Summer 12-14-2015

When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction?

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WHEN AND WHY DO NAVTIVE ENGLISH SPEAKING STUDENTS IN SPANISH IMMERSION SETTING SWITCH INTO ENGLISH DURING MATH INSTRUCTION?

by

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A capstone submitted in partial fulfillment of the

requirements for the degree of Master of Arts in Teaching

Hamline University

Saint Paul, Minnesota

Fall 2015

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DEDICATION

To my husband, without him, I wouldn't be where I am today. He is my rock, my pillar, and my home. I would also like to dedicate this project to my children for persevering through these last few years while I worked on completing this capstone. Thank you to my capstone committee.

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CHAPTER ONE

INTRODUCTION

Speaking Spanish is a passion in my life. Learning this second language started out as my foundation for going to college. I had no idea what I wanted to do with myself but I knew I loved Spanish. When I received my first teaching position at a Spanish immersion elementary school, I did not realize that the professional obligation to speak Spanish would supercede the students' need to understand. Spanish comes first, before understanding, at first. With that being said, I began thinking about what to do when a native English speaker is misunderstanding, specifically in math because of the Spanish language. If the student was told the word in English, the understanding would 'click' immediately and the student could move on with his or her learning. After several years of observing Spanish immersion student switch into English during math, I began to wonder the focus of this capstone. *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction*?

Researcher Background

Teaching in a Spanish immersion elementary school has been a challenge. The students are native English speakers who have been in the school from kindergarten to sixth grade. An area where Spanish immersion students struggle, but no Spanish immersion administrator nor teacher will happily admit, is math. Teaching fourth and sixth grade math to English speaking students these past four years has been a challenge.

The big taboo of being a Spanish immersion teacher is code switching into English when the subject area or vocabulary in the second language is lacking. Code switching according to Judit Moschkovich (2007) is "the practice of using more than one language in the course of a single communicative episode,". In many foreign language classrooms and second language acquisition courses, the use of the first language is banned. We are taught, even as students of a second language, that we need to circumvent words and topics we do not know well in the second language. It is necessary, as I was taught through high school and college, that if I am in a Spanish speaking country that I will not have my English vocabulary or language to depend on. I have to figure out how to get what I want from a conversation or a question without speaking in English. This is how I treated sixth grade math. The primary goal for the students in this school is to learn Spanish. I do not aim to undermine that goal by any means, but simply establish the when and why students switch into English during math.

Being the teacher meant I had both a mathematical and language goal in mind; I knew the endpoint I wanted to get my students to, but sometimes I didn't always know the path. A specific math target is the goal of the lesson; however there is also a language goal too. The language barrier that occurs in math is more apparent than other subject areas making the goal convulted. Many times I was tempted to say the keyword or the main math objective in English just to allow our lesson to move further. Mahmoud (2012) states that the L1 can be used to support L2 acquisition especially in homogenous classes when appropriate, but not in the case where the use of L1 rescued the unprepared teacher.

One occasion that comes to mind that explains this language conundrum is when I was trying to explain to my students that "razón" means ratio without saying "ratio." Razón in Spanish also means reason. This was difficult to overcome. I drew an example of a ratio on the board and the students said "proporción." I asked for synonyms of proportion in Spanish and everyone drew a blank. It may have been that the students lacked the vocabulary in English also, but I felt it was more that I was unable to explain this new vocabulary in Spanish without saying the word in English. How easy would it have been for me to say "ratio?" Well, I didn't; that would have been breaking too many of our school values and the values I hold so high being a Spanish immersion teacher. I wrote ratio on the board instead. The mumbles and groans in the class were gone and all 29 students chorused an "oh" of recognition. It made me chuckle in the moment.

This situation was left untouched and I didn't think of it again until my Teaching Math in the Elementary School course at Hamline University when we were given an article by Judit N. Moschkovich (2011). In her paper, she said that code switching during mathematical computation may not affect the mathematical reasoning. For students to really understand conceptually the math being taught they need to participate in rich, contextual, discourse conversations in the math class. In some instances one of the strategies students use to do this is switching into whatever language with which they are more comfortable. In my instance, the students switch into English. This paper aims to begin uncovering the reasons why students switch and when do they switch from the immersion language (L2) to their native language (L1) during math. I also aim to explore what if any effects there are on the acquisition of Spanish as a second language.

What I already know about this topic comes from courses at Hamline University and the University of Minnesota. English immersion students, who are native or heritage Spanish speakers, switch into Spanish during mathematical discourse. Researchers have investigated why and when theses students code switch. What has not been as heavily researched in the United States is when and why do Spanish immersion students, who are native English speakers, switch into English during mathematical discourse? What I have realized during these courses and my experience is that there is a link between mathematical reasoning and the native language. This paper aims to uncover the when and why of English speakers in Spanish immersion.

I have learned from Moschkovich that the mathematical reasoning is not affected when Latino students in an English immersion setting were studied (Moschkovich, 2007). Prior experience has also taught me that the use of the first language to teach the second language works. As I student taught in a high school as a Spanish teacher, I used English to teach Spanish. Using English to teach a foreign language is not a new concept. There is an entire field around second language acquisition and the methods to teach a second language. This field and those methods and their effectiveness have been studied for years.

The role of the mother tongue (L1(first language)) in EFL (English as a foreign language) teaching context, as well as the use of translation as a language learning/teaching resource, has long been the subject of much controversy and academic debate in both L2 (second language) acquisition and professional teaching spheres (Juarez & Oxbrow, 2008).

Moschkovich and the Teaching Math in the Elementary School course that was a part of my elementary teaching licensing program…were the inspiration for this question but it has been puzzling me for longer than that. Although Moschkovich's paper is speaking to bilingual students in English immersion schools and bilingual education, the question pertains to native English speakers in a Spanish immersion, or any immersion setting.

When speaking Spanish is one of the goals of a Spanish immersion school, how do we balance the all day Spanish only philosophy with the district and state's desires to meet academic standards and perform well on standardized tests? One of the ongoing debates among language teachers is that whether or not to use the students' L1 in a foreign language (L2) classroom or learning environment (Mahmoud, 2012). How can we, as the classroom teachers, balance the research on code-switching with the literature noting the high value of staying within the second language while at the same time acknowledging the benefits of the students' L1 in the L2 classroom? At the same time, how do we support high outcomes on standardized tests? I want to know how, as a Spanish immersion teacher, I can support a rich Spanish mathematical conversation while teaching the math standards in a rich, deep, contextual manner?

Furthermore, if code switching is an effective strategy that doesn't affect mathematical reasoning (Moschkovich, 2011) does it have an adverse effect on Spanish acquisition for native English speakers in a Spanish immersion setting? Also, why do students in this setting switch into English, and when do they switch into English? Hannah Lehti-Eklund (2012) highlighted how the competent use of a second language requires the use of the first language to repair the second language. She writes that

students use the first language to further continue the conversation in the second language.

Many times while learning a second language the use of the first language helps organize the material of the new language and new subject in a deeper more contextualized manner than simply relying on the second language. This is especially true when the second language has deficiencies. While teaching sixth grade math, the chapter I noticed the students had the most difficulty with in Spanish was linear equations, specifically the equation $y=mx+b$. Students had never been exposed to this equation in their math careers as elementary school students. This unit was going to be their first exposure. I looked up the seventh grade math standards for linear equations and algebraic equations. I realized that I was going to be their background knowledge for that future grade level; the prior experience the seventh grade teachers will so heavily depend on when opening a unit or a lesson. My disappointment came when the students took the linear equations test in Spanish and I saw the scores. They could perform the procedure well, but in word problems about linear equations, they all failed.

To investigate the aim of this capstone, I will record students during five lessons. I will give them a Likert Scale Questionnaire that I will use to indicate which students I should interview in the open-ended interview portion of this research project. I will also use the Likert Scale Questionnaire as guidance while listening to the audio recordings of the lessons and transcribing the audio recordings. During math class and audio recordings of the lessons, I will make observations and take notes of when students change and during what parts of class they switch languages. Afterward, I will interview five students and ask why they switched.

Answering this question means that I have license, researched license, to switch languages during math as long I am not diluting the Spanish delivery, but enhancing the math delivery. I will not skip into complete English delivery, but simply switch key words or phrases. I want to know that, even though I hold "staying in the language" near and dear to my heart, that I am not jeopardizing their math education or their Spanish language acquisition by code-switching myself.

Conclusion

In conducting and analyzing the data for this capstone, I hope to gain clarification and the justification for making informed instructional decisions especially when teaching first-experience math concepts. I want to see if code switching will improve student learning in math while not diluting the students' acquisition of Spanish.

It aims to answer the questions *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction*? This type of research has been done extensively on Latino students in English immersion setting that will be much of the basis of my literature review. Chapter Two will be an exploration of the research that exists surrounding this topic. Chapter Three will present research methods used. Chapter Four will present an account of the data gleaned from the research. In Chapter Five, I will reflect on the process and provide suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

The aim of this study is to explore the effectiveness of code-switching for native English speakers in a Spanish immersion setting. *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction*? Specifically, this study is aimed at native English speakers in a suburb of the area of the Upper Midwest. The students are fourth grade native English speakers in a Spanish immersion school. The expectation of the school is to speak Spanish in the homeroom one hundred percent of the day. Students, however, switch into English at certain times of their day. The purpose of this study is to discover when they switch, why they switch and if it would be more beneficial to allow them to switch when the subject matter is considered high stakes, specifically math. My intent is to bring attention to the need for research on code switching in elementary math classes in immersion schools.

This chapter presents an overview of the research that has been done regarding code-switching. Most of the research that has been done, has been done with native Spanish speaking students in bilingual or English immersion programs. The need for research on native English speaking students in bilingual or Spanish immersion programs is lacking as well as the allowance of code-switching in elementary math classrooms.

History of Immersion Schools

Immersion schools have become more commonplace in the United States. On the global scale, fluency in a second language is a valuable asset. Jennifer Smith from Omniglot states that …being fluent in a second language offers numerous benefits and opportunities. Learning a second language is exciting and beneficial at all ages. It offers practical, intellectual and many aspirational benefits.

Spanish immersion has grown to a great size. From 1971 until 2011, The Center for Applied Linguistics (CAL) has recorded an increase of immersion schools from three immersion schools to 448 in the United States. In the state in which took place this study, there are 50 of these schools in 19 different school districts. Of these 50 schools, 32 are elementary schools.

Code-switching

Code-switching is the mixing of a person's languages during communication. Speakers of more than one language (e.g., bilinguals) are known for their ability to code-switch or mix their languages during communication. This phenomenon occurs when bilinguals substitute a word or phrase from one language with a phrase or word from another language (Heredia, 2013). Language alternation is a normal, common, and important aspect of bilingualism (Brice, 1999). To illustrate this, *Yo quiero un baloncesto orange* (I want an orange basketball). The speaker has switched the adjective from Spanish to English. Another example, *He wants to eat uvas.* (grapes). The speaker has switched the noun from English to Spanish. These are basic examples. Bilinguals tend to switch more than just one word at a time and also tend to switch phrases. Code-switching in the Spanish immersion elementary school occurs most often when a student

cannot communicate clearly in Spanish. The student will switch into English and then back to Spanish.

During mathematical discourse, students, researchers and practitioners are interested and sometimes puzzled by students using two languages. They often wonder when, how, or why students switch from one language to another (Moschkovich, 2007). Bilingual speakers of Spanish and English, often practice code-switching. This code-switching often occurs during mathematical computations and conversations when in a school setting. This phenomenon was researched through the lens of mathematical discourse and sociolinguistic studies. These two lenses provided the socio-cultural perspective of why, when and how students code-switch and the mathematical lens allowed for the examination of what about math makes students code-switch.

Bilinguals code-switch inside of school while conducting academic and subject matter conversations, but also during social interactions. Code-switching is a natural product of the interaction of the bilingual's two languages (Heredia, 2013). What specifically about math makes bilingual students switch languages is the aim of this study. There is a lack of research regarding native English speakers in Spanish immersion schools, or any other language immersion school or program. The research that does exist focuses on that of Latino students in English immersion programs or bilingual programs. Students in these programs have been heavily researched due to the phenomenon of immigration and the number of Spanish speaking individuals moving to the United States. Schools have shifted from monolingual populations, to bilingual, multilingual populations. More than 12.4 million Hispanics were enrolled in the nation's public schools pre-K through 12th grade in October 2011, according to a Pew Hispanic Center

analysis of U.S. Census Bureau data (Pew Hispanic Center, 2012). This rise in number has required the pre-k through 12th grade school system to change.

Being bilingual in the United States has not always been viewed as an asset. These students are often seen as deficient or illiterate in both languages because of speaking Spanish. As Judith F. Kroll stated,

> Until recently, research on language processing and its cognitive basis assumed that monolingual speakers were the model subjects of study and that English provided an adequate basis on which universal principles might be generalized. In this view, bilinguals were considered a special group of language users, much like brain-damaged patients, children with language disorders or deaf individuals who use a signed language to communicate (2009).

Switching during subject matter conversations, like during math class, has been a sign of being unintelligent. In the U.S., teachers working with Latino students were documented to consider code-switching as an unacceptable variety of language (Ramirez and Milk, 1986). However, since the 1980s, studies have revealed that code-switching is a strategy students use to communicate more clearly.

If assessments of mathematical proficiency focus on the speed of simple arithmetic computation in a bilingual's non-preferred language, it is possible that bilingual mathematics students might be assessed as less proficient in computation if they do not use their preferred language or are required to switch languages. A teacher might ascribe slight delays in responding orally or longer delays on written assessment to students "not knowing their math facts" when in fact these students do know their math facts. Considering these findings, instruction should, when possible, allow bilingual learners to choose the language for carrying out arithmetic computation and to take more time on timed tests of arithmetic computation, (Moschkovich, 2007).

Students switch into English (L1) during math to do more than mathematical computation. According to Lehti-Eklund (2013) who's study was in regards to Finnish students learning Swedish, students switch when there are problems occurring during tasks done in the foreign language (FL) (the foreign language in this study was Swedish). These problems are dealt with in L1 (Finnish in this case) as problems of everyday interaction, whether they are problems of hearing and understanding each other or

difficulties related to the institutional context. Lehti-Eklund writes that students use their L1 to repair concepts in the FL. They use the L1 to deal with the creation of understanding in the FL (Lehti-Eklund, 2013). If switching allows for the creation of understanding, and English speakers in Spanish immersion have difficulty understanding math in Spanish, English could allow for this understanding to be created in a novel way. In a study by Slotte-Luttge (2005), they claim that code-switching allows the students to participate quicker and have more meaningful interactions in the classroom to build up the knowledge. The participation is also more meaningful. Lehti-Eklund advised that there is a price to pay for participating as a bilingual in a monolingual discourse at school, as working with languages takes up more time and does not always result in accurate use of the language (2013). Although there may be repercussions for switching languages during math discourse, the offset of a deeper understanding of math may be the gain.

Code-switching or code-mixing appear along the entire continuum of proficiency. In some instances, they may be due to lack of appropriate lexicon in the second language; at other times, they may represent sophisticated language use with sound, cognitive, social-pragmatic, and linguistic functioning (Brice, 1999). Code-switching does not mean that the student does not know English or Spanish well, it means they are able to move between both languages fluently when one language experiences a deficiency and the other language can compensate. English students in Spanish immersion switch languages during math as an example of the deficiency in Spanish regarding math.

Code-switching as a resource during mathematical discourse

During mathematical discourse, there is a variety of language being used. Inside of the classroom there are formal and informal conversations being conducted about math and conversations socially. The interactions of these conversations are between student and student, teacher and student and occasionally, between teacher and teacher. The language being used by the teacher during mathematical discourse is the formal mathematical language (Setati & Adler, 2000). The language the students most often come into the classroom using is the informal language of math. For example, learners, in their everyday life, may refer to a half as any part of a whole and hence can talk about dividing a loaf of bread into 'three halves' (Setati & Adler, 2000). This language is then heard by the student. More often than not, the student responds using informal mathematical discourse. The teacher replies in turn using the students' information, but in a formal mathematical way. This allows the student to access mathematical discourse while accessing the L2 (Setati &Adler, 2000).

During these interactions, the use of the learners' main language in teaching and learning mathematics as a support needed while the learners continue to develop proficiency in the language of learning (LOLT), at the same time as learning mathematics (Setati &Adler, 2000). While the student is not able to respond formally in the L2 yet, the teacher is modeling the necessary tools to do so eventually. In these moments, it is plausible that the student may switch languages in order to grasp the mathematical discourse and at a later time grasp the L2 completely. Code-switching in this manner by the student could eliminate the road-block of completely comprehending the language, but at the same time enhance the math.

Another strategy Setati and Adler (2000) suggest when operating in mathematical computations in multilingual classroom is for students to write down their informal utterances in the main language, then write them in informal mathematical English (L2 in this case) more formal. In this case, the teacher works first on learners' writing their informal mathematical thinking in both languages, and thereafter on formalizing and translating the written mathematics into the LOLT (English).

Further, mathematical discourse has at least two separate areas: calculations and procedures, and the conceptual framework behind those procedures. In the Spanish immersion classrooms, students switch more heavily during one portion than the other. During calculational discourse, two plus two equals four, students tend to stay in the L2. Students switch during calculational discourse when a new procedure is taught and the vocabulary has not been practiced. During procedural discourse, students discuss why the procedure of two plus two equals four. In these conversations, the L2 is deficient.

Setati and Adler (2000) investigated the exchanges between languages, in this case Tswana and English, between mathematical discourses and between informal and formal language. The teacher in their study, Ntombi, switched between all of these dimensions when instructing math. What their study revealed was an important relationship between code-switching, the kinds of mathematical discourses used and whether these enable or constrain learner access to communicating mathematics. Ntombi used a range of discourse in her teaching and these were reflected in the learners' communication of mathematics. The movement between discourses was facilitated by the use of the learners' main language (Tswana) (Setati & Adler, 2000).

While in dual immersion and bilingual programs, educators often use the students' home language as a resource. It is the students' wealth of background knowledge in any subject matter, context and interaction that makes for rich contextual discourse inside of the classroom. If such is true, switching into English in a Spanish immersion program should prove the same. However, there is so much controvery around using the first language in a second language education program that it is unclear whether or not code-switching would prove the same. Many educators also believe that avoiding interference from the learner's first language is necessary in effective language teaching and learning and these educators may believe that avoiding code-switching is the only way to ensure that the learner's first language does not interfere with the target-language development (Turnbull & Dailey-O'Cain, 2009).

Susan Polland's (2002) research affirmed the positive effect of code-switching during mathematics for English as a second language and English language learners. It must be addressed though that there are two bodies of research regarding the use of the first language in target language education. English as a second language programs encourage the use of the first language to acquire the second language, in this case English. On the other hand, immersion/foreign language instruction research does not support the use of the first language. The use of the first language by students is seen (by teachers and policy makers) as contravening the basic premises of immersion (Turnbull & Dailey-O'Cain, 2009).

To discover when and why native English speaking students in a Spanish immersion setting switch into English during math instruction is the aim of this capstone. Whether or not code-switching during math instruction is a resource to the immersion

student's education is outside of the scope of this paper, but it provides background on why this capstone is being conducted.

CHAPTER THREE

RESEARCH METHODS

Chapter three will give an overview of the methods used to conduct this action research capstone. It also includes information about the participants, location and setting of the research project. The techniques used for data collection and data analysis will also be explained in this chapter.

The research reviewed in chapter two highlighted many studies regarding the positive or negative benefits to the role of code switching while learning a new language and mathematics, like in an immersion setting. Much of that literature was aimed at when to use the first language in a second or even third language classroom or even whether to use the first language or not. The students examined in many of those studies were not native English speakers. The research that has been done that is similar to the aim of this capstone was focused on native Spanish speakers in English immersion schools and settings. This action research project was designed to answer the question, *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction?* The area of research regarding native English speaking students in immersion settings is lacking. The following research project will begin the body of this type of study in the years to follow.

Methodology

The paradigm that best fits this question was a mix of quantitative data collection and analysis and qualitative data collection and analysis because it allowed the researcher to examine the occasions where students switched from the immersion language to their native language. Creswell (2009) stated that the combination of qualitative and quantitative methodologies allows for more depth into the research question at hand. The National Institutes of Health, specifically the Office of Behavioral and Social Sciences Research (OBSSR) define mixed methods research as the use of multiple methods of data collection, and purposefully combining the two methods with the intent of using both of their strengths (Creswell, Klassen, Plano & Clegg Smith, 2011). The OBSSR also highlights that the use of mixed methods allows for the philosophical tensions between researchers to be used as new knowledge that can expand the dialectical discovery.

The Use of Sequential Explanatory Mixed Method

The decision to use a mixed method analysis, specifically sequential explanatory in this capstone was to begin to uncover the reasons why students code-switch during math class. Sequential explanatory analysis is characterized by John Creswell (2009) by the collection and analysis of quantitative data in a first phase of research followed by the collection and analysis of qualitative data in a second phase that builds on the results of the initial quantitative results. The use of quantitative data collection in combination with qualitative data collection will be to pinpoint the students who heavily switch during math class and also those students best equipped to verbalize their reflections on their usage either in English, Spanish or both during math class. Qualitative analysis begins with a Likert Scale questionnaire before quantitative data was collected. The purpose of

the qualitative data is to inform the quantitative data that was collected (Schoenfeld, 2007). The researcher will count when the code switching occurs. Creswell (2009) highlights this model as a quantitative data collection used to identify participants for the qualitative part of data collection. Creswell (2009) also write that there is more insight to be gained from the combination of both qualitative and quantitative research than either form by itself. The datum will be collected separately, but connected in the later phases of analysis.

Native English speaking students in a Spanish immersion setting are switching into English during math at certain points of the class period. Examining these occurrences and the number of occurrences during those periods allowed the researcher to interview five students and ask why they switched at those moments. Examining the frequency was the quantitative portion of data collection.

Participants and Location

This project will take place in a fourth grade Spanish immersion classroom. The teacher will be the researcher. The class contains thirty students. These students are self-identified as 21 white, 1 black, 6 Asian-Pacific Islander, 1 Hispanic and 1 American Indian or Alaska Native White. Of the thirty students, 15 are male and 15 are female. Socioeconomic status is unknown to the researcher as well as their free and reduced lunch status.

According to the Stratis Health Culture Care Connection City Profile of the city in which the study took place and the U.S. Census Bureau 2005-2009, stated that the median household income, based on 2005-2009 estimates, was $93,248 - nearly double the national median income of $51,425 per household, (2011). This school is in an

affluent part of the outer suburbs of the metropolitan area of the Upper Midwest. Spanish immersion in this area and in this district is considered a choice school. Students in the district may attend by choice instead of their neighborhood school and students from outside of the district are allowed to open enroll. The diversity of this school is less so than that of other comparative schools in the district. Students who will participate in this study are between the ages of nine and ten.

Data Collection

The procedures for collecting data were audio recordings and subsequent transcripts, observations, and journal reflections. A Likert Scale questionnaire (see figure 1) was given to the students in Spanish (see appendix A) after the quantitative data was collected from the transcriptions of the lessons.

Based upon the audio recordings and questionnaires, students who switched heavily were targeted for closer analysis. This closer analysis was an open-ended interview (see Appendix B). The students and teacher/researcher conducted the interview in Spanish (see Appendix C).

Five students were identified and interviewed using the previous interview protocol. All students were males, including one Asian-Pacifican Islander. Four students were native English speakers at home and the fifth student speaks Korean and English at home.

The information collected will be used as follows: quantitative data on when and how often English is being used during math class; class was audio recorded for 5 math lessons, 3 of which were conceptual math lessons and 2 of which were procedural rote math lessons; survey of students using the Likert Scale; and five three to four minute

interviews with the students who were identified as students who change between English and Spanish with high frequency.

Figure 1. Likert Scale Questionnaire

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	I speak Spanish during math when I don't understand					
2.	I speak English during math when I don't understand					
3.	I always speak Spanish during math.					
4.	I always speak English during math.					
5.	I use Spanish to tell my friend how to do a math problem like "what is the area of a square with sides that measure nine inches?"					
6.	I use English to tell my friend how to do a math problem like "what is the area of a square with sides that measure nine inches?"					
7.	I use Spanish to tell my friend that nine times nine is eighty-one.					
8.	I use English to tell my friend that nine times nine is eighty-one.					
9.	I use Spanish when I count in my head.					
10.	I use English when I count in my head.					
11.	It is easy for me to ask my teacher a question in math class in Spanish.					
12.	It is easy for me to ask my teacher a question in math class in English.					
13.	Math is my favorite class in school.					

Data collection was comprised of audio recording the students during five math lessons. Three of these lessons were conceptual lessons of math. For example, how is the area of a rectangle calculated using the height multiplied by the length being the conceptual math lesson versus the rote procedural lesson of base times height. During these lessons, the teacher/researcher allowed for verbal peer interaction to occur and set up specific scenarios that would necessitate speaking to one another during the lesson and work time. The major aspect from this portion of data collection was to observe when students used English and how often they used it. After the lessons, students were

surveyed with Likert Scale Questionnaire. These questionnaires were used to pinpoint which students would interview the most reflectively about their reflective math processes and why they used English when they did.

Data Analysis

Using the audio transcripts, the researcher will count each time a student switched from Spanish to English during math class. The researcher will categorize the occurrences as exclamatory word or phrase, lack of Spanish vocabulary or lack of circumnavigation skills (see figure 2). The aim of this capstone is to explore when and why students switch from Spanish to English during math. The hypothesis is that students switch more often during conceptual math than during procedural math.

Figure 2

Count of code-switch occurrences from audio transcripts

Type of occurence	Exclamatory word or phrase	Lack of Spanish vocabulary	Lack of circumnavigation skills
Day One Round One			
Day One Round Two			
Day One Round Three			
Day One Round Four*			

*days two to five are listed completely in the figure in chapter four

Ethics

In order to research the following steps will be taken to protect the participants:

1. Parent permission slips were signed giving permission to audio record and interview students by the researcher. (see Appendix D)

2. Audio transcripts were created and will be destroyed six months after completion of this project.
3. Participant names and school location will be changed in this research project.
4. Data collection and analysis were done and results will be destroyed six months after completion of this project.

Conclusion

In this chapter the mixed method paradigm chosen was discussed. Also described were the methods of collecting data and how the mixed method paradigm was used to do so. This chapter also described why sequential explanatory was the method chosen and how it best fit this capstone. Finally, outlined in this chapter were the ethics of this action research project and the steps taken to protect privacy. The discovery of what native English speakers in Spanish immersion do in their schools, specifically in their math classes has been started.

CHAPTER FOUR

RESULTS

This study focuses on answering the question: When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction? This study took place in a Spanish Immersion elementary school in a second ring suburban in the Upper Midwest between the months of April 2015 and May 2015. This research was conducted using a mix of quantitative data collection and analysis and qualitative data collection and analysis.

Data Collection

The beginning phase of data collection involved the audio-recording of five individual math lessons. These lessons were conceptual in nature the first three days and rote procedural math the last two days. The decision to use conceptual and rote procedural math lessons was to investigate if students switched more heavily during one type of lesson versus the other.

Data collected was from audio-recordings where the number of occurrences students switched from Spanish to English to solve the problem occurred within their group. From these occurrences where students switched, the researcher categorized those times into the following: exclamatory phrases or words, lack of Spanish vocabulary, and lack of circumnavigation skills. Figure 2 outlines the document used to differentiate and count occurrences.

Figure 3. Code-Switching Code Count Collection Document

	Exclamatory word or phrase	Lack of Spanish vocabulary	Lack of circumnavigation skills
Day One Round One			
Day One Round Two			
Day One Round Three			
Day One Round Four			
Day Two Round One			
Day Two Round Two			
Day Two Round Three			
Day Two Round Four			
Day Three Round One			
Day Three Round Two			
Day Three Round Three			
Day Three Round Four			
Day Four Round One			
Day Four Round Two			
Day Four Round Three			
Day Four Round Four			
Day Five Round One			
Day Five Round Two			
Day Five Round Three			
Day Five Round Four			

Exclamatory words or phrases pertaining to this capstone are defined as words like *oh, I know!, oops, bam! ok!* and *what the heck?!* Native speakers of English so commonly use these phrases that they often occur while speaking Spanish unintentionally.

Lack of Spanish vocabulary is defined as not knowing the particular word in Spanish the student desires or not knowing what the direct translation of the word is. An example would be tennis shoes or post-it note.

Lack of circumnavigation skills is defined as the inability of the student to speak around the unknown word using the vocabulary they do have. For example, if a student does not know what the word for poverty is in Spanish, they would say, "when people live on the streets and don't have food or water."

For the purpose of this study, the class was divided into four groups of students. These groups of students were called rounds, per the school language used at the school site. A round is a group of students working on an activity; at the end of the activity, the students switch to the next round and so on until all rounds have completed all activities.

Data Samples From Audio-Recording Transcriptions

The occurrences of code-switching from Spanish to English are italicized in the samples. When the occurrences became redundant, they were removed from this body and placed in the appendices for reference. The occurrences that were removed from this chapter were placed in the appendix were the redundant exclamatory use of words and phrases such as *ok, well, umm, wait*. These samples are found in Appendix E.

An example of an occurrence involving the lack of Spanish vocabulary occurred in the first lesson when students were asked to name six different triangles according to their characteristics:

Student 13: ¿Puedo usar tu lapiz? [Can I use your pencil?]
Student 19: Sí. [Yes.]
Tosses pencil to student three.
Student 19: Yo sabe es *sharpened*. [I know it's sharpened.]
Student 16: Es acutángulo. [It's an acute triangle.]
Student 13: *Ok*.

Student 15: Obtusángulo. [It's an obtuse triangle.]
Student 13: Escaleno, escaleno. [Scalene, scalene.]
Student 15: Obtusángulo. [It's an obtuse triangle.]
Student 13: También es escaleno. [It's also a scalene triangle.]
Student 15: Es obtusángulo. [It's an obtuse triangle.]

In this segment, the students were asked to make a list of the properties of six different triangles. They also were asked to write what the triangles had in common. During this lesson, students were recorded speaking all Spanish except one time. In this case, the student lacked the Spanish word for *sharpened,* when referring to a pencil.

Later in this same discourse, another such occurrence appeared. The students were recorded debating what semejante [similar] meant in regard to triangles.

Student 13: Dos es equilátero. [Two is an equilateral triangle.]
Student 16: No, no es. [No it isn't.]
Student 15: Tres son semejantes. [Three triangles are similar.]
Student 12: Son semejantes. [They are similar.]
Student 19: Tus ojos son semejantes. [Your eyes are similar.]
Student 16: Semejante es…[Similar is…]
Student 15: Mira al *post-it*. [Look at the post-it.]

Student 15 was referring to a *post-it* in the classroom that defined semejante [similar]. Both of these occurences, *sharpened* and *post-it,* were categorized as lack of the Spanish vocabulary for its English counterpart. Neither of these occurences were directly related to a word in Spanish regarding the triangles.

Of the five minutes and forty seven seconds of this portion of the lesson, there were five audible occurences of code-switching. The final occurences happened near the end.

Student 13: Debemos ir a (inaudible) tres ahora. [We should go to (inaudible) three now.]
Student 15: Tres es congruente, tres es obtusángulo. [Three is congruent, three is an obtuse triangle.]

Student 13: Semejante con uno. [Similar with one.]
Student 19: Yo pienso todo eso es correcto. [I think all of this is correct.]
Student 15: Triángulo es congruente, es paralelogramo. [Triangle is congruent, it's a paralleogram.]
Student 16: Todos son triángulos. [They're all triangles.]
Student 15: *Well, yeah*.
Student 13: Pero, [But,]
Student 16: No sabe eso. [I don't know this.]
Student 19: Todos son triángulos. [They're all triangles.]
Student 7: *Wait*…puedo ver eso. [Wait, can I see this?]
Student 13: Cuatro es isósceles. [Four is an isoceles triangle.]

In this segment of the lesson, the three occurences were *well, yeah,* and *wait*. The researcher categorized these occurences as exclamatory words or phrases and also as not directly related to math content but more conversational nuance. For the readability of this chapter, further occurences categorized as exclamatory words or phrases such as *well, yeah, wait, ok,* or *umm* will be mentioned as exclamatory occurences but will not be detailed in the body of this chapter. The samples can be found in Appendix E.

The second group of fourth graders audio-recorded within the same triangles lesson had more occurences. More of the occurences were directly math related as well as due to a lack of the Spanish word.

Student 8: Número uno tiene triángulo o escaleno. [Number one has triangle or scalene.]
Student 14: Obtusángulo, no obtusángulo. [No, it's an obtuse triangle, obtuse triangle.]
Student 8: Ángulo obtuso. [Obtuse triangle.]
Student 24: Todos los tres lados son diferentes. [All three sides are different.]
Student 29: Y dos agudos. [And two angles are acute.]
Student 8: Todos los lados son diferentes. [All of the sides are different.]
Student 1: Incluyendo, [Including,]
Student 8: Con diferentes, [With differences,]
Student 29: *Stop, are you kidding me?*
Student 1: Diferentes longitudes. [Different lengths.]
Student 8: *Umm*..número dos es isósceles y, [Umm..number two is isoceles and,]

Student 1: También acutángulo. [Also it's an acute triangle.]

In this segment, the code-switch was due to a lack of the Spanish vocabulary for *are you kidding me?*

In the third round of this same triangle lesson, the number of occurences, switching from Spanish to English, was five times. Four of the five times were categorized as a lack of Spanish vocabulary for the English counterpart. The second occurence was spoken in English and then in Spanish. This occurence was categorized as exclamatory words or phrases. The occurences are as follows:

{Student 28 was poking his friends in the group while recording was occuring.}
Student 22: {estudiante 28} Eso es una forma de *bullying*. [This is a form of bullying.]
Student 2: *We can talk in English* podemos hablar *English*. Necesitas hablar acerca de mate. [You need to talk about math.]
Student 22: Estamos…[We are…] {interrupted by inaudible student}
Student 22: {estudiante} 28 tú puedes hablar también. [Student 28 you can talk too.]
Student 2: {estudiante} 28 es *picking his nose.* [Student 28 is picking his nose.]
Student 22: Todos son triángulos y tienen tres vértices. [All of them are triangles and they all have three vertexes.]
Student 6: Señora Holland necesita escribir todo eso. [Señora Holland needs to write all of this.]
Student 22: Número tres es escáleno y número tres es… [Number three is scalene and number three is…]
Student 4: Todos son triángulos. [All of them are triangles.]
Student 24: Todos son figuras. [All of them are figures.]
Student 22: Número cuatro es isósceles. [Number four is an isoceles triangle.]
Student 2: Yo voy hacer el *background music*. [I am going to do the background music.] {starts singing}
Student 22: Por favor {estudiante} dos. [Please {student} two.]
Student 2: {still singing}
Student 22: Todos son triángulos. [All of them are triangles.]
Student 4: Todos son…[All of them are…]
Señora Holland: ¿Cómo participas? [How are you participating?]
Student 28: {Murmuring in response to the teacher's re-directing question}

Student 2: *What the heck* {unknown student}, *you're like…*

In the last round of the triangle lesson, there were ten occurences of code-switching.

> Student 8: Número uno, *all of them.* Número uno escaleno obtuso. [Number one, all of them. Number one scalene obtuse triangle.]

Several minutes later in the lesson was the second occurence.

> Student 9: Tres es isósceles. [Three is isoceles.]
> Student 20: Todos tienen tres aristas. [They all have three aristas.]
> Student unknown: Numero dos *is not*. [number two is not.]{referring to it not being isoceles]

In both of these occurences, the students commit a syntax error. The student was attempting to speak Spanish while using English syntax. The student realized mid-sentence that it was not going to work so he had to switch to English to make the syntax work. In both of these occurences the phrase *all of them* and *is not* should have been at the beginning of the sentence, in the case of the first occurence or in front of the noun, as in the case of the second occurence. The researcher categorized these as lack of circumnavigation skills.

The third occurence was irrelevant concerning math. It was categorized as exclamatory word or phrase.

> Student 20: *Our teacher is smart and awesome and she should get her master's degree. She's the best.*

This student also committed this occurence a minute later and it was categorized as exclamatory word or phrase. This occurence was followed by an exclamatory phrase or word occurence also (see Appendix E).

> Student 11: Isósceles acutángulo. [Isoceles, acute triangle.]

Student 11: Isósceles acutángulo. [Isoceles, acute triangle.]
Student 20: *Our teacher made us smart*.
Student 11: Ok, cinco es creo que…[Ok, five is, I believe…]

In the second day of lessons, there were four groups of students who participated. In this second day of audio-recordings, the students were working on comparing and contrasting a triangle, a square, a rectangle and a star according to their geometrical characteristics.

In the first round of day two, there were twelve occurences. The composition of groups of students stayed the same on day two as day one. The first and second occurences were immediate. They were categorized as exclamatory word or phrase and can be found in the appendix. The more notable occurrences are detailed below.

Several minutes later into the round,

Student 12: Dos de los triángulos de número uno, si conectas dos de ellos, puedes formar un rombo, sí es un rombo, si como *slide slide*-o el rombo va a ser un cuadrado. Entonces uno y dos tienen algo en común. [Two of the triangles from number one, if you connect two of them, you can form a rhombus, yes, it's a rhombus, if you, like, slide, slide-o, the rhombus; it's going to be a square. So, one and two have something in common.]

After a moment of discussion, the group continues,

Student 13: También, lo que tienen en común es que son paralelogramos, polígonos tienen cuatro vértices y cuatro aristas cuatro lados cosas científicos muy *fancy* es extremos. Extremos son lados. [Also, what they have in common is that they are parallelograms, polygons. They have four vertexes and four edges and four side things. Scientific, very fancy is ends. Ends are sides.]
Student 27: Básicamente tienen cuatro cosas. [Basically, they have four things.]
Student 13: *Yeah*.
Student 12: Si es tres dimensional. [If it's three dimensional.]
Student 13: Será un cubo si era tres dimensional. [It would be a cube if it was three dimensional.]
Student 13: *Ok, um*, también… [Ok, um, also…]

Student 19: ¿Qué pasó si pones esto aquí? ¿Qué van a pasar? [What happened if you put this here? What's going to happen?]
Student 27: Si pones esto allí esto dos veces *shrink* dos de esos forma tres. [If you put this here, this two times, shrink, two of these forms three.]

Second round of day two, there were eleven occurences five of which were exclamatory and can be found in Appendix E. The first occurrence noted here is categorized as a lack of Spanish vocabulary for the desired word in English. The following occurence is noted because the student said the word in English and then self-corrected with the word in Spanish. This is an exclamatory word or phrase of English.

Student 13: Muchas líneas de simetría en número cuatro. Yo soy el *announcer*.

Later, during round two of day two,

Student 13: ¿Por qué están *whispering* susurrando? [Why are they whipsering?]
Student 25: Número dos es cuadrado y tiene cuatro lados de vértices cuatro de simetría líneas de simetría. [Number two es square and they have four sides, four vertexes and four lines of symmetry.]

Day two, round three.

There were six occurences during this round. In this round, the most common occurences were *ok* and *umm*. Those examples can be found in Appendix E. The occurence highlighted here was categorized as lack of Spanish vocabulary.

Student 22: O tres d. Esto es mas corto, es el *nickname*. [Or three d. This is much shorter, it's the nickname.]
Student 30*:* Nombre más corto. [Shorter name.]
Student 6: Versión más corto. [Shorter version.]

The last occurence was also due to a lack of the Spanish vocabulary. The student was reacting to another student in the group because they were speaking quietly.

Student 30: Estás *mumbling*. [You're mumbling.]

Day two, round four was similar to round three. All of the occurences were *ok*s and *umm*s and can be found in the appendix.

Day three, round one had three occurences. The first occurence was a lack of circumnaviagtion skills and lack of Spanish vocabulary. The student was unable to communicate the procedure for division word problems in Spanish. Attempting to explain the procedure for division in Spanish required three students to piecemeal their knowledge to get all of the Spanish academic language together. Each student contributed a phrase or word to the conversation, but no individual was able to accompolish the task. The second occurence in the following passage was an exclamatory word or phrase.

> Student 7: Necesitamos ocho cajas. Por que siete van a estar como en…[We need eight boxes because seven goes in, like…]
> Student 16: Viente tres dividido. [Twenty three divided by…]
> Student 15: No sabes cuántos puede go en *the box*. [You don't know how many go in the box.]
> Student 7: Uhh…
> Student 15: ¿Número de cajas? [Number of boxes?]
> Student 16: *Wait*, dividido entre…[Wait, divided by…]

Day three, round two, experienced the same types of occurences. None of the occurences were directly math related. They were *oks* or *umms*.

In day three, round three, there were two occurences, with one occurence that was unlike the occurences in the previous round. It is unlike the others because of the Spanish syntax compared to the English syntax. In Spanish, the sentence is *no es*. In English, the sentence is no, it's not. These occurences were categorized as a lack of circumnavigation skills.

> Student 9: Ok, tenemos que dividir 23 entre 4. [Ok, we have to divide 23 by 4.]
> Student 4: Y esto es nuestra respuesta. [And this is our answer.]

Student 22: Vamos a hacer una fuerte voz. [We are going to do strong voice.]
Student 30: Fuerte voz es fuerte asombroso. [Strong voice is strong awesome.]
Student 9: *No, it's not*.

Day three round four, there were four occurrences. In two of the occurrences, the individual student understood the math, but lacked circumnaviagtion skills to describe the mathematical procedure.

Student 17: (Read the problems.)
Student 9: Seis cajas. [Six boxes.]
Student 17: Veinte tres dividido entre. Necesitamos seis cajas. Cinco por cinco es… [Twenty three divided by…We need six boxes. Five times five is…]
Student 2: Puedes usar esto. [You can do this.]
Student 17: No puedes. [No you can't.]
Student 2: En la vida real, sería seis. [In real life, it would be six.]
Student 17: *Puedes order umm una box, hay diferentes sizes*. Sería seis residuo; es seis. Veinte tres dividido entre cuatro sería seis residuo uno. Entonces, ella necesita seis cajas y una va a tener una extra. [You can order umm one box, there are different sizes. It would be six remainder one. Twenty three divided by four. So, she needs six boxes and one is going to have an extra.]

This same student in the next problem was able to do the math, but unable to do it all in Spanish. He lacked circumnaviagtion skills and the researcher categorized it as lack of circumnavigation skills.

Student 17: (Reads the next problem.) Nueve y medio dividido entre dos igual es cuatro. [Nine and a half divided by two equals four.]
Student 9: Tienes que hacer un mitad de un mitad. [You have to do one half of one half.]
Student 17: Este, *what's half of half?* [This, what's half of half?]

In day four round one, there were many *oks* and *umms*. However, of the nine occurrences counted, there was one student who continued to use English instead of trying to circumnavigate the words she did not know. This occurrence is a lack of

Spanish vocabulary that would encourage circumnaviagtion skills. However, this student lacked both the vocabulary and the circumnaviagtion skills.

> Student 13: Ok, el *crowd* dice boo. [Ok, the crowd says boo.]
> Student: Boo.
> Student: Boo.
> Student 13: Es incorrecto. [It's incorrect.]
> Student 12: Cuatro sextos mas tres octavos igual a… Decimos es… [Four sixths plus three eights equals… We say it's…]
> Student 16: No, es seis por ocho igual a cuarenta y ocho. [No, it's six times eight equal to forty eight.]

This interaction was followed by the group discussing the problem in Spanish. Another student interjects again with the same word in English. As the other students argued, student thirteen interjected again with the English word *crowd* with an added *news*. Followed by her last interjection completely in English.

> Student 7: El *crowd* fue incorrecto. [The crowd was wrong.]
> Student 12: *Ok*, siguiente problema. Cuatro menos tres octavos. El denominador común: cuatro por ocho es treinta y dos. Seis por tres igual a dieciocho. Treinta y dos menos dieciocho es, restas el tres. Treinta y dos menos dieciocho igual a…entonces es catorce cuarenta y ochavos. Siete y veinte cuatroavos es la respuesta. [Ok, following problem. Four minus three eighths. The common denominator: four times eight is thirty two. Six times three equals eighteen. Thirty two minus eighteen is, minus the three. Thirty two minus eighteen equals…so, it's fourteen and forty eighths. Seven and twenty fourths is the answer.]
> Student 13: Hay *any news* del *crowd*? [Is there any news from the crowd?]
> Student 15: No de eso. [Not about this.]
> Student 13: *Shouldn't you guys know this?*

The last occurrence in the previous round is remarkable because of the mix of academic Spanish and the lack of Spanish vernacular. In Spanish immersion schools, there is often a lack of teaching social Spanish. When this lack of skill is combined with the student desire to use vernacular language with one another, the result is code-switching. LaVan (2001) wrote that 'using the vernacular is a way of establishing

identity, of being part of the group. Children have a powerful need to use a vernacular language with each other, especially as they get older, and normally, the only vernacular language at their disposal is that of their L1'. In this vignette, although just a snapshot, this student was attempting to fit in as the math was becoming difficult for her.

Day four, round two, was unremarkable. Followed the pattern of minimal occurrences of switches to English. Those occurrences being *wait* and *ok*.

Day four, round three, the switches to English were *ok* and *yeah* until group members asked a fellow group member to participate.

> Student 12: *Come on* {estudiante} *twenty three*.
> Student 23: *Ok, I'm talking happy*.
> Student 18: En español. [In Spanish.]
> Student 23: Estoy hablando *happy*? Yo estoy más terrible en este. [I'm talking, happy? I'm horrible at this.]

Day five, round one, the occurrences were a lack of Spanish vocabulary.

> Student 13: ¿Dónde está mi *grippy-o*? [Where's my grippy?]
> Student 1: Así que tres va en tres uno. ¿Cuántas veces va? [So, three goes into three, once. How many times does it go?]

Several moments later, student thirteen interjects English again. This is also a lack of Spanish vocabulary because she lacked the Spanish word for *hold*.

> Student 13: Y la respuesta es 126. [And the answer is 126.]
> Student 13: ¿Quién quiere explicar ahora? [Who wants to explain now?]
> Student 25: ¿Puedo tratar? [Can I try?]
> Student 13: {Estudiante} veinte cinco. [Student twenty five.]
> Student 25: Yo voy a tratar. [I'm going to try.]
> Student 1: Está bien {estudiante} viente cinco. [It's ok student twenty five.]
> Student 13: Soy el persona que yo *hold-o* eso. [I'm the person that is going to hold this.]

Likert Scale Questionnarie Results

Following this first phase of data collection, the students in the classroom were given a Likert Scale Questionnaire (see Table 1 for the English translated version and Appendix A for Spanish version given to students). The Likert Scale Questionnaire was a self-assessment the students did themselves after the audio-recorded lessons. The questinonnaire included 13 questions that ranged from, I speak Spanish during math when I don't understand, I speak English during math when I don't understand, and Math is my favorite class in school.

This questionnaire was used to identify which students were most likely to code-switch during math according to their self-reflection. The students checked either strongly agree, agree, neutral, disagree, or strongly disagree according to the statement to which they were responding.

Of the 13 statements on the Likert Scale Questionnaire, 6 were statements that demonstrate how the students used Spanish either with other students, with the teacher, or internally in their heads. Six statements were how the students used English with other students, with the teacher, or internally in their heads. The last statement, Math is my favorite class in school, was put in the survey to give the students an opportunity to express how they felt about math in school. The raw data can be found in Table 1. Using the survey, the researcher was able to monitor the audio recordings more acutely for students who self-identified as switching more often to English from Spanish during math instruction.

Table 1. Likert Scale Questionnaire Results

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	I speak Spanish during math when I don't understand	32%	23%	26%	13%	6%
2	I speak English during math when I don't understand	7%	24%	17%	21%	31%
3	I always speak Spanish during math.	23%	35%	13%	26%	3%
4	I always speak English during math.	3%	11%	18%	25%	43%
5	I use Spanish to tell my friend how to do a math problem like "what is the area of a square with sides that measure nine inches?"	41%	27%	21%	7%	4%
6	I use English to tell my friend how to do a math problem like "what is the area of a square with sides that measure nine inches?"	10%	14%	24%	21%	31%
7	I use Spanish to tell my friend that nine times nine is eighty-one.	55%	28%	14%	0	3%
8	I use English to tell my friend that nine times nine is eighty-one.	7%	17%	3%	37%	37%
9	I use Spanish when I count in my head.	10%	14%	21%	17%	38%
10	I use English when I count in my head.	36%	18%	25%	7%	14%
11	It is easy for me to ask my teacher a question in math class in Spanish.	38%	24%	21%	10%	7%
12	It is easy for me to ask my teacher a question in math class in English.	14%	3%	14%	24%	45%
13	Math is my favorite class in school.	28%	24%	24%	17%	7%

Open-Ended Interview Responses

From the survey and the audio-recordings, the researcher identified five students who switched heavily from Spanish to English during math and who were also heard switching more heavily from Spanish to English in the audio recordings. These five students participated in an open-ended interview with the researcher in Spanish (see Appendix C)

The five students who were selected based on the Likert Scale Questionnaire and the audio recordings were four students who identified as white and one self-identified as Asian-Pacific Islander. All were males. The questions were open-ended. Of these five students, two are identified as gifted and talented by the school district. These students have 96% or higher in math and reading standardized tests. All interviews were conducted in Spanish. Spanish questions and responses may be found in Appendix F.

Question Number One: When do you notice yourself switching from Spanish to English in math? Do you try going back to Spanish? What do you do after you noticed you switched?

To this question, the first student responded, "only when I need a different language and I choose the easiest one to do it."

The second student responded shortly. He said he changes "a lot" and that he doesn't try to switch back to Spanish and he realizes that he should switch back to Spanish.

The third student noted that he switches when he is "in games" and if he is "dividing in IXL," (IXL is website based learning that has math skills split into categories

that students can access to practice certain math skills through rote memorization) and that he "sometimes" tries to return to Spanish. He is also aware that when he catches himself in English that he should switch back to Spanish.

The fourth student noticed that he changes "many times" from Spanish to English and he said, "um, I don't know, only that I am speaking English," in response to when do you notice yourself switching from Spanish to English in math? Do you try going back to Spanish? What do you do after you noticed you switched?

The last student had the most different response to question number one. He said that he first noticed himself switching from Spanish to English during math "in, like, third grade." When asked if he tries to switch back to Spanish he responded "no." When asked why he doesn't try to switch back he said, "because I like to speak English."

Question Number Two: When a friend asks you to help them understand a math problem, like the area of a rectangle, which language do you prefer to use when talking to your friend?

Two students said they use English to explain to their friends and didn't elaborate any further. Students one, three, and four were able to elaborate on why they use English versus Spanish when they were asked.

Student one said English, "because they are able to, like, do what I am saying more easily." The third student elaborated with, it "depends on the question; if it is easy I use Spanish, if it is dificiult and I don't know the words I use English." The fourth student responded similarily to the third student and elaborated with, "I try in Spanish, but many times I don't know many mathematical Spanish words."

Question Number Three: Why do you prefer that language?

All of the students responded with a variation of the same answer. Student one, "so that they know what I am saying and so that they understand what I am doing." Student two, "because it is easier to explain." When asked why it was easier to explain in English he responded, "because I don't know many words in Spanish."

Student three required more elaboration on question number three. The following questions were not a part of the initial interview protocol; but follow up questions were necessary for student three. The researcher followed up question three by asking why do you prefer English when math is difficult? He responded, "because it is easier to explain and I know all the words." Then he was asked why do you prefer Spanish when the math is easy? To which he responded similarily, "because it is easier to explain and I know all the words."

Student four responded, "because it makes more sense when I talk." And when asked "Can you give me an example?", he responded, "when I don't know a word in Spanish, I usually change, like, Spanish to English in one sentence and it doesn't make sense."

Lastly, student five, when asked, responded, "because it is my language I use all day."

Question Number Four: What part of math in Spanish is the most difficult for you?

The five students selected had a wide variety of responses. For students one and two, long division was the most difficult part; student three said book work. Student four replied, "geometry because there are a lot of big words that I know in English, but I don't know in Spanish." The last student responded, "the Spanish vocabulary" was the most difficult.

Question Number Five: What part of math in Spanish is the easiest for you?

Four students said that multiplication was the easiest part of math. Students four and five gave examples of why it was easy. Student four said, "multiplication because there isn't a lot of words," and student five replied, "it's only easy when I am multiplying. I am saying the numbers in Spanish to myself."

Question Number Six: What is your favorite class in school?

The last question of the open-ended interview, of the five students interviewed, all males, student one and student two said that physical education was their favorite, student three and student five responded that math was their favorite, and student four responded that math and physical education were their favorite clases. Student five added that math would be better if it was in English.

Conclusion

This chapter analyzed the data collected from three different forms of data collection. The audio-recordings, Likert Scale Questionnarie, and open-ended interviews were used to answer the question: *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction*? This chapter highlighted commonalities between when students switch into English as well as why they switch into English.

In chapter five, I will reflect on what I learned from my research, as well as make connections between my literature review, methodology, and data collection. I will also discuss the major findings, implications and further research needed.

CHAPTER FIVE

CONCLUSION

In this research project I attempted to answer the question *When and why do native English speaking students in a Spanish immersion setting switch into English during math instruction*? I will reflect on the learning from this research, address the limitations and implications of my study, make recommendations for future research and conclude by discussing how this capstone will effect how I teach math to native English speakers in a Spanish immersion classroom.

Summary of Findings

From the transcripts of the audio recordings, I observed there were many more exclamatory phrase and word occurrences than any other type of occurrence. In this study, fourth grade students were saying, "okay, yeah, and umm" in almost every audio recording session. These phrases were so automatic that it seemed the students didn't even recognize that they said it. Also, students haven't been taught that okay, yeah, and umm are English, much like I haven't taught Spanish immersion students that rodeo, patio and lasso are actually Spanish words. Many language policies in the Spanish immersion classrooms are to penalize students for using their first language (L1). The language policy would be one of the only ways for students to know that these words are English and not Spanish. When a student says those English exclamatory phrases or

words in my classrooms, I don't even raise an eyebrow because it is so common and automatic for English native speakers to say these words.

The Likert Scale Questionnaire results concur with my observations of the audio recording results. In the survey, students had a very high opinion of themselves when it came to how much they used Spanish in the classroom compared to how much they used English. This was not surprising. It seems that by fourth grade in Spanish immersion, and possibly any immersion student is so bilingual that the two languages become a third and the lines between languages are blurred. The results of the Likert Scale Questionnaire and the audio recordings lead me to conclude that vernacular Spanish needs to be taught so that students can clear up those blurred lines of which language 'okay' belongs to and to which language belongs lasso.

From the open-ended interviews, the same two themes appeared. The students mostly stated that they used English instead of Spanish in math class because it was easier and they didn't know all the words in Spanish in order to stay in Spanish. Also, students have a more intense and intrinsic need to socialize in their L1 than they did in earlier grades (LaVan, 2001). Also, LaVan writes that "they also appear to be less'in awe' of the novelty of being able to communicate in a second language."

Based on all three forms of data collection, the need to teach Spanish vernacular in Spanish immersion schools is necessary. "Using the vernacular is a way of establishing identity, of being part of the group. Children have a powerful need to use a vernacular language with each other, especially as they get older, and normally, the only vernacular language at their disposal is that of their L1. Therefore, children who remain in the L2 (superordinate) may be marked as non-members of the group," (Tarone & Swain, 1995).

The students' lack of content vocabulary represents an impediment to their academic understanding of the mathematics. This makes a rich, contextual discourse more difficult and makes academic conversations between students less engaging. The lack of content language was most evident in the first day of audio recording. The students had not been exposed to the vocabulary for squaring numbers. One student continuously used the English word "squared" in the middle of his oral explanation of the Pythagorean theorem ($a^2 + b^2 = c^2$). The other students were not able to help this student with the vocabulary either, because none of them, at fourth grade, had been exposed to this vocabulary, let alone the theorem. Had I been near during this discussion, I would have interjected with the word he needed for now, and expounded on the vocabulary in a lesson in the following days.

Other instances of the lack of content vocabulary appeared during the triangle lessons. The students noticed that two triangles looked the same, but one was slid over, or translated. Instead of using the Spanish vocabulary the student said, "slide-o." The use of the 'o' at the end was to emphasize the Spanish. Many Spanish immersion students over generalize that all Spanish words have an 'o' at the end. To make jest of this, this student added the 'o.'

The last instance of the lack of content vocabulary was when a student didn't know how to say ½ of ½ or ¼. Instead of saying one fourth, he said half of half. At the time of this study, the fourth grade students had just been taught and assessed on how to add, subtract, multiply and divide fractions. However, they had not been taught how to say the fractions themselves.

As a teacher, I have observed that the less engaging a lesson or activity is, the more the students talk in side conversations. In the Spanish immersion classroom, these side conversations are often in the L1. In the math curriculum and math lessons, the inclusion of a language objective intertwined with the math objective will address this lack of content vocabulary and also make the lessons more engaging because the students will be working on two priority objectives at the same time.

Reflections on Findings

Two primary conclusions can be drawn from this action research project. First, Spanish immersion teachers need to teach vernacular Spanish in a more formal way. There needs to be a curriculum developed around teaching native English speakers how to talk to peers in Spanish and a curriculum designed to teach them how to speak to adults and adults teaching content areas. The second conclusion is that we need to embed language objectives into our content area lessons, especially in math.

This research project provided me with the chance to look at my teaching in a Spanish immersion classroom. Not only did I begin to think about how I was teaching math, I began to think about how I teach every subject area. Math was my emphasis because of the obvious code switching that was occurring. As I was researching, I began to hear and see this type of code switching in other content areas. I realized that there was a pattern in the code switching like what I saw when I audio recorded five math lessons. Students tend to switch from Spanish to English and back when there is a deficiency in the second language (L2). When students were provided with an opportunity for rich discourse, the use of English decreased. The use of L2 increased.

Lesson planning also changed after this project because I began to teach individual words that I knew students were lacking. During the first six weeks of the school year that followed the collection of data used in this study, I focused heavily on content vocabulary. For example, in math we did an alphabet taxonomy. We listed every letter in the alphabet and then students went through their math textbooks and looked for words they didn't know and began organizing them alphabetically in their taxonomy. Then we took those taxonomies and a dictionary and began defining those words. Although we didn't use English until the last possible instructional moment, the students' mathematical vocabulary appears to have increased considerably compared to the students in this research project.

Major findings from the Likert Scale Questionnaire revealed that students' perceptions of themselves are that they are speaking and using Spanish more frequently than what a teacher, like myself, may hear and see. This may be an indication of their level of bilingualism, in that they may not be self-aware of the code-switching they are doing. Further research into this area is needed. The Likert Scale Questionnaire also revealed that students don't seem to have a problem with rote math versus conceptual math in their second language. Interestingly though, the Likert Scale Questionnaire did show that of the 31 students surveyed, 10% said they counted in Spanish in their heads. This has implications for Spanish immersion because it indicates that there may be a disconnect between internal mental processes and external processes of math. If a student is counting in their head in English, and responding in Spanish, I conclude that they are at a particular stage of their L2 acquisition and that we need to also teach how to think in Spanish.

Limitations

Reflecting on the culture of our school, another interesting revelation from the Likert Scale Questionnaire was that 38% of students said, “Para mí es fácil pedir a mi maestro una pregunta en la clase de matemáticas en español [For me it’s easy to ask my teacher a question in Spanish.]” That’s because the culture of school is only to speak Spanish to our students and students only speak Spanish to Spanish speaking teachers. Based on our school philosophy, that percentage should be nearer to 100%. A clarifying statement to put on the Likert Scale Questionnaire would have been, “Yo pido a mi maestro una pregunta en español [I ask my teacher a question in Spanish.]” This would strengthen the effectiveness of the questionnaire.

The audio recording of lessons was also a limitation because I was unable to see the students speaking and therefore my transcriptions are not as accurate as far as who was speaking. It also limited my ability to see their non-verbal gestures. I wasn’t able to see if they were grasping for words or looking to help their peers. This limitation did not effect who was chosen for the open-ended interviews nor did it affect the Likert Scale Questionnaire, but it did affect how clearly the lessons were transcribed.

Another limitation in this research project was the complexity of the math lessons. As a trained elementary school teacher, my background training in math is incomplete. The training I received was one six-credit class. Although that class did inspire this capstone, the lessons used in the research I would now consider low in Bloom’s Taxonomy of critical thinking (Bloom, et al, 1956). I knew the lessons would spur conversation, but in the end they were not as deep and rich as I would have liked.

I, myself, am a non-native bilingual Spanish speaker. During this project, at times I was aware of my lack of circumnavigation skills as I was listening to my students' lack of circumnavigation skills. In order to get around a word I don't know, I avoid it completely. This makes math awkward when teaching and the teaching point unclear. I should be working around an unknown word in conversation or when I am teaching and explaining this process to the students as I finish. Modeling this behavior and skill will teach it at the same time.

I believe I would have been better able to describe and teach the mental activity going on in my head during math and been better able to convey that to students giving them an opportunity to focus on their own mental processes. As a non-native speaker of Spanish, teaching Spanish immersion, it is often difficult to teach well all the time because I am consumed by speaking correctly. There is an imbalance between the goals of the school and my personal teaching goals in the classroom on a daily basis. Along with speaking the language, I would like to teach the content well.

Implications

Implications for future research are clear from this capstone. Audio, while useful in capturing student language, proved too limited by itself. It is essential that video is taken of the students to capture student non-verbal gestures and interactions. This would enhance the accuracy of the transcriptions. Some parts were inaudible and side conversations were taking place that only audio wasn't able to capture. Video, with good audio capacity, would capture more information of the student exchanges.

Further, in the Likert Scale Questionnaire instead of the Spanish phrase *yo puedo* [I can] future research should use a phrase like *yo hago* [I do] or *yo digo* [I ask] so that

students think about what they actually say and do instead of what they can say or do. The students responded whole heartedly and with such good perceptions of themselves speaking in Spanish during math class because the questionnaire stated, for example, *I can speak* in Spanish to my friends instead of *I do speak* Spanish to my friends.

Also, the Likert Scale Questionnaire responses should have been anonymous until all questionnaires were counted. Knowing the students' identity before selecting them for the open- ended interview may have skewed the choice of students selected. However, knowing the identity gave the opportunity to select a racially diverse pool of students.

Recommendations for Further Research

My review of the literature made clear that there is a critical need for further research where native English speakers in immersion schools are concerned. As our nation moves forward in providing immersion schools as choices, we need to better understand how they work and what happens to students during and after attending immersion schools. Studies are also needed longitudinally through twelfth grade as well as into post-secondary education and the workforce on those students to see what the benefits and downsides are to this type of schooling. Comparison studies are needed between immersion schools and non-immersion schools also to see what effects, if any, exist in the learning of elementary content, such as mathematics, in a second language.

Moving Forward

This capstone will effect how I teach math to native English speakers in a Spanish immersion classroom in several ways. First, I will continue to do a math vocabulary study with my students using the alphabet taxonomy at the beginning of the school year and revisit this taxonomy throughout the school year. I will also identify high frequency

math words that all fourth graders should know and bring that list to my team for consensus. I will pass this list along to my third grade teacher colleagues for their assessment also.

During math, I will make my mental processing public by doing it out loud and as clear as possible to students. Making my thinking out loud will highlight and model Spanish circumnavigation skills. Verbalizing my thinking out loud will also demonstrate mathematically what I am doing to solve math problems. I will also highlight a language objective to my students that I plan on using during my lesson and that they should plan on using during their work time. I will also make a high frequency math phrase list that I will treat much like the high frequency math words list that I will create.

From this capstone, I have concluded that teaching students how think in Spanish would require teaching students how to reflect on their thinking in math. To do this would require metacognition sentence starters and lessons revolving around how to think about thinking in math.

Not only are high frequency math words and phrases needed, but there is also a need to teach the exclamatory word and phrase students used during math. Instead of saying *okay,* Spanish immersion students should be saying any variation of okay, like vale, pues, or claro. These phrases need to be taught to the point of automaticity. This area is not addressed officially in the curriculum at this Spanish immersion school site. Also, teaching these exclamatory words and phrases would enhance the side conversations students have when learning math. This also will address the need to fit in socially as students become better apt at conversing with their peers in Spanish.

At a school level, I will communicate to my team my findings and my conclusions as well as communicate my findings to my principal.

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Appendix A

La encuesta de Likert Scale en español

		Totalmente de acuerdo	De acuerdo	Ningún opinión	No estoy de acuerdo	Totalmente no estoy de acuerdo
1.	Yo hablo español en matemáticas cuando no lo entiendo.					
2.	Yo hablo inglés en matemáticas cuando no lo entiendo.					
3.	Yo hablo español siempre durante matemáticas.					
4.	Yo hablo inglés siempre durante matemáticas.					
5.	Puedo usar el español para decirle a mi amigo cómo hacer un problema de matemáticas como " ¿cuál es el área de un cuadrado con lados que miden nueve pulgadas? "					
6.	Puedo usar el inglés para decirle a mi amigo cómo hacer un problema de matemáticas como " ¿cuál es el área de un cuadrado con lados que miden nueve pulgadas? "					
7.	Puedo usar el español para decirle a mi amigo que es nueve veces nueve ochenta y uno.					
8.	Puedo usar el inglés para decirle a mi amigo que es nueve veces nueve ochenta y uno.					
9.	Yo uso del español cuando yo cuento en mi cabeza.					
10.	Yo uso del español cuando yo cuento en mi cabeza.					
11.	Para mí es fácil pedir a mi maestro una pregunta en la clase de matemáticas en español.					
12.	Para mí es fácil pedir a mi maestro una pregunta en la clase de matemáticas en ingles.					
13.	Matemáticas es mi clase favorita en la escuela.					

Appendix B

Open-Ended Questions for Students Who Heavily Switch From Spanish to English During Math

1. When do you notice yourself switching from Spanish to English in math? Do you try going back to Spanish? What do you do after you noticed you switched?
2. When a friend asks you to help them understand a math problem, like the area of a rectangle, which language do you prefer to use when talking to your friend?
3. Why do you prefer that language?
4. What part of math in Spanish is the most difficult for you?
5. What part of math in Spanish is the easiest for you?
6. What's your favorite class in school?

Student Name: **Date:**	
When do you notice yourself switching from Spanish to English in math? Do you try going back to Spanish? What do you do after you noticed you switched?	
When a friend asks you to help them understand a math problem, like the area of a rectangle, which language do you prefer to use when talking to your friend?	
Why do you prefer that language?	
What part of math in Spanish is the most difficult for you?	
What part of math in Spanish is the easiest for you?	
What's your favorite class in school?	

Appendix C

La entrevista para los niños identificados quién cambian lenguas con alta frecuencia

1. ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?
2. ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el o el inglés?
3. ¿Por qué prefiere ese idioma?
4. ¿Cuál es la parte de matemáticas en español que es el más difícil para ti?
5. ¿Cuál es la parte de matemáticas en español que es el más fácil para ti?
6. ¿Cuál es tu clase favorita en la escuela?

Nombre: **Fecha:**	
¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	
¿Por qué prefiere ese idioma?	
¿Cuál es la parte de matemáticas en español que es el más difícil para ti?	
¿Cuál es la parte de matemáticas en español que es el más fácil para ti?	
¿Cuál es tu clase favorita en la escuela?	

Appendix D

Lesson Samples from Transcriptions highlighted in body of chapter 4

Fourth Round Day One Sample: Triangles

Student 11: Seis es equilátero acutángulo. Tienen tres lados. [Six is an equilateral acute triangle.]

Student 9: *Well*, tres aristas, sí so dos [Well, three aristas, yes, so two.]

Student 11: Sí dos. [Yes, two.]

Student 20: *Ok*

Student 9: Terminamos [We finished]

Student 11: So, es una de mis favoritas clases. [So {Math} is one of my favorite classes.]

Student 20: Yo también. [Me too]

Student 9: A mi me gusta mate, yeah, uh-huh. [I like math too, yeah, uh-huh.]

First Round Day Two Sample: Figures

Student 13: Todos tienen en común todos son… [They all have in common, they all are…]

Student 19: Sí [Yes]

Student 13: *Ok*

Student 7: También otra cosa que tienen en común es que son figuras, obviamente. [Also, the other thing they have in common is that they are figures, obviously.]

One minute later,

Student 13: Ahhh, cuatro vértices [Ahh, four vertexes]

Student 22: Dos y tres tienen cuatro vértices. [Two and three have four vertexes.]

Student 7: Lo siento. [Sorry.]

Student 13: *Ok, umm*, todos son polígonos, figuras que son polígonos. [Ok, umm, all are polygons, figures that are polygons.]

Followed by,

Student 13: *Yeah*, sí , *ok*, um uno no como no tiene en común con los otros. [Yeah, yes, ok, um, one doesn't, like, have anything in common with the others.]

Student 12: Los triángulos que forman la estrella son triángulos isósceles. [The triangles that form the star are isoceles triangles.]

Student 13: *Yeah*.

Student 7: Yo tengo uno dos y cuatro tienen aristas de numero par y uno y cuatro tienen aristas impar. [I have one, two and four have even numbered vertices and four has uneven number of vertices.]

Student 13: *Umm, ok.*

Second Round Day Two: Figures

Student 1: Estos tres y dos, dos y tres tienen cuatro lados y cuatro vértices.

Student 24: También tienen cuatro ángulos rectos.

Student 1: También tienen cuatro ángulos rectos.

Student 25: *Ok* el como, ¿so puedo escribir en esto? ¿Um {estudiante} 1 quiere escribir dos y tres?

Student 1: Tres y cuatro.

Student 24: Tres y dos.

Student 25: Tres y dos son como el mismo tamaño. Tiene un ángulo de noventa grados.

Student 13: Cuatro lados cuatro vértices y cuatro ángulos rectos

Student 1: Y um cuatro lados es alto uno.

Student 25: El estrella no tiene ninguna simetría.

Student 24: Si tiene.

Student 5**:** *Oh yeah*.

Student 1: Entonces tiene mucha simetría.

Several minutes later,

Student 25: Umm el cuadrado también el triangulo *well umm* en dos umm tiene…

Student 1: Para número uno es equilátero porque todos los lados están iguales.

Student 13: Número uno tiene tres ángulos agudos tres vértices y tres lados y tres líneas de simetría tiene tres de todo hah!

Day Two Round Three: Figures

Student 22:Si no quieres hablar, está bien no judge. [If you don't want to talk, it's fine, don't judge.]

Student 6: Shh.

Student 22: *Ok*, umm, todos tienen un ángulo. [Ok, umm, all have an angle.]

Later,

Student 30: Esto es *like*…[This is like…]

Appendix E

Open-Ended Interview Questions and Responses in Spanish

La entrevista para los niños identificados quién cambian lenguas con alta frecuencia

1. ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?
2. ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?
3. ¿Por qué prefiere ese idioma?
4. ¿Cuál es la parte de matemáticas en español que es el más difícil para ti?
5. ¿Cuál es la parte de matemáticas en español que es el más fácil para ti?
6. ¿Cuál es tu clase favorita en la escuela?

Nombre: estudiante 2 **Fecha: 12 de Mayo de 2015**	
¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	Me: Estudiante numero 2 ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? Response: Solo cuando necesito hablar un idioma diferente y yo escojo uno mas fácil para esto. Y se puede hacer mas fácil. Me: ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? Response: Unas veces pero no mucho Me: ¿Qué debes hacer cuando te das cuenta que has cambiado? Response: parar y cambiar a inglés o español.
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	Me: ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés? Response: inglés, Me: porque inglés con un amigo Response: porque ellos pueden como hacer lo que yo estoy diciendo más fácil
¿Por qué prefiere ese idioma?	Me: ¿Por qué prefiere ese idioma? Response: para ellos que pueden hacer lo mas fácil para que ellos understand que estoy haciendo
¿Cuál es la parte de matemáticas en español que es el más difícil para ti?	Me: ¿Cuál es la parte de matemáticas en español que es el más difícil para ti? Response: larga división Me: porque Response: porque tienes que hacer más veces y es un poco difícil um es umm umm yeah los números son un poco confundidos Me: los números que Response: son un poco confundidos
¿Cuál es la parte de	Me: ¿Cuál es la parte de matemáticas en español que es el más fácil para

matemáticas en español que es el más fácil para ti?	ti? Response: multiplicación Me: Porque Response: porque he practicado para dos anos
¿Cuál es tu clase favorita en la escuela?	Me ¿Cuál es tu clase favorita en la escuela? Response: educación física

Nombre: estudiante 20 **Fecha: 12 de Mayo de 2015**	
¿Cuándo notas que cambiaste de español a Inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	Me: ¿Cuándo notas que cambiaste de español a Inglés en las matemáticas? Response: Mucho Me: ¿Intentas volver a español? Response: no Me: ¿Qué debes hacer cuando te das cuenta que has cambiado? ¿Qué debes hacer cuando hablas inglés? Response: hablar español
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	Me: ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés? Response: inglés
¿Por qué prefiere ese idioma?	Me: ¿Por qué prefiere ese idioma? Response: porque es más fácil de explicar Me: porque piensas es más fácil Response: porque no sé muchas palabras en español
¿Cuál es la parte de matemáticas en español que es el más difícil para ti?	Me: ¿Cuál es la parte de matemáticas en español que es el más difícil para ti? Response: larga división Me: porque Response: porque no sé como hacer el cosa Me: que significas cuando dices la cosa (I drew the standard algorithm) Response: ya, este Me: con la barra, cuando no es en el algoritmo tradicional
¿Cuál es la parte de matemáticas en español que es el más fácil para ti?	Me: ¿Cuál es la parte de matemáticas en español que es más fácil para ti? Response: ¿cómo, cómo que? Me: cuál parte de mate es la más fácil, multiplicación trabajando con la maestra, división trabajar con pareja cual es la más fácil para ti Response: multiplicación
¿Cuál es tu clase favorita en la escuela?	Me ¿Cuál es tu clase favorita en la escuela? Response: este es fácil educación física
Follow up to question 5	Me: porque piensas que multiplicación es tan fácil Response: yo sé todas mis tablas Me: es fácil explicar multiplicación a un amigo por ejemplo o difícil a un amigo Response: fácil Me: porque piensas es fácil explicar a un amigo Response: yo sé como explicarlo

Nombre: estudiante 28 **Fecha: 12 de Mayo de 2015**

¿Cuándo notas que cambiaste de español a Inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	Me: ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿cuándo te das cuenta? Response: no sé Me: no sabes Response: no sabe Me: cuando oyes ti mismo hablando inglés en mate Response: si Me: trabajo de libro, ronda de maestra, con IXL, cuando? Response: cuando está en juegos Me: solo en juegos Response: si dividir en IXL Me: ¿Intentas volver a español? Response:algunas veces Me: ¿Qué debes hacer cuando te das cuenta que has cambiado? Response: cambiar lo a español
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	Me: ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés? Response:los dos depende Me: depende en que Response: depende de la pregunta si es fácil uso español si es difícil y no sabe la palabra uso inglés
¿Por qué prefiere ese idioma?	Me: porque prefieres inglés cuando es difícil Response: porque es más fácil para explicar y sabe todos las palabras Me: por que prefieres español cuando es fácil Response: porque es más simple sabe todos las palabras que necesito usar para describir y que pasa en la problema
¿Cuál es la parte de matemáticas en español que es el más difícil para ti?	Me: ¿Cuál es la parte de matemáticas en español que es el más difícil para ti? Response: trabajar en libro Me: porque Response: porque necesito explicar y no sé todos las palabras que necesito
¿Cuál es la parte de matemáticas en español que es el más fácil para ti?	Me ¿Cuál es la parte de matemáticas en español que es el más fácil para ti? Response: trabajar con maestra y algunas veces juegos Me: porque para los juegos Response: porque si los juegos y IXL son muy fáciles o divertidos es fácil para explicar

Nombre: estudiante 16 **Fecha: 12 de Mayo de 2015**	
¿Cuándo notas que cambiaste de español a Inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	Me: ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿cuándo te das cuenta? Response: muchos veces Me: ¿Intentas volver a español? ¿pruebas cambiar a español? ¿tu intentas cambiar de ingles a español? Response: sí Me: ¿Qué debes hacer cuando te das cuenta que has cambiado? De español a inglés Response: que um no sé solo sabía que estoy hablando ingles Me: ¿que debes hacer?

	Response: cambiar a español
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	Me: ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés? Response: yo trato en español pero muchos veces yo no sabe muchos palabras español de matemáticas
¿Por qué prefiere ese idioma?	Me: ¿Por qué prefiere ese idioma? Response: porque tiene mas sentido cuando hablo Me: puedes darme un ejemplo Response: cuando yo no sé una palabra en español usualmente cambio como español a inglés en una oración y no tiene sentido
¿Cuál es la parte de matemáticas en español que es el más difícil para ti?	Me: ¿Cuál es la parte de matemáticas en español que es el más difícil para ti? Response: geometría porque yo hay muchas grandes palabras que yo sé en inglés pero no en español
¿Cuál es la parte de matemáticas en español que es el más fácil para ti?	Me ¿Cuál es la parte de matemáticas en español que es el más fácil para ti? Response: multiplicación porque no hay muchas palabras
¿Cuál es tu clase favorita en la escuela?	Me:¿Cuál es tu clase favorita en la escuela? Response: gimnasio o mate ME: porque piensas Response: porque yo soy active y matemáticas yo pienso que yo soy bueno en matemáticas y no es boring

Nombre: estudiante 17 **Fecha: 12 de Mayo de 2015**	
¿Cuándo notas que cambiaste de español a inglés en las matemáticas? ¿Intentas volver a español? ¿Qué debes hacer cuando te das cuenta que has cambiado?	Me: ¿Cuándo notas que cambiaste de español a inglés en las matemáticas? Response: um hmm cuando en cuarto grado? O? todo? Me: en las matemáticas Response: en como el medio del tercer grado Me: especialmente en mate, porque ejemplo Me: ¿Intentas volver a español? Response: no Me: ¿por qué piensas? Response: porque me gusta hablar inglés Me: ¿Qué debes hacer cuando te das cuenta que has cambiado? Response: cambiar a español
¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés?	Me: ¿Cuando un amigo te pide que les ayuden a comprender un problema de matemáticas, al igual que el área de un rectángulo, que prefieres utilizar a la hora de hablar de tu amigo, el español o el inglés? Response: inglés
¿Por qué prefiere ese idioma?	Me: ¿Por qué prefiere ese idioma? Response: porque es mi idioma que uso todo el día
¿Cuál es la parte de	Me: ¿Cuál es la parte de matemáticas en español que es el más difícil

matemáticas en español que es el más difícil para ti?	para ti? Response: el vocabulario de español
¿Cuál es la parte de matemáticas en español que es el más fácil para ti?	Me ¿Cuál es la parte de matemáticas en español que es el más fácil para ti? Response: el haciendo el um como multiplicación Me: cual parte de la multiplicación Response: solo cuando estoy multiplicando estoy diciendo um los números en español a mi mismo
¿Cuál es tu clase favorita en la escuela?	Me:¿Cuál es tu clase favorita en la escuela? Response: matemáticas Me: entonces, matemáticas es tu favorita, si fuera en inglés sería mejor Response: sí