance, especially visual motor performance, is a predictable variable in determining children's preparedness for school. Second, their study supports the position that the domains of developmental skills such as motor, reading, and mathematics are intercorrelated with a young child's developing skills (Son & Meisels, 2006).

According to Cooper and Schleser (2006), Piaget's (1941) theory of intellectual development was one of the first theories introduced that described changes in cognitive functioning. Piaget theorized that "cognitive development was a gradual and continuous process

of change that occurs along a continuum characterized by four development stages: sensorimotor, preoperational, concrete operational, and formal operational” (Cooper & Schleser, 2006, p. 302). Sometimes children are considered to be between the stages and are classified as being transitional during those times. It’s important to understand that each stage of development involves different reasoning skills. Cooper and Scheser (2006) provided an explanation for this as they reported the work of Siegler (1998) who claimed this was due to the development of both organization skills and the integration of cognitive processes. Although Piaget categorized these stages by age, others believed the rate children passed through these stages was more individualistic which meant that children in a kindergarten classroom could actually be reasoning at different levels (Cooper & Schleser, 2006).

When Cooper and Schleser did their study, they decided to not only compare the performance of African American and Caucasian children, but also to consider their levels of cognitive development skills as well. They hypothesized that the achievement gap in mathematics would completely dissipate when they controlled the cognitive development levels. As they hypothesized, African American students scored significantly lower on the Math Fluency and Applied Problems subtests. However, they noted there was no significant difference between African American children and Caucasian children on the Calculation subtest. When testing their cognitive development levels, almost twice as many African Americans remained in the preoperational stage of development rather than advancing to the next stage. It should be noted that they could not provide an explanation for this and suggested further research was needed to determine why African American children remain in the preoperational stage longer than Caucasian children. Finding this factor to be significant, Cooper and Schleser (2006) went further with their study allowing them to control the cognitive development level. In doing so,

they found that mathematics achievement scores between African American and Caucasian students became “statistical indistinguishable” (Cooper & Schleser, 2006, p. 305).

According to Beyer (2008), researchers in cognition have determined there are four cognitive skills children must master in their primary grades in order to be effective readers, writers, and learners. These skills are comparing, classifying, sequencing, and predicting. Without mastery of these skills at an early age, students rarely achieve grade-level performance in reading comprehension or independent learning (Beyer, 2008). According to two researchers, one tool that may correct the problems of deficits in cognitive skills development is having children learn a foreign language in elementary school (Stewart, 2005; Landry, 1974). Stewart (2005) states that there are many benefits to learning foreign language which include improving cognitive abilities, influencing achievement positively in other disciplines, and increasing achievement test scores. These benefits occur especially when the study of a foreign language begins in elementary school (Stewart, 2005). Landry (1974) discusses other benefits based on his study. Landry (1974) claims that switching languages throughout the day on a regular basis forces students to maintain a certain adaptability and willingness to change. This would enable students to develop possible neglected potentialities such as divergent thinking abilities involving fluency, flexibility, and originality (Landry, 1974).

De Ramirez and Shapiro (2007) considered the effects of Spanish reading fluency on Spanish-speaking ELL students. Their study showed two significances about Spanish reading fluency. First, it had moderately high correlation with English reading fluency. Second, when used at the beginning of the school year, Spanish reading fluency was a predictor of English reading at the end of the year. This was an important breakthrough as De Ramirez and Shapiro (2007) were able to identify the difference in poor reading skills as being a

cognitive/developmental deficit versus a learning disability. Students who receive reading instruction in their first language and still lack development of reading skills in their first language were thought to have a deficit in the development of their cognitive skills. According to De Ramirez and Shapiro (2007), this will likely affect literacy development in both languages. These students do not necessarily have a learning disability and using the appropriate teaching strategy can correct the problem (De Ramirez & Shapiro, 2007).

Foreign Language in Elementary School (FLES)

The correlation between the developmental skills and the absence or presence of foreign language has been examined, showing a difference with student achievement, helping develop cognitive skills, and that elementary school is a better time for students to learn a foreign language than later in school (Landry, 1974; Johnson, Flores, & Ellison, 1963; Larew, 1961; Stewart, 2005). This has been a longstanding issue. Administrators, teachers, and students face the challenge of making modern foreign languages as effective as possible in order to meet the demands of the developing world situations (MFL, 1942; Lipton, 1998), such as those occurring during World War II and continuing to the present. The United States government promptly recognized the importance of the contribution foreign language could make during the Second World War. It recognized that the ability to speak and read foreign languages was not only important then but would also be important to the future of America. Therefore, the government began to encourage classroom instruction of foreign languages (MFL, 1942; Lipton, 1998).

Beardsley (1942) reported to a committee on the widespread of foreign language instruction. In this report, he claimed there was so much interest in Spanish that it created problems for administrators to provide teachers who were really capable of teaching Spanish. According to him, “teaching of Spanish even in the elementary schools is significant”

(Beardsley, 1942, p. 220). He also claimed valuable time was lost when the government had to train soldiers to speak foreign languages. Hence, a plan was developed to avoid this in the future by starting foreign language instruction as early as elementary school (Beardsley, 1942). By 1948, not only was foreign language being taught in elementary school, but some public schools were operating programs similar to that of dual-language schools today (Pei, 1948; Lipton, 1998). According to Lipton (1998), the 1940s and 1950s were part of a period considered as having a very rapid growth in learning foreign languages. Committees were formed to develop guidelines based on surveys they conducted in 1953, 1954, and 1955. The real breakthrough came in 1957 when The National Defense Education Act (NDEA) became law in 1958, which provided funds for foreign languages in both elementary and secondary schools. In fact, Title VI of that Act provided funding for teacher training (Lipton, 1998).

With this recognized need for foreign language, President Eisenhower challenged the Modern Language Association of America with “I hope that you will explore the ways in which language study can be used to strengthen our own cultural heritage as well as to cultivate better understanding between our citizens and those of other countries” (as quoted by Pelora, 1957, p. 373). The New Jersey Department of Education recognized that teaching foreign language two or three years in high school was creating a dilemma because the aural-oral approach, which they believed to be the best method, required more than two or three years for success. Thus, they published a document in 1954 as a guide for teaching Spanish beginning in elementary school. This document was an effort to solve the dilemma claiming the best age for beginning the continuous learning of a second language was between the ages 4 and 8, anticipating superior performance at ages 8, 9, and 10 (Pelora & Wizda, 1957). “In this early period the brain seems to have the greatest plasticity and specialized capacity needed for acquiring speech” (Pelora, 1957,

p. 374). In 1958, the federal government supported teacher training programs as it proposed that all elementary students should study a foreign language, specifically those in grades three through six (Hildreth, 1959). Trends began to develop concerning the teaching of modern foreign language and some issues became quite controversial. Many questions arose from these trends such as "the best age for children to begin language study, length of study, curriculum planning for language study, methods and materials of instruction, evaluation of programs, and teacher training" (Hildreth, 1959, p. 136). Wilder Penfield was one of the first pioneers to study the effects of second language learning (Larew, 1961). Based on Penfield's claims, determining the best age to begin teaching children a foreign language depends on the development of the brain. Larew (1961) attempted a study to confirm Penfield's claims. She separated the children according to age and they were all taught the same lessons and given the same test. Children participating in the study were of ages 7 through 11 for elementary school, and age 14 for junior high school. The elementary students attended the same school and were in grades two through six. The ninth graders who participated attended the same junior high school. The results of her study showed that 7 year-olds scored higher than all other age groups, which she interpreted as confirming the work of Penfield (Larew, 1961).

Elementary-age children who participated in a foreign language program usually left their regular classes several days per week for about 20 minutes. Concerns developed indicating students would perform lower in their basic skills and other subjects since they were losing time of instruction in these areas of study. In an attempt to answer this question, Johnson (1963), a researcher at the University of Illinois, conducted a pilot study with third-graders. The experimental group received 25 minutes of foreign language instruction daily during the second semester only. The control group received no foreign language instruction. Both groups were

pretested during the first semester and then again at the end of the second semester to compare their gains for the school year. Results showed only two categories out of nine where the control group outscored the experimental group, and the difference in these scores was not significant. The researchers then concluded that taking students out of class for foreign language studies, i.e. less instruction time for other studies, did not have a negative effect on their achievement by lowering their scores in other subjects, but in fact increased their scores (Johnson, 1961). Table 1 shows these results found in Johnson’s study.

Table 1
Comparison of the Difference in Mean Gains in Achievement (in years) between the Experimental and Control Groups from September to June

Characteristic	Mean Gain of Control Group	Mean Gain of Experimental Group	Difference in Mean Gain as Favors Experimental Group
Arithmetic			
Number Concepts	1.49	1.63	(+) 0.14
Reasoning	1.51	2.02	(+) 0.51
Computation	1.32	1.68	(+) 0.36
Language (English)			
Punctuation	1.7	1.68	(-) 0.02
Grammar	0.49	1.12	(+) 0.63
Reading (English)			
Comprehension	1.18	1.17	(-) 0.01
Vocabulary	0.85	0.83	(-) 0.02

(Johnson, 1961, p. 201)

This pilot study was conducted in the spring semester of 1959. After the results, Johnson proceeded with a more rigorous study on fourth graders and increased the number of participants. The results of the follow-up study provided further evidence “that the inclusion of foreign language instruction in elementary school curricula will not reduce the extent of average gain in pupil achievement in basic learnings as measured by standardized achievement tests” (Johnson, 1963, p. 11).

In the late 1950s and early 1960s, teaching a foreign language increased by almost 200% as the Office of Teacher Placement reported receiving 275 calls for foreign language teachers at the elementary and high school levels, and 92 vacancies at the college level (Kettlekamp, 1961). "The demand for foreign language teachers has been so great that the supply has not kept up with the demand" (Kettlekamp, 1961, p. 356). The shortages created problems due to state certification rules and regulations. New procedures had to be adapted and most states required a minimum of 20 hours in foreign language preparation to be eligible for certification to use the foreign language as a minor teaching field (Kettlekamp, 1961). With these changes, foreign language became a normal part of school in many states across the nation. These changes were believed beneficial to the students as a whole because students were learning more than a second language (Strasheim, 1969). According to Strasheim (1969), programs expanded to meet the needs of the students in the school by teaching foreign language as an experience through music and art for students culturally deprived, or possibly as language arts for students needing skill development in a single language. There were also programs developed for students who were college bound and planning to major in a foreign language in college (Strasheim, 1969). Teachers also noticed student achievement improvements in their core English class. Teachers reported that learning a foreign language contributed to better student understanding of the world as well as helped them develop an appreciation of literature. According to Strasheim (1969), learning a foreign language actually introduced the study of the humanities, thus providing a well-rounded education and contributing to the students' education as a whole. In an effort to understand student changes and to provide opportunities for the study of foreign languages in the future, Strasheim argued that "we must have research into the affective domain, into behavioral aspects, and into the cognitive domain" (p. 496).

Numerous studies have shown that foreign language in elementary school did not interfere with student performance in other subjects (Stewart, 2005; Lopez & Tashakkori, 2004; Johnson, Flores, & Ellison, 1963; Johnson, 1961). Such studies have left the impression that since it didn't hurt the students, then why not do it? However, some researchers argue "that a unique contribution that FLES could make to the cognitive development of children is not being emphasized" (Landry, 1974, p. 10). In fact, Landry argued, a child's experience with two languages at the elementary level had significant effects related to creative functioning which were measured by divergent thinking tasks. According to Landry, other researchers, K. Riegel, Ramsey, and R. Riegel, had also researched the idea that foreign language in elementary school had positive effects on divergent thinking skills (Landry, 1974). Landry did another study where he categorized the students at first, fourth, and sixth grade levels as those who participated in foreign language and those who didn't. He separated the groups by gender. "Divergent thinking abilities, such as fluency, flexibility, and originality, were the potential behaviors involved in this study because they are characterized by adaptability and willingness to change" (Landry, 1974, p. 13). Landry's findings supported his hypothesis in favor of the FLES group at the sixth grade level, where he hypothesized that FLES students would score higher. Landry (1974) noted that similar trends seemed to be forming but no statistical evidence was obtained at the fourth grade level. The positive results in Landry's studies helped to continue opening doors for teaching foreign language in elementary school. According to Stroller (1976), the greatest breakthrough came when Congress passed the Bilingual Education Act of 1968, which created a future for people with limited English skills, as it set goals and strategies to resolve their education problem. Stroller claimed additional goals were established including those pertaining to projects being funded with federal money. These changes were due to the 1974 Amendment to the

Bilingual Education Act (Stroller, 1976). Stroller said that “what is fascinating about the history of bilingual education in the United States is not that it existed as early as 1800, but that its rise and fall and subsequent resurgence are tied tightly to sociopolitical issues” (p. 48). This may have led to a roller coaster effect which we see in policy today. In fact, foreign language instruction has remained stable across the nation at the high school level but decreased substantially in middle and elementary schools. One concern is there is unequal access to foreign language in rural schools and schools with low socioeconomic status (Pufahl & Rhodes, 2011). Some even believe there is a huge mismatch when considering what is being taught in our schools versus what our nation is demanding. America expects “an education system that prepares all children to be competent world citizens, who can communicate in more than one language” (Pufahl & Rhodes, 2011, p. 272). Pufahl and Rhodes suggest that many policy makers and educators do not realize the well-established cognitive, social and academic benefits of learning a foreign language.

Two-Way Immersion Programs

Two-way immersion programs were introduced and expanded through charter schools in the early 1970s (Cobb, Vega & Kronauge, 2006). However, progress has been slow as some are opposed to such programs even though research has shown these programs are positive. In fact, in 1998 California passed a proposition which opposed bilingual education that required additional criteria in order to maintain dual immersion programs. For example, one option was that the school could apply for alternative school status (Quintanar-Sarellana, 2004). The state of Alabama is the only southern state that does not have any two-way immersion programs in place.

A two-way immersion program or dual-language program is most popular in a K-5 setting. However, there are K-8 schools that take the bilingual learning style to the middle school

level and a few high schools do this as well. These schools consist of a major language and the minority language which can be any foreign language; the most popular is Spanish. Some programs reflect a 50:50 model where instruction is given an equal amount of time in English as well as the minority language. Other programs require the use of the minority language initially 80 to 90% of the time. According to Ballinger and Lyster (2011), the ideal classroom would include a teacher who is fluent in both languages and an equal ratio of students who come from homes where the minority language is used and students who come from English-speaking homes. However, Quintanar-Sarellana (2004) argued that although the ideal student population is 50% for each language, the program can still be successful as long as neither language group falls below 30% of the classroom population.

According to Lindholm-Leary and Block (2010), segregated schools were the norm for children of color, including Hispanic children prior to the 1960s in Alabama and in a few other southern states. Lawsuits promoted more equitable and desegregated educational opportunities documenting the negative educational impact of segregation due to schools not providing an equal educational opportunity for all students (Lindholm-Leary & Block, 2010). With federal laws in place which protected students requiring schools to provide an equal educational opportunity for all students, segregated schools now have a different impact on students. Recent studies have shown that segregated middle schools can produce positive educational outcomes (Lindholm-Leary & Block, 2010). This was shown in different studies for both Black and Hispanic schools. Segregated classrooms and schools are beginning to spread throughout the nation. In fact, according to Lindholm-Leary & Block (2010), schools are more segregated now than they were 30 years ago. The increase of these segregated classrooms opens the opportunity for schools to explore dual-language programs. For example, instead of having smaller numbers

of Latino students attending all schools within a district, most of them would be bused to one school, namely a two-way immersion school, where the goal is to have approximately 50% of the student population to be Latino.

Educators, psychologists, and neurologists have shown that bilingualism can enhance cognitive and academic functioning in both children and adults (Lindholm-Leary & Block, 2010). "Research has shown that foreign-language study in the early elementary years improves cognitive abilities, positively influences achievement in other disciplines, and results in higher achievement test scores in reading and math" (Stewart, 2005, p. 11). A dual-language program provides an environment that allows the students to not only acquire a second language but also learn about another culture without sacrificing their individual identities (Alanis & Rodriguez, 2008). Different studies show that the introduction of foreign languages at the elementary level has multiple benefits. Also, "younger children are more receptive to language learning and develop a more native-like pronunciation when second language learning begins before the onset of adolescence" (Stewart, 2005, p. 12).

Because many still oppose such programs, administrators must consider teachers' attitudes when hiring and/or keeping teachers. "Teachers [who] perceive bilingualism as an asset, not a problem, are essential to the success of two-way bilingual programs" (Quintanar-Sarellana, 2004, p. 92). Alanis and Rodriguez (2008) said that there is more involved than just changing the language of instruction. According to them, teachers must adjust their philosophies, their teaching strategies, and their views of English learners. "As teachers shift their beliefs about second language acquisition to one of enrichment versus one of remediation, the entire focus of the curriculum begins to shift as well" (Alanis & Rodriguez, 2008, p. 316). The result may be success. In fact, the overall goals of two-way immersion programs are to help both groups of

students develop positive cross-cultural attitudes, achieve high academic goals, and develop bilingual proficiency (Ballinger & Lyster, 2011). Teachers at successful dual-language programs promote children who are more creative and better problem solvers than students who do not study a second language (Stewart, 2005). In fact, "Hispanic students participating in a dual-language program in segregated settings of predominantly low SES/Hispanic schools achieve comparably and significantly higher than their mainstream peers in tests of English reading/language arts and mathematics" (Lindholm-Leary & Block, 2010, p. 55). Such high success rates in these programs are due to the fact the programs are responsive to the needs of the children, the school, and community (Alanis & Rodriguez, 2008).

According to Lindholm-Leary and Hernandez (2011), both research and national reports confirm that Latino students are considered at risk for underachievement and high school dropouts without preference to whether they are native English- or Spanish-speaking students. Interestingly, they went one step further in their study by categorizing the Latino students by their current level of English proficiency which allowed them to compare the students between categories as well. While their research showed significant comparisons between the groups, Lindholm-Leary and Hernandez (2011) concluded that all Latino students experience more advantages when they participate in a program where their home language and culture were included in their schooling, such as bilingual programs.

While much of this review has focused on students of the Latino ethnicity, one must remember for dual-language schools to operate, there should be equal representation of students who are native English speakers. According to Ballinger and Lyster (2011), this group of students also benefit from the program. They too will be more creative and better problem solvers (Stewart, 2005). This includes African Americans. In fact, when native English speaking

students, including African American, attended a dual-language program for four years, Thomas and Collier (2003) found they scored between the 63rd and 70th percentiles in reading on the Stanford 9, as compared to the native English speakers in monolingual classes, who averaged around the 50th percentile. Not only did these African American students score higher than their monolingual peers, but they acquired a second language as well (Thomas & Collier, 2003). After studying over 2 million student records in 15 states, Thomas and Collier (2002) concluded that implementing a dual-language program, schools can expect one-sixth to one-fifth of the achievement gap to close each year.

The state of North Carolina hired Thomas and Collier to do a longitudinal study comparing dual-language schools and non-dual-language schools within the state. Not only did they compare the schools as a whole, but they also used subgroups which allowed them to compare students within their own race or ethnicity. Test scores from the end of grade test were used for this study. In reading, they found that African American students who participated in a dual-language program scored significantly higher in all grades when compared to African American students who did not participate in dual-language programs. They also found that beginning in the fourth grade, these students scored one grade level higher than African American students not participating in the program (Thomas & Collier, 2010). Thomas and Collier (2010) also found that African American students who participated in dual-language programs scored significantly higher in all grade levels in math when compared to African American students who did not participate. Beginning at the fifth grade level, African American students who were dual-language program participants scored higher than their African American peers who were non-participants in the next grade and who were typically one year older (Thomas & Collier, 2010). These results are shown in table 2 which shows the mean scores

for the end of grade test given by the state. In their report, Thomas and Collier (2010) chose to report the mean, standard deviations and effect sizes but not p-values. As indicated by the mean values, African American students who attended a dual-language school scored higher, and by middle school, they began scoring one grade level higher than African Americans who didn't attend a dual-language school.

Table 2
African American Students by Grade, Program Type and Subject

	Mean (Reading)		Mean (Mathematics)	
	DL Program	Non-DL Program	DL Program	Non-DL Program
Grade 3	337.1	334.4	342.7	340
Grade 4	343.8	341.3	348.8	346.4
Grade 5	349.9	346.8	355.5	351.9
Grade 6	355.0	348.9	356.1	351.8
Grade 7	354.3	352.2	358.8	354.5
Grade 8	358.9	355.2	362.9	357.8

Thomas & Collier (2010, p. 19 – 20)

Using subgroups, Thomas and Collier (2010) confirmed previous studies showing that all students can benefit from a dual-language program (Stewart, 2005; Ballinger & Lyster, 2011). Other subgroups tested in their study were students of low socioeconomic status and students with special needs. In both of these subgroups, students attending a dual-language school scored higher in both reading and math than students in the same subgroup who did not attend a dual-language school. Thomas and Collier provided a report at the end of each year of their study and provided vital information to North Carolina policy makers, concluding that dual-language programs were beneficial to all students (Thomas & Collier, 2010).

In summary, student achievement is generally lower for Latino and African American students. Researchers have shown that achievement scores are higher for Latino students if they

receive instruction in their native language. Dual-language schools allow English language learners and native-English speaking students to learn in their native language while also learning a foreign language and culture at the same time. Therefore, researchers suggest a dual-language school is better as they have shown that students benefit from these schools, including African American Students. Reasoning behind this recommendation is that learning a foreign language in elementary school increases the development of cognitive skills. With an increase in cognitive skills, students increase their reading and mathematics skills as well.

CHAPTER 3

METHODOLOGY AND METHOD

Purpose

Studies have shown the positive effects of learning a foreign language in elementary school when researchers compared students who participated in an elementary foreign language program to those who did not learn a foreign language. The purpose of this study is to determine if research conducted to date has shown that learning any foreign language in elementary school has an effect on student performance in reading and mathematics. The determination will be made through a meta-analytic review of previous research studies. The term meta-analysis was introduced by Glass (1976) when he defined it as being an analysis of analyses. This approach was used to compile the results of individual studies for the purpose of integrating the findings (Glass, 1976). For individual studies, researchers use the significance of the tested variable (p-value), but the focus changes to measuring effect sizes when doing a meta-analysis in order to determine the magnitude of the effect (Borenstein, Hedges, Higgins, Rothstein, 2009). The results of using effect sizes are statistically more powerful than individual studies, which is why researchers choose the approach of a meta-analysis (Lipsey & Wilson, 2001) and why it is the method of choice for this study.

The effect size is a measure that indicates the degree of departure from the null hypothesis in standard units (Cohen, 1977). “To perform a meta-analysis we compute an effect size and variance for each study, and then compute a weighted mean of these effect sizes” (Borenstein, Hedges, Higgins, Rothstein, 2009, p. 7). According to Borenstein, et al. (2009), a

meta-analysis reflects the strength of a relationship between two variables, thus yielding stronger results than an individual study alone. Glass (1976) claimed the reason for doing a meta-analysis is for the purpose of integrating the overall findings. Combining these two ideas, this study will use a meta-analysis to determine if a strong relationship exists between learning a foreign language in elementary school and student performance, and if so, integrating the overall findings into today's classrooms.

Research Questions

This study will focus on student performance and learning a foreign language in elementary school. Different types of foreign language programs are available for students where the programs vary according to the amount of time students spend daily in a foreign language classroom setting. Therefore, this study will also focus on student performance and the type of foreign language program attended. The research questions guiding this study are:

1. When comparing students who learn a foreign language in elementary school and those who don't, is there a difference in student performance in mathematics?
2. When comparing students who learn a foreign language in elementary school and those who don't, is there a difference in student performance in reading?
3. When comparing students who learn a foreign language in elementary school and those who don't, is there a difference in student performance in vocabulary?

These questions will guide the analysis of this study first to determine if research has shown that student performance in reading and mathematics is affected by learning a foreign language in elementary school and if so, determine in which subject the impact of foreign language is larger. Based on the analyzed research, the researcher might be able to determine if a recommendation can be made to policy developers about teaching foreign language at the elementary school level.

Criteria for Selection of Research Articles

In a preliminary review, studies published in English were identified with no limit on timeframe. Search methods used to identify studies were limited somewhat to the extent of using articles only found as full-text and in peer-reviewed journals. Scout was used to search for any related articles in the libraries of education, psychology, or special collections. Although qualitative research can provide much-needed information, only quantitative studies were included since the data considered for this study will be student achievement based on test scores only. Therefore, the first search requirement was a word reflecting quantitative studies, such as ANOVA, regression, multivariate, or correlation. Other search terms included combinations of the following: dual-language immersion/mathematics/reading, FLES/mathematics/reading, two-way immersion effects/mathematics/reading, and quantitative study/two-way immersions elementary/reading/mathematics.

Inclusion and Exclusion Criteria (Step 1)

The initial search yielded 1,102 articles, not all of which were studies. First exclusions were articles that were not obviously studies based upon their titles. Additional exclusions were studies that were obviously irrelevant to this study based upon their titles or their abstracts. This left a possibility of 100 studies to consider in this meta-analysis. Furthermore, a detailed investigation of the remaining 100 studies based upon their content also led to additional exclusions, leaving only 75 studies to be considered. For example, mathematics and reading achievement are important factors in this study, but they are irrelevant if not associated with foreign language. Also, some studies were found to be irrelevant because they focused on other topics in dual-language schools such as teachers, motivation, and leadership. There were a few qualitative studies that were excluded and interestingly one mixed methods study where only the

qualitative data were excluded. These exclusions reduced the possibilities so that the final database included a total of 51 studies for categorizing. After categorizing, additional studies were excluded leaving the final count at 17 studies for the meta-analysis.

Categorizing the Studies (Step 2)

The studies were first categorized by grade/age. When comparing all studies, some of them could fall into more than one category and thus creating additional criteria for categorizing. Such cases will be explained as needed. A coding form was created to categorize the data which included the following categories:

- Grade level
- Predominant Race
- Predominant Sex
- Type of Program/School
- Native Language
- Second Language
- Subjects Tested

It should be noted that categorizing the studies may also lead to further exclusions if any particular study does not fall into specific categories as listed above. After categorizing each study, accounting for any that may need excluding, the remaining studies will be coded according to their effect sizes.

Effect Size Coding (Step 3)

Calculating the effect size and weights will be the next step in the meta-analysis process. In order to do this, a coding page was created to include the following information about each

study:

- Effect Size Value
- Type of Effect Size
- Sample Size (for calculating inverse variance weight ω)
- Level of Significance of Effect Size (1 = not significant; 2 = $< .01$; 3 = $< .05$)

Effect Size Calculation (Step 4)

First, the effect size (ES) of each study will be transformed to adjust for bias using a special formula. Once transformed, these values will be the adjusted effect sizes (ES'). These values will be averaged to obtain an overall mean of the effect sizes. Due to different sample sizes, the effect sizes must be weighted when calculating the mean of the effect sizes. Thus, the weighted mean of the effect sizes will be calculated using the inverse variance weight ω . The following formulas will be used for these calculations:

- $ES' = \left[1 - \frac{3}{4N - 9} \right] ES$
- $\omega_i = \frac{2 n_t n_c (n_t + n_c)}{2 (n_t + n_c)^2 + n_t n_c (ES')^2}$
- $\overline{ES} = \frac{\sum (\omega_i ES_i)}{\sum \omega_i}$

Note that the t subscript refers to the treatment group, the c subscript refers to the control group, while n represents the number of participants. Also, N is the total number of participants within a study.

The proper formula was used to calculate the effect size, i.e. Cohen's d, based on how the data was reported. While most studies reported results using mean and standard deviation, there were other methods used such as reporting t-tests and F-scores only. For all studies, the corresponding formula was used to determine Cohen's d as shown below:

When provided with mean and standard deviation the formula used was

$$d = \frac{\overline{X}_t - \overline{X}_c}{SD_{\text{pooled}}}$$

where the subscript t refers to the treatment group while the c refers to the control group. SD in the formula was calculated by using the average of the standard deviation of the treatment group and the control group. The effect size for 10 studies was calculated using this formula.

When a study provided t-scores without standard deviations, the following formula was used:

$$d = t \sqrt{\left[\frac{n_t + n_c}{n_t n_c} \right] \left[\frac{n_t + n_c}{n_t n_c - 2} \right]},$$

where the subscript t refers to the treatment group, the subscript c refers to the control group, and the variable t refers to the t statistic reported in the study. The effect size for only one study was calculated using this formula.

When having to calculate Cohen's d from F-tests, the formula used was:

$$d = \sqrt{F \left[\frac{n_t + n_c}{n_t n_c} \right] \left[\frac{n_t + n_c}{n_t n_c - 2} \right]},$$

where the subscript t refers to the treatment group, the subscript c refers to the control group, and the variable F refers to the F statistic reported in the study. The effect size for four studies was calculated using this formula.

Also, it should be noted that two studies provided the effect sizes and therefore, no calculations were needed.

A weighted effect size was then calculated for each category. The following formula was used to calculate the weighted effect size for each category:

$$\omega_i = \frac{2 n_t n_c (n_t + n_c)}{2 (n_t + n_c)^2 + n_t n_c (ES')^2} ,$$

where the subscript t refers to the treatment group, the subscript c refers to the control group, and the variable ES' is the unbiased effect size which was calculated using the following formula:

$$ES' = \left[1 - \frac{3}{4N - 9} \right] ES ,$$

where N is the total number of participants in the study and ES is the original effect size.

This adjustment is made to correct any bias (Lipsey, M. & Wilson, D., 2001).

Originally, it was intended to not only categorize the data, but to also break the data down into groups according to age. However, fewer studies were available for older students which didn't provide enough studies to do a separate meta-analysis per age group. Therefore, one analysis was done for each category grouping all data into one group irrelevant of their age. The following table provides an overall view of effect size criteria when calculating Cohen's d.

Table 3
Effect Size Table

	Means	ANOVA Designs	Correlation	Multiple Regression	Chi Square
Magnitude	<i>d</i>	<i>Eta Squared (n²)</i>	<i>r</i>	<i>R²</i>	<i>W or ϕ (phi)</i>
Small	< .20	.01	.10	.02	.1
Medium	.20 to .80	.06	.30	.13	.3
Large	≥ .80	.14	.50	.26	.5

Homogeneity Testing

A test for homogeneity will be conducted in each category using a chi-square test. The Q value will be calculated to determine if the null hypothesis can be rejected or not. If the null hypothesis cannot be rejected it indicates homogeneity within the category. This basically is saying an individual effect size will differ from the population mean only by sampling error. If the Q value is significant, then the null hypothesis will be rejected indicating there is variability of the effect sizes larger than one would expect from a sampling error only. In such cases, heterogeneity testing is then needed to possibly determine the causes for the differences among the effect sizes (Lipsey & Wilson, 2001).

A meta-analysis is an approach that combines and compares effect sizes across studies and allows for non-significant findings to also contribute useful information to the results. This is an important factor as it helps offset any argument toward publication bias. For example, some test scores may be found to be higher for the treatment group than the control group but the results may not be significant. There can also be scores where the control group scores significantly higher than the treatment group. All of these possibilities will be included in the meta-analysis, thus helping to ensure the results will be unbiased.

CHAPTER 4

RESULTS

This meta-analysis was done to determine if learning a second language in elementary school affected student achievement. At first, it was intended to consider only mathematics and reading test scores. However, further into the study, vocabulary scores were also considered. More studies involving preschool children and students in kindergarten were conducted than what was anticipated. Since these children can't read, the need to include vocabulary was decided.

Descriptive Results

There were a total of 17 studies used in this meta-analysis. They were broken down into three categories based on what they tested. These categories were mathematics, reading and vocabulary. Of the 17 studies, 6 studies reported test scores in mathematics, 11 studies reported test scores in reading, and 8 studies reported test scores in vocabulary. It should be noted that vocabulary was added for two reasons. First, students in Kindergarten could not be tested in reading due to their inability to read. Because vocabulary affects reading, it was decided to add that component in order to include those studies in the meta-analysis. Secondly, without the additional vocabulary studies, there was a possibility of not having enough studies overall to do a meta-analysis. An effect size was calculated for each test score reported per category. The more common approach to interpreting effect sizes that involve a second language is the use of

Cohen's levels. Although they were intended to be a general guide, Cohen's levels of small where d is .2, medium .5, and large .8, have become more like a prescription instead (Plonsky, L. & Oswald, F., 2014). Table 4 shows the effect sizes per study.

Table 4
Effect Sizes for 17 Studies Based on Test Scores

No.	Author	Year	Grade	Sample Sizes		Effect Sizes		
				Treatment	Control	R	V	M
1	Baker	2012	K – 3	83	131	.11		
2	Barnett	2007	PK	79	52		-.05	.13
3	Brega	1967	9 – 12	76	54	1.05		
4	Cobb	2006	6 – 7	83	83	.53		.31
5	Cohen	1974	K – 2	15	6	.45		.18
6	Cunningham	2000	5 – 6	30	30		.71	
7	DeSousa	2012	3			.99	1.97	
8	Duran	2010	PK	16	15		.03	
9	Farver	2009	PK	31	32		.58	
10	Lopez	2004	K – 2	103	112	.25		
11	Lopez	2004	K – 2	33	33	-.25		
12	Mendez	2015	PK	20	22		-.13	
13	Nakamoto	2012	K – 3	210	85	.29	.40	
14	Ramirez	2009	Adult ^a	54	24	.11		.27
15	Restrepo	2013	PK	144	112		.18	-.03
16	Taylor	2010	3 – 5	836	612	.08		.09
17	Vocolo	1967	9 – 12	31	31	.41		

Note. R = Reading; V = Vocabulary; M = Mathematics; PK = Pre-kindergarten.

^aThis study collected data from adults who were no longer in school.

The inverse variance weight was calculated for each study and multiplied by the original effect size to determine the weighted effect size. The sum of the weighted effect sizes divided by the sum of the inverse variance weights yields the overall weighted effect sizes for each category. After these calculations, the weighted effect sizes for the categories were 0.114398 for mathematics, 0.224122 for reading and 0.640896 for vocabulary. For both simplicity and consistency, since Cohen's d categories uses one number past the decimal, answers were rounded to the nearest tenth making the results be 0.1 for mathematics, 0.2 for reading, and 0.6 for vocabulary. These results coincide with Cohen's predictions of being small for reading while

placing vocabulary in the medium category (<http://www.cem.org/attachments/ebe/ESguide>).

While there was a positive impact in mathematics (0.1), Cohen begins his small category with 0.2, therefore, mathematics would not qualify as small. Table 5 shows these values.

Table 5
Inverse Variance Weights and Weighted Effect Sizes for 17 Studies Based on Test Scores

No.	Author	Year	Grade	Inverse Variance Weight			Weighted Effect Sizes		
				R	V	M	R	V	M
1	Baker	2012	K – 3	37.23			4.00		
2	Barnett	2007	PK		31.35	31.30		-1.42	3.94
3	Brega	1967	9 – 12	8.82			9.22		
4	Cobb	2006	6 – 7	4.10		41.04	21.26		12.71
5	Cohen	1974	K – 2	8.55		8.72	3.83		1.60
6	Cunningham	2000	5 – 6		14.08			10.00	
7	DeSousa	2012	3	44.63	33.76		43.96	66.98	
8	Duran	2010	PK		.24			.01	
9	Farver	2009	PK		15.09			8.68	
10	Lopez	2004	K – 2	31.37			7.92		
11	Lopez	2004	K – 2	16.37			-4.16		
12	Mendez	2015	PK		.25			-.03	
13	Nakamoto	2012	K – 3	70.18	69.82		20.49	27.69	
14	Ramirez	2009	Adult ^a	16.59		16.49	1.83		53.16
15	Restrepo	2013	PK		12.90	14.70		2.36	-.47
16	Taylor	2010	3 – 5	347.60		352.50	28.12		30.86
17	Vocolo	1967	9 – 12	15.19			6.21		

Note. R = Reading; V = Vocabulary; M = Mathematics; PK = Pre-kindergarten.

^aThis study collected data from adults who were no longer in school.

What do these numbers mean percentage wise? Consider a sample size of 25. An effect size of 0.8 (Cohen’s large category) means that the average person in the treatment group is 0.8 standard deviations above the average person in the control group and will exceed the scores of 79% of the control group. This is the requirement for the results to be considered as large according to Cohen. For the effect size of 0.5 (medium), 69% of the treatment group would score above the average person in the control group. This can be compared to the results of the vocabulary category. The effect size for reading was 0.2 which means that 58% of the treatment group will score above the average of the control group. According to Cohen, the effect size for

mathematics was not large enough to qualify as small but consider its percentage values. With the effect size of 0.1, this means that 54% of the students in the treatment group will score above the mean of the control group. Also, because 96% of the two groups will overlap, there is a 53% chance that a person picked at random from the treatment group will have a higher score than a person picked at random from the control group. There is a 53% chance that a student selected at random from the treatment group will have a higher score than a person selected at random from the control group (<http://rpsychologist.com/d3/cohend>). Even though these numbers are associated with Cohen’s small category, I think those odds are exciting when thinking about the chances of improving math achievement in the classroom. Once again one must consider the question, what is small?

Homogeneity Testing

A homogeneity test was calculated for each category, referred to as the Q statistics. If Q is greater than the critical value for a chi-square with $k - 1$ degrees of freedom, then Q is significant and the null hypothesis is rejected (Lipsey & Wilson, 2001). If Q is not significant, which indicates homogeneity, then the null hypothesis is not rejected. Vocabulary included 8 studies indicating the degrees of freedom to be 7. With 11 studies reported in reading, the degrees of freedom would be 10. Lastly, mathematics 5 degrees of freedom since there were only 6 studies reporting mathematical data. Table 3 shows the values of the homogeneity testing.

Table 6
Q Statistics for Homogeneity Testing

Subject	K	df	CV	Q	P
Reading	11	10	18.307	48.44	<.00001
Vocabulary	8	7	14.067	81.56	<.00001
Mathematics	6	5	11.070	2.60	.76137

Note: k = number of studies; df = degrees of freedom; CV = critical value; Q = Q statistic; $\alpha = .05$

The Q value is used to determine if there is a significant variance other than sampling error between two categories. If Q is significant and the null hypothesis is rejected then the variability of the effect sizes is larger than what would be expected for a sampling error. As indicated in the table, in the categories of reading and vocabulary, Q is greater than the critical values therefore, the null hypotheses were rejected. It should be noted that heterogeneity tests could be conducted in these two categories but were not done at this point, leaving that for further research. The results differed for mathematics because the Q value was less than the critical value. Therefore, Q was not significant, which indicated homogeneity, thus the null hypothesis could not be rejected. In such cases, when homogeneity is indicated, there is no need for heterogeneity testing. Even though Q was less than the critical value in the category of mathematics and the null hypothesis was accepted, effect sizes were calculated in that category as well to provide information for further research.

CHAPTER 5

CONCLUSION

Now that the information is provided through a current meta-analysis, the most important part is determining what to do with the information. There are several possibilities of how the results could be used to increase student achievement. I would like to explain a few of these possibilities since I intend to continue my research by using some, if not all, of them.

Another Meta-Analysis

This meta-analysis did not break the categories down by age/grade level. The effect size was calculated for each study as a whole. Therefore, a study that tested more than one grade level may have had both positive results and negative results because one grade out-performed another grade. A closer look by grade level might reveal better results than grouping them all together. However, it should be noted that this could require further research that might not be possible to obtain. For example, if the data was not reported separately on a particular study the author would have to be contacted to determine if such data were available.

A New Teaching Strategy/Program

There are programs discussed in the literature review that would include studying foreign language in the state of Alabama that would not require drastic change. Simply put, a school district would hire the teacher and create a class time for the children to attend her class three to five times per week. Some school districts pay hundreds of thousands of dollars for new teaching strategies where this would only cost the salary of a teacher. It is also possible to consider this as

no additional expense at all if the school already has qualified ESL teachers, simply their roles would shift from assisting one-on-one to teaching a class. Recalling from the literature review, elementary school is a better time to learn a foreign language because it assists with developing the students' cognitive skills (Landry, 1974; Johnson, Flores, & Ellison, 1963; Larew, 1961; Stewart, 2005). With further research, perhaps learning a foreign language in elementary school could be considered a new teaching strategy with positive effects.

There are some promising results from this meta-analysis. First, all of the weighted effect sizes were positive. Since there weren't any negative results, the teaching strategy would be considered a positive approach, regardless of the size itself. Secondly, one could consider a domino effect. As shown in the literature review, vocabulary affects reading and reading affects mathematics (Vukovic, 2012). Therefore, focusing on vocabulary may also improve mathematics scores. There were no limits on studies as to the location origin where studies took place. Therefore, the most prominent result of all is that these positive results apply to all students regardless of race, gender, nationality, first (native) language, or second (foreign) language. While in the bilingual programs, both groups of students benefitted regardless of whether the language used for instruction was their native language or a foreign language. For example, students who had an English speaking impairment improved both their foreign language (English) skills and their native language skills when taught in their native language in elementary school. In addition to this interesting fact, students receiving instruction in a foreign language while in the dual language program also obtained higher achievement scores, thus benefitting from the program as well. This is an important finding for policy and practice in the schools, since all students would benefit from foreign language learning.

Where ELL populations are large enough to warrant a charter school, Alabama policymakers and educators may want to consider developing such schools (see below for further discussion of this recommendation). Given the rural nature of the state, another solution might be online instruction in order to reach a sufficiently large student population to justify the expense of foreign language instruction.

When considering the levels small, medium and large, how one interprets those words can make a difference as well as the item you are referring to. Even though the effect size may have been small, as a teacher, I would be excited if a teaching strategy improved test scores for my students. Reading was categorized as small and any improvement is better than no improvement at all. Perhaps additional research can be done to see how students respond to learning a foreign language in elementary school, especially in the state of Alabama. With our current reading crisis, if using this as a teaching strategy will help, it would be a step in the right direction, even if it is a small step.

Further Research/Study

I believe there is an important fact missing in the reporting of the data used in the meta-analysis. In all studies included in this meta-analysis, authors only reported the mean values for each group. This was done in an attempt to compare them, hoping the higher mean would be associated with the treatment group. There are questions that need to be answered and can only be answered through further research. Basically, the study is missing data. With all the data, such as all test scores instead of only the mean values, specific factors could be considered about the students and their achievement. "Research has shown that foreign-language study in the early elementary years improves cognitive abilities, positively influences achievement in other disciplines, and results in higher achievement test scores in reading and math" (Stewart, 2005,

p. 11). Researching further, one might possibly show that learning a foreign language in elementary school will improve student achievement and possibly close the achievement gap to a much smaller percent.

In addition, researchers might want to consider additional statistical methods. In view of the fact that meta-analysis establishes strength of relationships, a method such as ANOVA, that suggests causal relationships, might be helpful.

Charter School

There is one last possibility that would require further research. If after completing further research I can show learning a foreign language in elementary school is promising for increasing test scores as well as closing the achievement gap, then the next step I would take would be to investigate the rules for the qualifications of a dual language charter school. In order for a dual language school to be successful in Alabama, it must be located where the percentage of students within a classroom speaking either language, English or a foreign language, cannot be less than 30% (Quintanar-Sarellana, 2004). There are areas in Alabama that now have a higher population of Latino people and therefore, a full investigation would be needed to determine if Alabama would first meet the criteria for opening a dual language school. If meeting the criteria, the process could be started to obtain funding for the school. If successful, this would be a life-changing event for the students. I would hope to be the administrator of the first dual language charter school in the state of Alabama, making it a life-changing event for me as well.

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