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# Effects of an Elementary Immersion Program on Academic Achievement in Core Subject Areas

Marlee Schmidt  
schmidmar@mnstate.edu

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Effects of an Elementary Immersion Program  
on Academic Achievement in Core Subject Areas

A Thesis Presented to  
the Graduate Faculty of  
Minnesota State University Moorhead

By

Marlee Jo Schmidt

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Arts in  
Teaching English as a Second Language

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### **Dedication**

This thesis is dedicated to my parents, Joseph Schmidt and Kelly Buettner-Schmidt. They instilled in me their value of hard work and their love of reading. It is also dedicated to my husband, Kody Olson, who both loves to adventure with me and is my greatest adventure.

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### Abstract

This study sought to find out if students who became bilingual score higher, lower, or the same on standardized tests as their monolingual peers across multiple disciplines. An answer was obtained by comparing the Minnesota Comprehensive Assessment scores of Spanish language immersion students to scores of non-immersion students for the following subject areas: reading in grades 3, 4, 5, 6, 7, 8, and 10; math in grades 3, 4, 5, 6, 7, 8, and 11; and science in 5, 8, and high school. The scores used came from a graduating class of 2018 with approximately 342 students. Data was analyzed using *t*-tests and Cohen's *d*. Students in a language immersion program achieve as well as or better than their non-immersion peers in the subjects of reading, math, and science. The data analysis revealed that in grades 3 - 5 the *t*-tests were statistically not significant and the majority of the tests had less than a small effect size. In grades 6 - 8, the analysis revealed that the *t*-tests were statistically not significant and the majority of the tests had a small effect size or greater. In grades 9 - 11, the analysis revealed that the *t*-tests were statistically significant and all of the tests had a medium effect size or greater. Future studies with a greater number of students are recommended.



## **Chapter 1: Introduction**

Second languages in the United States have historically been taught as subjects in high school but are now shifting into elementary school language immersion programs in which the second language is the means through which subjects are taught. There were less than 20 immersion programs in Minnesota in 2010 compared to over 70 immersion programs in Minnesota in 2016 (Minnesota Advocates for Immersion Network, 2017). Academic content must still be learned and retained effectively when taught through a second language in an immersion program. However, the academic achievement of students in immersion programs is not well researched. In order to assess short term and long term academic subject achievement, a comparison of immersion program students' standardized test scores to non-immersion students' standardized test scores provides pertinent information.

### **Research Goal**

The research goal for this project was twofold. The study analyzed if students who attended a Spanish language immersion program at an elementary school in Minnesota scored higher, lower, or the same as their non-immersion program peers on standardized tests in each grade during an immersion program. It also analyzed if students who attended the Spanish language immersion program scored higher, lower, or the same as their non-immersion program peers on standardized tests in each grade after they had completed the immersion

program and joined their non-immersion program peers in the middle school and high school years. The results provide information on the immediate effects and the lasting effects of a language immersion program on academic achievement, showing that the students who attended the Spanish language immersion program scored equal to or higher than their non-immersion peers in reading, math, and science and that their scores were increasingly higher as they moved up in grade.

### **Definition of Terms**

Immersion: “Immersion is a method of foreign-language instruction in which the regular school curriculum is taught through the medium of a second language” (Lindholm-Leary, 2001, p. 27).

Total Immersion: “In *total* immersion programs, 100% of instruction in kindergarten through grade two is provided in the second language. By the upper grades, at least 50% of instruction continues to be offered in the second language” (Padilla, Fairchild, & Valadez, 1990, p. 115).

Dual Language Education: “Dual language education (DLE) programs have a variety of names in addition to dual language. These include: bilingual immersion, two-way bilingual immersion, two-way immersion, two-way bilingual, Spanish immersion (or whatever the target language is, combined with the word immersion), and developmental bilingual education. . . .DLE includes native as well as non-native speakers of the target (non-English) language.” (Lindholm-Leary, 2001, p. 30).

Non-immersion Program: A school program in which students are not immersed in a second language. Students either have no second language learning or they only have one class period of foreign language study per day in the school setting.

MCA: The Minnesota Comprehensive Assessments, a standardized test for grades three through twelve covering the subjects of reading, mathematics, and science.

### **Literature Review**

One way to measure the effectiveness of immersion programs is to compare the standardized test scores of immersion program students to the standardized test scores of non-immersion program students. However, the analyses that have been completed in such a manner have not led to a clear accord regarding short term effects of immersion programs. An example of this lies in the following studies which all address fifth grade students. Alanis and Rodriquez (2008) found that fifth grade immersion program students scored better than their peers on the reading, mathematics, and science portions of the Texas Assessment of Knowledge and Skills. In contrast, Hollingsworth (2013) found that fifth grade immersion program students showed no statistically significant difference from the English only control group on vocabulary and reading tests. Rega (2015) found that the language immersion students showed no statistically significant difference from the non-immersion students on the Northwest Evaluation Association Measures of Academic Progress (NWEA MAP) math tests in fifth grade. Conflicting results such as these fail to provide adequate research to inform

those that make decisions regarding effective education. This study will add to the body of research in order to bring further clarification on the influence of participation in immersion programs on academic achievement.

In regard to long term effects of immersion programs, there is an insufficient amount of research. In one of the only studies addressing the long-term effects of a language immersion program, researchers found that properly implemented dual language immersion is at least as effective as traditional programs in core subject academic achievement (Cobb, Vega, & Kronauge, 2006). With promising but limited prior research such as this, it is clear that more research should be done to confirm the effectiveness of such programs. This study will contribute to the existing body of research by replicating the method of analyzing test scores and looking at both the short-term and long-term effects of participation in a Spanish immersion program.

**Subject areas.** Previous research has considered the relationship between participation in an immersion program and achievement in multiple academic subjects. Most of the research on the effects of an immersion program has focused on the subject of language arts. A considerable amount focuses on math, a smaller amount on science, and very few on social studies.

At least 15 studies have addressed achievement in English language arts. Six of these studies showed that immersion students outperformed their non-immersion peers in language arts (Alanis & Rodriguez, 2008; Cobb et al., 2006; Marian, 2013; Rega, 2015; Thomas, Collier, & Abbott, 1993; Willig, 1985). Six studies found that immersion students scored equal to or better than their non-

immersion peers in language arts (Cazabon, Nicoladis, & Lambert, 1998; Christian, 1997; Lindholm-Leary, 2001). Two researchers found that score differences were not statistically significant (Hollingsworth, 2013; Marian, 2013). In an in-depth study of time to achievement, Collier (1989) found that immersion students reached national norms on language arts tests in as little as two years. No language arts research was identified where immersion students had scores lower than non-immersion students.

Nearly as much research has been completed on mathematics achievement as on language arts achievement. At least 10 studies have addressed achievement in mathematics. Three of these studies found that immersion program students scored better than their non-immersion peers (Alanis & Rodriguez, 2008; Marian, 2013; Willig; 1985). Four studies found that the immersion students scored equal to or better than the non-immersion students (Cazabon, et al., 1998; Christian, 1997; Lindholm-Leary, 2001; Thomas, et al., 1993). Two studies did not find statistically significant differences between immersion and non-immersion program students (Cobb et al., 2006; Rega, 2015), while Collier (1989) found that immersion student performance in mathematics reaches national norms in as little as two years. Again, no research was found that showed immersion program students do not score as well as their non-immersion peers.

Though more research is available for language arts and math standardized test scores, several studies have included science scores. Two studies found that immersion students score better than their non-immersion peers on science tests (Alanis & Rodriguez, 2008; Lindholm-Leary, 2001). A study by Christian (1997)

found that students scored equal to or better than their non-immersion peers. In 1989, Collier delved further into the specifics of science achievement and found that immersion students take four to seven years to reach national norms in science. No research was found that indicates students in immersion programs scored worse than their non-immersion peers.

As with science achievement, there are few studies done on social studies achievement. Two studies found that immersion students score better than their non-immersion peers on social studies tests (Christian, 1997; Lindholm-Leary, 2001). In the same study mentioned above, Collier (1989) found that immersion students take four to seven years to reach national norms in social studies. No research was found that shows students in immersion programs do not score as well as their non-immersion peers.

The studies discussed above show that immersion program students scored at least as well as, or better than, their non-immersion peers. This indicates that the results from this study will also show that immersion program students score at least as well as, or better than, their non-immersion peers. The use of subject area tests will replicate the methods of previous research and add to the existing research on the relationship of participation in an immersion program and achievement in mathematics, reading, and especially science as very few studies have focused on science.

**Language majority versus language minority.** In programs that have both language majority and language minority students enrolled, their test scores can be analyzed separately. This separation can give insight into the academic

achievement of students enrolled in dual language education programs. Even so, more studies analyzed language majority students than language minority students.

Three studies have found that language majority students in an immersion program scored better than non-immersion peers (Alanis & Rodriguez, 2008; Cazabon et al., 1998; Thomas & Collier, 1997). Two studies found that language majority students in an immersion program scored as well as or better than their non-immersion program peers (Marian, 2013; Rega, 2015). One study found that the difference between language majority immersion students and their non-immersion peers was not statistically significant (Hollingsworth, 2013).

As the previous studies on academic achievement have shown that language majority immersion program students score at least as well as non-immersion program students, they also indicate that language majority immersion program students will score as well as non-immersion program students in this study.

Less data was found for language minority students. Two studies found that language minority immersion students score higher than language minority non-immersion students (Alanis & Rodriguez, 2008; Thomas & Collier, 1997), while Christian (1997) states that language minority immersion students score at least as well as or better than language minority non-immersion students. An earlier study by Collier (1989) found that language minority students with solid academic instruction in the first and second language will reach national norms on standardized tests in language arts and mathematics in as few as two years and

meet national norms on standardized tests in reading, science, and social studies in four to seven years. It is also worth noting that Greene (1997) found that at least some native language instruction is more effective than English only instruction for language minority students.

These previous studies have important results for language minority students: that with instruction in both their native language and their new language they will score as well as language minority non-immersion students. This indicates that language minority immersion students in this study will score at least as well as language minority non-immersion students.

**One-way immersion and two-way immersion.** Conflicting results have been found when assessing results of one-way immersion programs. On one hand, Thomas and Collier (1997) found that children in well-implemented one-way immersion programs outperform their non-immersion peers in the upper elementary, middle, and high school years. One researcher found results that agreed, at least in reading. Rega (2015) found that one-way Spanish immersion students had statistically higher reading scores than non-immersion students and that one-way Spanish immersion students did not have statistically different math scores than non-immersion students. Hollingsworth (2013) disagrees with Rega, as Hollingsworth found that the one-way Spanish immersion student scores were not statistically different than the non-immersion students on vocabulary and reading comprehension.

In the same study by Thomas and Collier (1997), children in well-implemented two-way immersion programs outperformed their non-immersion



peers in the upper elementary, middle, and high school years. More studies also found that students in two-way immersion programs progress in academic areas as well as or better than their non-immersion peers (Alanis & Rodriguez, 2008; Cazabon et al., 1998; Christian, 1997; Cobb et al., 2006; Marian, 2013; Thomas & Collier, 2002).

These findings indicate that, in early elementary school, the one-way Spanish immersion program students in this study may not score as well as the non-immersion program students. However, these findings do suggest that they will score as well as or better than non-immersion program students by upper elementary school and that these positive findings will continue through middle school and high school.

**Time.** The majority of previous research focuses on academic success during the grades in which the immersion program takes place. One study that took place during the immersion program found that immersion program students outperformed their non-immersion peers (Thomas & Collier, 1997). Additionally, four studies found that immersion program students scored equal to or better than their peers in the non-immersion program (Cazabon, et al., 1998; Hollingsworth, 2013; Rega, 2015; Thomas et al., 1993). No results were found that indicated the immersion program students performed worse than their non-immersion peers during the immersion program.

Several studies agree that the more time immersion program students spend in a dual language program the higher the standardized test scores (Alanis & Rodriguez, 2008; Collier, 1989; Dolson, 1985; Thomas & Collier, 1997;

Thomas et al. 1993). Specifically, Dolson (1985) found that by grade six the immersion program students often surpass their non-immersion peers. Collier (1989) found that in four to seven years immersion students reach norms in reading, social studies, and science, and in two years immersion students reach norms in mathematics and language arts. Thomas et al. (1993) found that immersion program students outperformed their non-immersion peers in English language arts after two years. A later study by Thomas and Collier (2002), found similar results, that immersion students outperform non-immersion students in four to seven years for all academic subjects.

Three studies compare the effects of immersion programs after immersion program students rejoin their non-immersion peers. The first study comes from Thomas and Collier in 1997, who found that immersion program students in well-implemented programs outperform their non-immersion peers in the upper elementary, middle, and high school years. This is supported by Lindholm-Leary (2001), who found that by grades six and seven, students perform at least at grade level in reading, language, and content areas on achievement tests. Further confirmation was completed by Cobb et al. (2006), who found that the beneficial effects of dual immersion elementary school are continued into secondary school. No studies showing negative long-term effects of immersion programs were found.

These studies indicate that this research needs to look at test scores of immersion program students over their entire school career to fully understand the effectiveness of the program on academic success. In particular, the work by

Collier (1989) indicates that mathematics and English language arts scores should be analyzed earlier as they take two years to reach norms whereas reading, social studies, and science should be analyzed further out as it takes four to seven years to reach norms.

### **Research Questions**

In order to fully understand the effectiveness of an immersion program on academic success, researchers will analyze the test scores for both short-term and long-term results with two separate research questions. The majority of the existing body of research does not analyze long-term results. This study will add to the body of research by following one set of students throughout their school years to form a cohesive analysis of the effects of the immersion program on academic achievement.

- Will students who attended a Spanish immersion program in kindergarten through fifth grade have statistically higher, lower, or equal Minnesota Comprehensive Assessment (MCA) scores on each test (reading, mathematics, and science) during the immersion program in third, fourth, and fifth grade than students who did not attend the Spanish immersion program in kindergarten through fifth grade?
- Will students who attended the Spanish immersion program in kindergarten through fifth grade will have statistically higher, lower, or equal MCA scores on each test (reading, mathematics, and science) after the immersion program in sixth through eleventh grade than students who

did not attend the Spanish immersion program in kindergarten through fifth grade?

The existing body of research indicates that students who attended the Spanish immersion program will score equal to or higher than their peers who did not attend the Spanish immersion program. Therefore, it is hypothesized that the immersion program students will score at least as well as their non-immersion program peers in all grades for all tests.

### **Limitations**

This study will contribute to the existing body of research, in particular because of its analysis of both short-term and long-term test scores to see the comprehensive effects of immersion programs on academic success. However, as the data come from a real school, there are limitations that may affect the results.

One important limitation is that random assignment was not possible as students were already members of the immersion and non-immersion groups. There could be differences between the immersion and non-immersion groups that were not controlled. The findings could be attributed to factors other than the immersion program, such as socioeconomic status. This can be seen in a study by Cobo-Lewis, Zurer Pearson, Eilers, and Umbel (2002), who found that high socioeconomic status children outperformed low socioeconomic children on each of their tests.

An additional limitation is that the researchers used existing, historical data. Therefore, the researchers did not control the way in which data was

collected and this could impact reliability. Data collection techniques cannot be verified, but it is assumed to be equal for immersion and non-immersion students.

## Chapter 2: Methodology

To determine if academic achievement is different for immersion program students than for non-immersion program students, the MCA test scores and enrollment status in an immersion program or a non-immersion program in a Minnesota school district were analyzed for all students in one graduating class. Test scores and enrollment status were subjected to a *t*-test for each grade level and academic subject in SPSS. After the *t*-tests were completed, Cohen's *d* was found for each test to determine effect size.

### Setting

This study was conducted in a school district in Minnesota that offers a Spanish immersion program at the elementary school level. In 2010, the town supporting the school district had a population of approximately 38,000 people. Minorities made up 23.4% of the school population in which this study takes place. Students eligible for free or reduced-price lunch made up 39.5% of the school population. Students with limited English proficiency made up 6.6% of the school population and students receiving special education services made up 16.7% of the school population.

Students who attend the total immersion program are immersed in the Spanish language for 90 - 100% of the time in kindergarten through second grade with no formal instruction in English. In grades three and four, 90% of the time is spent in Spanish. In grade five, 80% of the time is spent in Spanish. The non-

immersion program students were taught all subjects in English for 100% of the class time for grades kindergarten through fifth grade.

For the graduating class used in this study, the immersion program students rejoined their non-immersion program peers in English only classrooms in sixth grade. For sixth grade through twelfth grade both groups of students were taught all subjects in English for 100% of the time, with the exception of students who enrolled in a foreign language elective class.

### **Participants**

The participants for this study included all of the students who were enrolled in a high school in Minnesota who did graduate or would have graduated in 2018. Exact numbers changed yearly depending on transfers in and out of the school and program. The greatest number of students occurred in eleventh grade, when 361 students were considered enrolled for this study. The smallest number of students occurred in third grade, when 251 students were considered enrolled for this study.

Families in the district have the option to enroll their children in the immersion program or in the non-immersion program. The greatest number of students in the immersion program occurred in third grade, when 24 students were considered enrolled for this study. The smallest number of students in the immersion program occurred in eleventh grade, when 19 students were considered enrolled for this study. The greatest number of students in the non-immersion program occurred in eleventh grade, when 342 students were considered enrolled for this study. The smallest number of students in the non-

immersion program occurred in third grade, when 227 students were considered enrolled for this study.

### **Materials**

The instrument used in this study was the Minnesota Comprehensive Assessment (MCA) from 2008 through 2017. The MCAs are standards-based accountability assessments which align with the Minnesota Academic Standards. The tests help districts determine how students are progressing towards academic benchmarks and are used by the district, school, teachers, parents, and the students themselves. The tests are also used for school and district accountability.

The MCA is composed of the following tests: third grade math and reading; fourth grade math and reading; fifth grade math, reading, and science; sixth grade math and reading; seventh grade math and reading; eighth grade math, reading, and science; tenth grade reading; eleventh grade math; and the high school science test. This study analyzed each of these tests.

The majority of students take the MCAs though exceptions include students who receive special education services, who take the Minnesota Test of Academic Skills (MTAS) if they meet the eligibility requirements. All students complete the testing unless a parent refuses to have their child participate and fills out a form stating such.

A scale score is determined for each test. For science, the raw score totals are converted to the scale score. For reading and math, the specific pattern of correct and incorrect answers is converted to the scale score. The scale scores are then assigned a proficiency level. There are four proficiency levels: *exceeds the*



*standards, meets the standards, partially meets the standards, and does not meet the standards. Exceeds the standards and meets the standards* are considered proficient, while *partially meets the standards and does not meet the standards* are not considered proficient.

The MCA shifted from Series II to Series III during the time frame of this study. The MCA-Series II was used from 2008 through 2012 and the MCA-Series III was used from 2010 through 2017. In the 2010-2011 school year, the MCA-Series II was used for reading and science, while the MCA-Series III was used for mathematics. In the 2011-2012 school year, the MCA-Series II was used for reading while the MCA-Series III was used for mathematics and science. In the 2012-2013 school year, the MCA-Series III was used for reading, mathematics, and science.

The MCA Series II aligned with the K-12 Minnesota Academic Standards from 2003. The standards were revised for mathematics in 2007, for science in 2009, and for reading in 2010, which prompted the development of the MCA Series III. This study does not compare scores between years; rather, this study compares scores of immersion program students to those of non-immersion program students in the same year. Therefore, the shift in standards and MCA Series did not affect the results of this study. The following scores from the following years can be compared because they were based on the revised academic standards. The grades three through eight mathematics MCA scores for 2011 through 2017 can be compared to one another and the grade eleven mathematics MCA scores for 2014 through 2017 can be compared to one another.

Grades five, eight, and high school science MCA scores for 2012 through 2017 can be compared to one another. Grades three through eight and grade ten reading MCA scores for 2013 through 2017 can be compared to one another. Likewise, scores from before these sets of years may also be compared as they were based on the earlier academic standards.

### **Procedure**

This study used existing data provided by the Learning and Accountability Department of the cooperating school district. The data were sent to researchers through Google Spreadsheets, opened in Excel, and then entered into SPSS for analysis. Data were spot checked as they were being transferred and again after they were all transferred from the original data file into SPSS.

The participants were split into two groups to form the independent variable: those who were enrolled in the Spanish immersion program (value label 1) and those who were not enrolled in the immersion program (value label 0). Students who did not fit into these two groups because they attended some but not all years of the Spanish immersion program were excluded from the analysis by assigning them a value label of 2. This exclusion was done in the following ways: the students who did not fit into one of these two groups for kindergarten through third grade were not included for the third-grade tests; the students who did not fit into one of these two groups for kindergarten through fourth grade were not included for the fourth-grade tests; the students who did not fit into one of these two groups for kindergarten through fifth grade were not included for the fifth-

grade through eleventh-grade tests. For this reason, twenty-two scores were excluded from the analysis.

There were three situations in which the data did not easily fit into the analysis procedure: when participants took the high school science MCA twice, when data showed a student did not take a test, and when a student's score was 0. For participants who took the high school science MCA twice, the score from the later test was entered in SPSS. When the original data file showed that a student did not take a test or that a student scored a 0 it was entered in SPSS as a *discrete missing value*.

### **Data Analysis**

After data were entered into SPSS, two types of tests along with descriptive statistics were run to analyze the data. A *t*-test was administered at each grade level separately for each subject area to determine if there was a statistically significant difference between students who were and students who were not enrolled in the Spanish immersion program. The  $p \leq .05$  level of significance was used for analysis. After all *t*-tests were completed, Cohen's *d* was calculated for each test to determine effect size. The use of Cohen's *d* allows researchers to calculate the size of the difference of a statistically significant *t*-test in a standardized way which could be used to compare effects between studies of similar design. Cohen's conventions for effect size were used with a small effect size ( $d=0.20$ ), a medium effect size ( $d=0.50$ ), and a large effect size ( $d=0.80$ ) (Cohen, 1988). Additionally, the following descriptive statistics were calculated: number of cases, mean, and standard deviation.

The original MCA scores provided by the Learning and Accountability Department had been multiplied by 100. The reason for this was unclear as the scores arrived from the state of Minnesota to the Learning and Accountability Department this way. To account for this in the results table, the decimal was shifted two places in the mean, standard deviation, upper limit, and lower limit after the data was analyzed.

### **Chapter 3: Results**

The purpose of this study was to determine if students enrolled in a Spanish immersion program scored higher, lower, or the same as their non-immersion program peers on standardized tests in each grade during the immersion program. It was also to determine if students who were enrolled in a Spanish language immersion program scored higher, lower, or the same as their non-immersion program peers on standardized tests in each grade after completion of the immersion program. The results indicate if immersion program students learn and retain the academic subjects tested more, less, or as effectively as non-immersion program students. Previous research suggests results will show that immersion students learn and retain academic subjects as effectively or more effectively than their non-immersion peers.

This chapter is divided into two sections to see the short-term and long-term effects clearly. The first section addresses the results of test score analysis during the immersion program from grades three, four, and five. The second section addresses the results of test score analysis after the immersion program from grades six through eleven. The two analyses done at each grade level for each test were the independent samples *t*-tests, to determine if there was a statistically significant difference between the immersion program students and non-immersion program students, and Cohen's *d*, to determine effect size.

An average of 292.35 scores were used for each test. An average of 271.24 participants were non-immersion program students (92.78%) while an average of 21.11 participants were immersion program students (7.22%). The students were in fourth grade when the MCA II switched to the MCA III for mathematics, in fifth grade for science, and in sixth grade for reading. The sample size varies for each specific test at each grade.

Table 1

*Results of Descriptive Statistics for MCA Scores by Program Enrollment*

Test	Non-immersion			Immersion		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Third						
Math	227	365.07	31.40	24	362.21	12.34
Reading	239	369.04	35.89	24	368.04	14.87
Fourth						
Math	231	464.68	30.71	22	457.95	12.51
Reading	247	466.65	38.93	21	463.14	12.97
Fifth						
Math	252	559.31	37.46	21	553.24	12.90
Reading	251	568.84	37.13	21	563.33	13.55
Science	241	547.87	21.88	21	548.95	10.39
Sixth						
Math	270	656.74	51.13	21	660.67	12.20
Reading	268	660.27	52.28	21	663.71	14.24
Seventh						
Math	273	752.41	53.20	20	760.60	11.78
Reading	271	754.20	28.86	21	756.43	15.17
Eighth						
Math	279	855.33	21.73	21	862.71	12.85
Reading	281	855.06	26.89	21	864.38	17.12
Science	282	850.31	21.23	21	855.43	10.58
Tenth						
Reading	327	1050.91	14.09	20	1058.10	10.56
Eleventh						
Math	342	1147.06	16.56	19	1158.53	15.51
Ninth - Eleventh						
Science	330	1047.25	12.96	20	1055.80	12.31

Table 2

*Results of t-test and Cohen's d for MCA Scores by Program Enrollment*

Test	<i>t</i>	<i>df</i>	<i>p</i>	95% CI		<i>d</i>
				<i>LL</i>	<i>UL</i>	
Third						
Math	.44	249	.66	-9.89	15.60	.12
Reading	.14	261	.89	-13.57	15.57	.04
Fourth						
Math	1.02	251	.31	-6.30	19.74	.29
Reading	.41	266	.68	-13.32	20.34	.12
Fifth						
Math	.74	271	.46	-10.13	22.27	.22
Reading	.68	270	.50	-10.56	21.57	.20
Science	-.22	260	.82	-10.59	8.43	.06
Sixth						
Math	-.35	289	.73	-25.96	118.12	.11
Reading	-.30	287	.76	-25.99	19.11	.09
Seventh						
Math	.59	291	.49	-31.68	15.31	.21
Reading	-.35	290	.73	-14.77	10.31	.10
Eighth						
Math	-1.54	298	.13	-16.85	2.08	.41
Reading	-1.5	300	.12	-21.05	2.41	.41
Science	-1.09	301	.28	-14.33	4.09	.31
Tenth						
Reading	-2.24	345	.03	-13.50	-.89	.58
Eleventh						
Math	-2.95	359	.003	-19.12	-3.81	.71
Ninth- Eleventh						
Science	-2.87	348	.004	-14.41	-2.70	.68

Table 1 provides descriptive statistics on both groups of participants, the immersion program students and the non-immersion program students, separately. For each group, the sample sizes, or numbers of students, are listed in the *n* columns, the mean scores in the *M* columns, and the standard deviations in the *SD* columns.

Table 2 provides the results of the *t*-test and Cohen's *d*. The *t* distributions are listed in the *t* column, the degrees of freedom in the *df* column, and the probability in the *p* column. Under the 95% Confidence Interval (CI) label, we

have the lower limits of the confidence interval in the *LL* column and the upper limits of the confidence interval in the *UL* column. Finally, we have the effect size, Cohen's *d*, listed in the *d* column.

### **During Immersion Program**

The math, reading, and science MCA t-tests for grades three through five during the immersion program were not statistically significant, as seen in column *p* of Table 2. *P*-values of less than or equal to .05 were considered statistically significant for this study and all the *p*-values for these grades were above .05.

The largest observed effect size for these comparisons was on the fourth grade math test where  $d=0.29$  was found to exceed Cohen's convention for a small effect size (column *d* of Table 2). Three of the seven effect sizes met or exceeded Cohen's convention for a small effect size. These three tests were the fourth grade math test, the fifth grade math test, and the fifth grade reading test. However, four of the seven effect sizes were found to be below Cohen's convention for a small effect size. These four tests were the third grade math test, the third grade reading test, the fourth grade reading test, and the fifth grade science test.

As seen in the *M* columns of Table 1, the mean scores of immersion students were higher than the mean scores of non-immersion students on one of the seven tests: the fifth grade science test. However, the mean scores of immersion students were lower than the mean scores of non-immersion students on six of the seven tests.



**After Immersion Program**

The math, reading, and science MCA *t*-tests for grades six through eight after the immersion program were not statistically significant, as seen in column *p* of Table 2. *P*-values of less than or equal to .05 were considered statistically significant for this study. As with the results of the tests during the immersion program, all the *p*-values were above .05 for these grades.

The largest observed effect size for these comparisons was on the eighth grade math and reading tests where  $d=0.41$  was found to exceed Cohen's convention for a small effect size, as seen in column *d* of table 2. Four of the seven effect sizes exceeded Cohen's convention for a small effect size. These four tests were the seventh grade math test, the eighth grade math test, the eighth grade reading test, and the eighth grade science test. However, three of the seven effect sizes were found to be below Cohen's convention for a small effect. These three tests were the sixth grade math test, the sixth grade reading test, and the seventh grade reading test.

As seen in the *M* columns of Table 1, the mean scores of immersion students were higher than the mean scores of non-immersion students on all of the seven tests: sixth grade math, sixth grade reading, seventh grade math, seventh grade reading, eighth grade math, eighth grade reading, and eighth grade science.

The math, reading, and science MCA *t*-tests, for grades nine through eleven, were statistically significant, as seen in column *p* of Table 2. *P*-values of less than or equal to .05 were considered statistically significant for this study. For

the tenth grade reading test,  $p=.03$ . For the eleventh grade math test,  $p=.003$ . For the ninth through eleventh grade science test,  $p=.004$ .

The largest observed effect size for these comparisons was on the eleventh grade math test, where  $d=0.71$  was found to exceed Cohen's convention for a medium effect size, as seen in column *d*. All three of the effect sizes were found to exceed Cohen's convention for a medium effect size. These tests were the tenth grade reading test, the eleventh grade math test, and the ninth through eleventh grade science test.

As seen in the *M* columns of table 1, the mean scores of immersion students were higher than the mean scores of non-immersion students on all of the three tests: tenth grade reading, eleventh grade math, and ninth through eleventh grade science.

### **Chapter 4: Discussion**

This study sought to determine if language immersion program students learn the academic subjects tested as effectively as non-immersion program students. It examined standardized test scores of immersion and non-immersion students during the immersion program to assess short term academic subject achievement as well as those from the years after the immersion program to assess long term academic subject achievement.

The findings of this study are generally in support of the small body of research that has already been done. Key findings of this study are the statistically higher scores of the immersion program students in all subjects tested for grades nine through eleven and the lack of statistical difference between the scores of the immersion program and those of the non-immersion program students in all subjects tested for grades three through eight. An additional important finding is the increasing effect size as participants move up in grade.

#### **Short-term Effects of Immersion Program**

The first research question asked if students who attended a Spanish immersion program in kindergarten through fifth grade would have statistically higher, lower, or equal Minnesota Comprehensive Assessment (MCA) scores on each test (reading, mathematics, and science) during the immersion program in third, fourth, and fifth grade than students who did not attend the Spanish immersion program in grades kindergarten through fifth grade. The results of this

study indicate that immersion program students, who learn academic subjects in a second language, learn the academic subjects tested as well as non-immersion program students, who learn academic subjects in their first language. It was found that students who attended the language immersion program did not score statistically different from students who attended the non-immersion program in grades three through five. These results are consistent with a previous study which shows that immersion program students do not score statistically different from non-immersion program students (Hollingsworth, 2013). It is also consistent with three studies which show that immersion program students score equal to or higher than non-immersion program students (Cazabon, et al., 1998; Rega, 2015; Thomas et al., 1993). However, these results were not consistent with one study that found that immersion program students scored higher than the non-immersion program students (Thomas & Collier, 1997). This inconsistency could be due to different schools introducing English instruction in a different way or schools in different states using different standardized tests.

### **Long-term Effects of Immersion Program**

The second research question asked if students who attended a Spanish immersion program in kindergarten through fifth grade would have statistically higher, lower, or equal Minnesota Comprehensive Assessment (MCA) scores on each test (reading, mathematics, and science) after the immersion program in grades six through eleven than students who did not attend the Spanish immersion program in grades kindergarten through fifth grade. After the analysis of test scores, two conclusions emerged.

First, the results of this study indicate that immersion program students, who learn academic subjects in a second language, learn the academic subjects tested as well as non-immersion program students, who learn academic subjects in their first language. It was found that students in grades six through eight who attended the language immersion program did not score statistically different from students who attended the non-immersion program. Though there is little previous research done in this area, Lindholm-Leary (2001) found that by grades six and seven, students perform at least at grade level in reading, language, and content area achievement tests. This is consistent with the findings of this study. However, Thomas and Collier (1997) found that immersion program students outperformed non-immersion students in middle school years, which is not consistent with the findings of this study. As with the short-term effects inconsistencies, this inconsistency could be due to different schools introducing English instruction in a different way or schools in different states using different standardized tests.

Second, the results of this study indicate that immersion program students, who learn academic subjects in a second language, learn the academic subjects tested more effectively than non-immersion program students, who learn academic subjects in their first language. It was found that students in grades nine through eleven who attended the language immersion program scored statistically higher than students who attended the non-immersion program. As with grades six through eight, there is little previous research done in this area. However, the results are consistent with a study by Thomas and Collier (1997) who found that

immersion program students outperform non-immersion students during high school years.

### **Effect Size**

An interesting finding was the growing effect size of Cohen's  $d$  as the students moved through the grade levels. Effect size shows the size of the difference between the test scores of the two groups: those of the immersion program students and those of the non-immersion program students. The growing effect size indicates that the impact of the immersion program increases over time. In third grade the effect sizes do not meet Cohen's convention for a small effect size. As students move into fourth, fifth, seventh, and eighth grade, a small effect size is seen. As students move into ninth, tenth, and eleventh grade, a medium effect size is seen. However, this pattern is not entirely consistent as the fourth grade reading, fifth grade science, in sixth grade the effect size dropped below a small effect size.

Additionally, a large difference can be seen when comparing the effect size of the first year of testing (third grade) to the last year of testing (eleventh grade). The smallest effect size is seen in third grade, when  $d=0.04$ . The largest effect size is seen in eleventh grade, when  $d=0.71$ . This difference indicates how large of an impact the immersion program has on academic achievement over time.

These findings are consistent with those of Cobb et al. (2006), who found that the beneficial effects of an elementary school immersion program are continued into high school. They are also consistent with Thomas and Collier

(2002), who found that immersion program students outperform non-immersion program students in all academic subjects in four to seven years. However, neither of these studies directly address effect size.

Taken together, the analysis of test scores of the participants in this study using *t*-tests and Cohen's *d* showed a trend over time suggesting that the beneficial influences of learning academic content in a new language emerge and strengthen over time.

## **Chapter 5: Conclusion**

This study found that immersion program students score at least as well as non-immersion program students. During the program, the two groups' scores are not statistically different. After the immersion program, in grades six through eight, the two groups' scores are not statistically different. After the immersion program, in grades nine through eleven, the immersion program students scored significantly higher than the non-immersion program students. Also important is the increasing effect size as students move up in grade.

These findings are important for stakeholders who currently have or are considering having an immersion program in their school system. The findings of this study and of many previous studies assure them that immersion programs are not detrimental to, and are actually beneficial to, students' academic success. The findings are also important to researchers, who need to analyze both the short term and long term effects of immersion programs to see a comprehensive view of their impacts.

### **Limitations**

One limitation in this study is the generalizability of the study. A single graduating class from one school in Minnesota was used for the comparison of test scores between immersion and non-immersion students. A larger number of scores taken from more graduating classes, different districts, programs with



students who speak first languages other than English, or programs that immerse students in languages other than Spanish could improve the generalizability.

An additional limitation is that all participants were not enrolled in the program and school throughout the entire study. Students transferred in and out of the school and program. Students that were not consistently enrolled in either the immersion program or the non-immersion program were removed from the statistical testing. A larger sample size would allow researchers to analyze a greater number of participants that were consistently enrolled or allow them to create additional groups for participants who were not consistently enrolled.

A final limitation is the switch from the MCA II to the MCA III. The MCA III is based on different standards than the MCA II. This switch does not affect this study as it only compares between the two groups in a single year. However, it could affect future comparisons of this study to other studies if the comparison is between multiple years.

### **Implications for Practice**

The lack of significant difference and the statistically higher results favoring the immersion program students point to a positive finding for practices in schools: that the immersion program is not detrimental to the learning of the academic subjects tested and is in fact beneficial. It is consistent with research done by Cobb et al., (2006) which found that immersion education is at least as effective as traditional programs in core subject academic achievement. This finding is of paramount importance to stakeholders who must make decisions about students and programs that affect learning. It suggests that schools who do

not yet have immersion programs should create them and encourages schools that do have immersion programs to continue them.

### **Implications for Research**

The finding that statistically significant results are not apparent until high school has implications for researchers. This is consistent with four studies that address long term effects of immersion programs (Cobb et al., 2006; Collier, 1989; Lindholm-Leary, 2001; Thomas and Collier, 1997). Research should look at long term effects of immersion programs to find a comprehensive view of the benefits of immersion programs.

An additional implication of this study and the recommendation of APA is the need for researchers to reanalyze past studies and to analyze future studies using effect size. This will allow studies of similar design to be compared, thus allowing further clarification on the influence of immersion programs on academic success.

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