

The Relationship Between English Language Literacy and  
ELL Student Academic Performance in Mathematics

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A Special Project

Presented to

Dr. Peter Dallas Finch

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FACULTY APPROVAL

The Relationship Between English Language Literacy and  
ELL Student Academic Performance in Mathematics

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## ABSTRACT

This quantitative study used regression analysis to investigate the correlation of limited language proficiency and the performance of English Language Learner (ELL) students on two commonly used math assessments, namely the Smarter Balanced Assessment Consortium (SBAC) and the Measures of Academic Progress (MAP). Scores were analyzed for eighth grade ELL students (N = 30) from a rural farming community in Central Washington State. The Washington English Language Proficiency Assessment (WELPA) was used as the independent variable for reading, writing, listening, and speaking. The study found a strong correlation between reading and writing and student math scores, and, a correlation of lesser magnitude between student abilities in listening and speaking and their performance on the math assessments. All findings were statistically significant ( $t\text{-test} < .05$ ). Results from the study strongly suggest that the achievement gap within our schools today needs to be analyzed and evaluated with the importance of literacy and its impact on all content areas. The results of this study should be used to encourage every educator to recognize the importance of language acquisition strategies for English Language Learners so that students can maximize their potential and successfully transition to their next level of learning.

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## CHAPTER 1

### Introduction

#### Background for the Project

MAP, SBAC, and ELPA21 are just a few standardized state tests that the Walker School District students must take, including ELL students, in the academic year (Walker is a pseudonym). The MAP test is given three times a year: Fall, Winter, and Spring. The ELPA21 is given once a year to ELL students in the Spring, and the SBAC is given once a year to all students in the Spring as well. These tests provide educators with scores that allow them to analyze student academic growth and determine academic and language proficiency levels.

In the Walker School District students are prepped for each of these tests in the classroom prior to the test dates. The MAP preparation is usually two weeks long and encompasses review material for both Math and Language Arts. The SBAC prep is usually two weeks long, and the ELPA prep is usually 3-4 weeks long. Taking a closer look at the prep time as well as the actual testing time, it is calculated that preparation for these tests is approximately 10 weeks, while the actual test time is approximately 2 weeks. This shows that out of a 180 day school year, the students are either test prepping or test taking, approximately 60 days in this school district. These mandated tests limit the amount of classroom instruction time for students.

With class instruction limited and these tests given in English, ELL students face many challenges. ELL students are mandated to take these standardized tests regardless of their English language proficiency level. The idea or belief that ELL students have the ability to adapt and perform in ways that native English speaking students can do is not realistic based on the research regarding language acquisition. The student performance on these assessments does not truly reflect the achievement/academic level of the ELL students.

ELL students who have not developed proficient language skills in math, language, reading and science could be struggling with these high stakes tests, and the gap could be due to lack of language skills and academic vocabulary. Standardized test scores in mathematics, and other content areas, are predominantly lower in non English speaking students than in native speakers (OSPI, 2016). The researcher speculates this is due to the lack of academic language and vocabulary comprehension in non-English speaking students in mathematics.

### Statement of the Problem

ELL students who have not developed academic language are performing at lower levels in mathematics. According to the OSPI, in 2015-2016, approximately 6% of 6<sup>th</sup> grade Limited English students met the state standard on the Math SBAC, 6.4% of 7<sup>th</sup> grade Limited English students, and less than 5% of 8<sup>th</sup> grade Limited English students met the state standard for Math. Limited English students are those who do not meet the proficiency standard on the state placement test for the Transitional Bilingual Instructional Program.

The researcher predicted that academic performance in math is affected by the lack of mathematical English academic knowledge in ELL students. The null of the hypothesis is that non-English speaking abilities or lack of speaking abilities have no bearing in mathematical practices on math tests administered in English. The researcher will examine the connection between English Language Literacy and the ability of ELL students to demonstrate their knowledge of mathematical concepts on standardized math assessments. Data were collected by examining student WELPA data, MAP data and SBAC data of the selected participants. The participants consisted of middle school ELL (Limited English) math students. These students were selected according to performance test scores associated with mathematics and language. Data were collected through tests, observations, interviews and collaboration with colleagues.

### Purpose of the Project

The purpose of this project was to explore the relationship between English Language Literacy and math performance in ELL students. The researcher examined the relationship between English language literacy and mathematical scores on state standard performance assessments. The researcher predicted that there is a disconnect for ELL students between verbalization and comprehension of English vocabulary and language and mathematical understanding on math tests administered in English.

### Delimitations

Students involved in this project were limited English speaking with minimal academic language exposure due to numerous factors (relocation, exposure), and students that were assessed on the WELPA, MAP and the SBAC.

The district where the research took place was a rural farming community in Washington state. OSPI reported that the district demographics in the 2015-2016 academic year were 95% Hispanic, 61% transitional bilingual, 23% migrant, and 68.5% free and reduced meals. The school where the study took place was labeled as a high poverty school (OSPI, 2016).

### Limitations

The researcher was unable to control the academic levels of the students selected as well as the English language proficiency level. The students were selected randomly from an 8<sup>th</sup> grade math class from the middle school. Each student within the focus group was given the same three state assessments (WELPA, MAP, and SBAC).

Another limitation is that the study was solely quantitative. Qualitative data would have provided additional information to illustrate student experience at the school.

### Assumptions

The researcher assumed the MAP, SBAC and the WELPA state standard based assessments are reliable and valid. The researcher is a highly qualified middle school mathematics teacher and has completed the ELL endorsement instruction course through Heritage University.

### Hypothesis or Research Question

English Language Learner Middle School students' academic performance in Math is affected by limited English Language Literacy.

### Null Hypothesis

Language challenges for non-English speaking students do not affect math test performance scores. There is no connection between poor testing performance and non English speaking students' abilities in mathematical practices.

### Significance of the Project

The researcher was looking to improve the tools and practices in her classroom to achieve student proficiency in academic language. The researcher wants to support ELL students with appropriate grade level academic language development. ELL students will benefit from this by grasping a better understanding of academic language and will be more prepared for rigorous state tests that require the use of academic language.

### Procedure

Data were collected using Spring Math SBAC assessment results, Spring MAP assessment results, and Spring WELPA results from 2015. The participants consisted of middle school ELL/math students. The data were gathered by investigating the assessment

scores and correlating the scores using a scale score and a scatterplot representation. The participants were students who were enrolled in the Walker School District in the 2016/2017 school year and were enrolled in the bilingual program. All students were considered Limited English students and had taken the SBAC, MAP, and the WELPA assessments in Spring 2015.

The researcher looked at the many disadvantages that ELL students face. Poverty, district demographics, student exposure to math education, and student relocation/migrant status have been studied and shown to affect academic achievement in ELL students. Poverty offers constraints on children's lives and affects learning and academic achievement. Poverty affects intervening factors that in turn affect achievement success for students. These factors include student health, literacy and language development, access to physical and material resources, and level of mobility including migrant relocation (Duncan & Brooks, 1997).

The data were collected, interpreted and presented on a scale level. The researcher was able to analyze a scale score from both assessments and determine the correlation. From the data collected the researcher was able to conclude whether or not the hypothesis presented was valid.

### Acronyms

BICS: Basic Interpersonal Communicative Skills

CALP: Cognitive Academic Language Proficiency

ELA: English Language Acquisition

ELL: English Language Learner

ELPA21: English Language Proficiency Assessment for the 21<sup>st</sup> Century

MAP: Measures of Academic Progress

MSP: Measurements of Student Progress

SBAC: Smarter Balance Assessment Consortium

SIOP: Sheltered Instruction Observation Protocol

WELPA: Washington English Language Proficiency

## CHAPTER 2

### Review of Selected Literature

#### Introduction

English Language Learners are one of the fastest growing populations in our schools today (Van Roekel, 2008). By 2030, the ELL population is expected to account for approximately 40 percent of the school-aged children in the United States (Roseberry-McKibbin & Brice, 2000). Given the overwhelming number of students who do not natively speak English, the federal and state governments, as well as local school districts are left to determine how best to serve these children in our classrooms. With the number of ELL students increasing, and our standardized assessments becoming more rigorous, these students are struggling to reach the state academic requirements (OSPI, 2016). Based on evidence that limited English language proficiency students exhibit difficulties with academic achievement, it is important to find adequate assessments that will represent their academic performance accurately.

Today's state assessments all employ language to measure student success. Students need the appropriate language skills to read the tests and respond to questions. Consequently, all the test scores include variance because of the various levels of language ability of students. Language ability is not the construct under examination in content area assessments but is confounded with the students' performances on these tests. The achievement gap between English Language Learners and native English speakers is a concern and believed to be a direct reflection of limited language proficiency.

The researcher outlined specific standardized test assessments, the challenges that ELL students' faced in the classroom, and the performance gap in meeting state math requirements.

## Standardized Assessments

Each year Washington state requires students to take several standardized tests to assess their progress. States tests include: Smarter Balanced English Language Arts (ELA) and Math, Measurements of Student Progress (MSP) Science test for Grades 5 and 8, and End of Course exams (EOC) Math and Biology tests as student's finish Algebra I, Geometry and Biology. Grades 3 through 8 take the Smarter Balance in both Math and ELA and, Grades 5 and 8 take the Science MSP (OSPI, 2016). These tests are required to be given annually for federal accountability.

The Smarter Balanced Assessment interim tests provide students with a preview of test questions aligned to academic standards for Grades 3–8 and high school (11<sup>th</sup> grade) in both English Language Arts (ELA) and Math. The Smarter Balanced assessment system claims to be a valid, fair, and reliable approach to assessing students, while providing educators, students and parents meaningful results. The assessment is aligned to the Common Core (OSPI, 2016).

Measurements of Students Progress (MSP) is a science assessment that is given in Grades 5 and 8. This test is used to assess students on the current Washington State Science standards (OSPI, 2016).

End-of-Course (EOC) exams in Math and Biology allow students in grades 9-12 to be tested on the knowledge and skills they have gained from taking specific courses. These tests different from tests like Smarter Balanced, which are comprehensive and assess overall content-area knowledge. EOC's which are specific to a course, are administered in the last three weeks of the course semester. Each school determines its own testing schedule (OSPI, 2016).

Another assessment that can be given, but is not required by the state of Washington, is the Measures of Academic Progress (MAP). MAP creates a personalized assessment experience

by adapting to each student's learning level. The assessment data provides essential information about what each student knows and is ready to learn (OSPI, 2016).

Another state mandated test for ELL students is the English Language Proficiency Assessment (ELPA21), an online English language learning assessment. This test is used to determine a student's eligibility for language development services. The ELPA21 annually assesses growth in English language development by the state's English language learners. This assessment tests reading, writing, listening and speaking knowledge and skills (OSPI, 2016). In Spring of 2016 the ELPA21 replaced the WELPA (Washington English Language Proficiency Assessment).

All of these tests have high English language demands and have shown to be extremely difficult for ELL students. These tests are written and administered only in English, and tend to leave ELL students at a disadvantage. How reliable and accurate can these test results be for English Language Learners? How can school funding, graduation, and educational data be interpreted accurately when these assessments may not reflect the true academic achievement of our ELL students? A study done by Jamal Abedi (2002), indicated that student assessment results might be confounded by their language background variables. ELL students generally perform lower than non-ELL students on reading, science, and math, because of the confounding issue of language in content knowledge assessments. This is a strong indication of the impact of English language proficiency on assessments. Moreover, the level of impact of language proficiency on assessments of ELL students is greater in the content areas with higher language demands (Abedi, 2002).

The validity and reliability of these assessments present complications when measuring academic knowledge and skill of ELL students. These tests may reflect the English language

proficiency of our ELL students, but due to linguistic difficulty, academic knowledge maybe inaccurately reflected (Menken, 2000). There is also great variance as to the level of each individual ELL student state to state; this affects data collection and the ability to accurately analyze our ELL population. Goh (2004) summarized four possible accommodations for ELLs, including setting modifications, timing and scheduling modifications, presenting modifications and responding to modifications. The gap between the academic achievement of ELLs and non-ELL's can be traced to both the learning process and the assessment process. Accommodations in the testing procedure is not enough to eliminate irrelevant factors in assessment (Menken, 2000).

#### Academic and Language Challenges English Language Learners Face in School

Acquiring academic language for ELL students can be very difficult. ELL students come from very different backgrounds and often face multiple challenges in and out of the classroom. ELL students face many disadvantages that include poverty, migrant status/mobility, family dynamics, lack of education of others in the home, age level, and years retained. The academic needs for these students is a constant challenge in the classroom. A very large majority of ELL students struggle each year to meet the academic standards for Math and English (OSPI 2016).

Our education system strives to close the achievement gap for ELL students, but with the regulations and laws behind the No Child Left Behind Act (NCLB) the gap continued to grow. The No Child Left Behind Act, signed into law by President George W. Bush in 2002, presented a “sweeping change” of the federal government’s role in education by asking America’s schools to describe their success in terms of what each student accomplishes (U.S. Department of Education, 2003). This law mandated schools to track the progress of students by annually measuring academic achievement. The NCLB proposed that ELL students should reach

academic achievement expectations just as all other students, but the law itself overlooked those that lack language proficiency (Van Roekel, 2008). ELL students were expected to meet the state proficiency level in both Mathematics and Language Arts before they were even proficient in the English language.

Lydia Breiseth (2010) states that many students have trouble mastering the kinds of language needed to succeed in school, especially if they have never been taught how to use it. She concludes that there are many differences between academic language and social language for ELL students. The “social” language is the language that ELL students communicate with and typically achieve proficiency in using; however, the use of academic language and its complexity is rarely mastered.

Research indicates that it takes four to twelve years of second language development for most advantaged students to reach a level of academic proficiency in which they can compete with native speakers (Collier, 1995). The language struggles and difficulties often make it extremely challenging for those students to be successful in achieving academic success. Wayne Wright (2006), an assistant professor of bicultural-bilingual studies at University of Texas, stated the struggles are not just in English language proficiency; ELL students need substantial English language skills to comprehend many math tests. Studies suggest that it takes five to seven years, not one, for students to become proficient enough in academic English to understand assessment questions. Students need substantial English language skill to comprehend math tests. The high educational risk for ELLs has been noticed and documented by different sources. ELL students score lower than mainstream students on national assessments in reading, math, and science (Kieffer et al., 2009) and ELL students have lower academic achievement and higher drop out

rates than native English speaking students (Center for Language Minority Education and Research, 1996).

With ELL students being put at a disadvantage, Breiseth (2010) states that many educators have never learned how to teach academic language since language has traditionally been considered the domain of ESL or English Language Arts (ELA) teachers. Providing correct instruction for our ELL students with incorporating academic vocabulary and allowing that to happen in a classroom, will help ELL students understand not only content, but the English language. ELL students are faced with not only becoming proficient in English but also comprehending academic content. The ability to use and understand academic language in all contents, is important in preparing our ELL students for rigorous college and career ready pathways.

Improving the education of our ELL students could mean that educators need to be focusing on implementing and improving academic language instruction in our content areas. Educators could focus on increasing students' ability to understand concepts, processes, and operations through teaching terminology and its associated academic vocabulary.

The use of CALP (Cognitive Academic Language Proficiency) in a classroom can be helpful in developing language and improving subject area content knowledge. CALP refers to formal academic learning. This includes listening, speaking, reading, and writing about subject area content material. CALP skills such as literacy and vocabulary continue to grow throughout schooling. In this sense and in the context of educational settings, language proficiency leans heavily towards CALP. This level of language learning is essential for students to succeed in school. Students need time and support to become proficient in academic areas. This usually takes from five to seven years (Cummins, 1999). Research has shown that if a child has no prior

schooling or has no support in native language development, it may take seven to ten years for ELL students to catch up to their peers (Thomas & Collier, 1998). CALP can help with meeting the academic needs of ELL students, especially content comprehension and academic language acquisition (Haynes, 2016). Recently the terminology was updated to Academic Language Proficiency (ALP) in current ELL literature and is sometimes referred to as Academic English since English is the language of instruction in the United States system. ALP is now widely accepted to be the key to school success because it is required to understand teacher talk, participate in class, and handle content assessment (Bailey & Butler, 2003). ALP includes all four language domains, namely listening, speaking, reading and writing.

One of the cornerstones of English language literacy acquisition is acquiring academic vocabulary (Beck, McKeown, & Kucan, 2002). ELL students struggle with both language proficiency and academic vocabulary acquisition. Vocabulary development, critical for English language learners, is strongly related to academic achievement (Manzo, Manzo, & Thomas, 2005). A strong academic vocabulary constitutes the foundation for understanding key concepts, which in turn enables students to solve mathematical problems (Molina, 2012). There are several different teaching methods and instructional strategies that have been helpful in the development of language and academic vocabulary for ELL students.

The Sheltered Instruction Observation Protocol (SIOP) method is an approach for teaching ELL students content in strategic ways while promoting English language development. The SIOP method teaches content to students learning English through a developmental language approach. A few of the SIOP techniques are cooperative learning, use of visuals and demonstrations, and targeted vocabulary development. Teachers that use this method in their classrooms make connections between the content being taught and students experiences and

prior knowledge, and they focus on expanding the student's vocabulary base (Echevarria, Vogt, & Short, 2008).

Dr. Robert Marzano shares a six-step process for teaching vocabulary terms so students develop deep understanding of terms. Marzano and Pickering (2005) based their research on the assertion that student achievement on standardized tests will increase when classroom instruction includes a focus on content specific vocabulary. Step One, teacher provides description, explanation, or example of the new term. Step Two, students restate or explain the new word in their own words. Step Three, students construct a picture, symbol, or graphic representation of the word. Step Four, students engage in activities to deepen their knowledge of the new word. Step Five, students discuss the new word, and Step Six, students play games to review new vocabulary. Academic vocabulary, specifically the language that may occur in multiple contexts or the precise words that are presented in a specific context, can help students acquire new learning strategies and skills.

According to Beck, McKeown, and Kucan's Three Tier Model (2002), the distinction between academic vocabulary words and content specific words has a significant bearing on the language success of English language learners. The Three Tier Model places vocabulary in three categories: Tier 1 which consists of basic or common words, Tier 2 which involves words that are used across the curriculum and multiple meaning words, and Tier 3 words are content specific. When teaching academic vocabulary, it is important to use effective strategies that will engage students in learning new words. Some of the strategies that can be used with the Three Tier Model are repetition, signal word, vocabulary journals, graphic organizers, and games.

These instructional strategies and research based models have shown to be great resources for teachers of English Language Learners. Explicit instruction through a variety of

approaches and activities provides English Language Learners with multiple changes to learn, practice and apply academic language (Zwiers, 2008).

### Examining Math Scores in Relation to Language Proficiency

The proposal that English proficiency impacts English language learner performances on mathematics assessments has been analyzed and investigated (Henry, Nistor, & Baltes, 2014). Analysis has revealed English proficiency as a statistically significant predictor of mathematics scores. Mathematics scores increase simultaneously with English proficiency but inversely with grade level. Grade level moderates the influence of English proficiency on mathematics scores.

The National Assessment of Educational Progress (NAEP) measures student performance at 4<sup>th</sup> and 8<sup>th</sup> grade in mathematics. In 1996, 2000, 2003, 2005, and 2007 Mathematics Assessments, an average of 92 percent of ELLs scored below *proficient* on the fourth-grade test compared to 68 percent of non-ELLs. (U.S. Department of Education, 2007). In 2011, the NAEP reported that 42 percent of grade 4 ELLs nation wide had failed the mathematics assessment compared to 15 percent of Grade 4 non ELLs (National Center for Educational Statistics, 2011). In 2013 and 2015, the NAEP reported a significant gap between non ELL students and ELL students. In 2013, 8<sup>th</sup> grade ELL students scored 246 and 246 in 2015 on the Mathematics assessment (test scores range from 0-500). Non ELL 8<sup>th</sup> grade students scored 287 in 2013 and 284 in 2015 on the math assessment (NAEP, 2015). These results represent an estimate of overall performance of students in our nation. These results show a national gap in the comparison of scores between ELL students and non-ELL students.

The Washington state report card reported ELL student scores were significantly lower on the state SBAC assessment than non-ELL students. In 2014-2015, 5514 8<sup>th</sup> grade students took the test, data showed that 11.7% of Limited English students passed or met standard, and

88.2% were below. In 2015-2016, 5334 students took this test, and data showed very similar results, 11.6% met standard, and 88.6% were below. In 2014-15, 46% of non-ELL 8<sup>th</sup> grade student took the test and met standard. In 2015-16, 47.8 % passed or met standard. (OSPI, 2016)

In Utah, ELL students did poorly on the required school proficiency exam (Haren, Holliday & Sharif, 2009). The study consisted of 22 students, ages 14-18. Ten students were from Africa, four were from Asia, and eight were from Spanish speaking countries. The study concluded that numbers and symbols are more easily understood than solving word problems. Visual examples are a great aid for conceptualization. Group collaboration and translation helps with vocabulary comprehension. And it is not a students' level of mathematical comprehension that matters, but their level of English acquisition.

Grant and Cook (2010) examined the relationship between language proficiency and mathematics achievement. Their study investigated two groups, grades 3-5 and grades 6-8. Their hypothesis was: "There are structural linear relationships between EL's proficiency in the academic languages of mathematics, science, language arts and social studies, and social and instructional language and their achievement on one's state mathematics test" (Grant & Cook, 2010, p.3). Grant and Cook chose to have students participate in an ACCESS assessment two times. This test measures EL proficiency standards and the state's four mathematics measures: number and operations, functions and algebra, geometry and measurement, and data, statistics and probability. Their findings concluded that success in mathematics is influenced by English language proficiency. Receptive skills directly influence mathematics achievements, writing and speaking play a role in mathematics achievement, and writing skills are closely related to mathematics achievement. This study confirmed that academic language proficiency influences mathematical achievement.

## Summary

With our standardized testing becoming more rigorous, the academic achievement gap is increasing and our ELL population is faced with difficulties reaching the state standards. The research presented in this chapter illustrated several studies and relevant evidence that supported the educational needs for English Language Learners.

Standardized assessments are an extreme challenge to ELL students. These tests not only challenge their content knowledge, but, also, their language proficiency. The assessments that were discussed in this chapter are known to have high English language demands which are extremely difficult for ELL students. These tests are all written and administered in English with little to no accommodations, and leave ELL students at a disadvantage. Standardized testing is only one of the many obstacles that ELL students face. Language proficiency affects content knowledge learning and assessment especially for ELL students. Regular standardized tests fail to take students' language proficiency into consideration; it is questionable whether these assessments represent the true academic knowledge of ELL students.

The every-day challenges of these students can play a factor in their learning abilities. Poverty is a huge factor that has been proven to play a role in lower achievement scores, along with students of color, students of disabilities, and students with limited English proficiency. Students come from all different backgrounds and face multiple challenges in and out of the classroom. The academic achievement gap for ELL students continues to grow. With the high language demands, these students are expected to meet state proficiency levels in both math and science. Research shows that teaching and providing correct instruction for our ELL students by incorporating academic vocabulary will help the students understand content and improve English language literacy.

The relationship between math performance and English language proficiency proved through the research presented to hold true. The studies indicated that English language acquisition and academic language play a role in assessment performance. The research showed significant importance to the instruction of academic language and the role it plays in the development of language acquisition and comprehension. Research not only shows the gap between ELL and non-ELLs, but also shows the relationship between language and math and the impact of language on state assessments. Research also showed that academic language proficiency influences mathematical achievement and also influences proficiency in academic languages in other content areas.

Educators need to be committed to improving the education of ELL students and collaborate on strategies to enhance academic language and increase student success. Classroom instruction should integrate academic content vocabulary in order to support language development and increase students' language proficiency. Educators need to provide guidance and instruction that will support both content based vocabulary and academic language.

## CHAPTER 3

### Methodology and Treatment of Data

#### Introduction

The researcher examined the relationship between English Language Learners language challenges and the outcome of their standardized test scores for mathematics. The researcher examined the relationship between academic performance and mathematic academic knowledge.

#### Methodology

The research method used was Correlational. Correlational research involves collecting data to determine whether, and to what degree, a relationship exists between two or more quantifiable variables. This research method was used by the researcher to determine whether and to what degree the WELPA test results, the MAPS test results, and the SBAC test results were related. The researcher used the Relation Type to see how the test results influence one another. The researcher collected data to determine if two or more variables were related. The study included 30 participants. The outcome of this study will allow the researcher to determine a relationship between student language or lack of language, and student understanding/ comprehension of mathematical practices on standardized tests.

#### Participants

The students chosen to participate were eighth grade middle school students. These 30 students were Hispanic ELL students who had not passed the WELPA assessment. The participants had scored a 2 or below on the WELPA and were below grade level on the MAP and SBAC state assessments.

## Instruments

The researcher used three particular state required tests that are administered in the school district yearly. The WELPA test was given annually, the SBAC was given once a year, and the MAP test was given three times a year (Fall, Winter, Spring).

The WELPA is known as the Washington English Language Proficiency Assessment. This test is a criterion-referenced and performance-based English test. It assesses both the receptive and productive language skills in contexts relevant to academic studies at tertiary level. The test assesses growth in English language development and assesses students in reading, writing, listening and speaking knowledge and skills.

The MAP test is known as the Measure of Academic Progress. This test is a computer adaptive interim assessment. Recommended usage is 3-4 times a year. The MAP is untimed. This test is used to inform instruction using valid, reliable and real-time data. It measures the growth of every student over time regardless of on, above, or below grade level performance, creates and reinforces evidence-informed instructional practices, evaluates and identifies professional development needs, and compares and predicts student achievement over time via exclusive normative and growth information.

The Smarter Balance Assessment Consortium (SBAC) is an assessment system that is aligned with the Common Core State Standards. The Smarter Balanced assessment system covers the full range of college- and career-ready knowledge and skills. The SBAC math assessment focuses on four claims: Concepts and Procedures, Problem Solving, Communicating Reasoning, and Modeling and Data Analysis. The overall claim for grades 3-8 is students can demonstrate progress toward college and career readiness in mathematics.

The researcher used test scores to determine the correlation between the three assessments and draw a conclusion from the data collected. The researcher hoped to validate the hypothesis that test performance is affected by the lack of English Language Literacy.

### Design

The researcher examined WELPA test scores, the MAP test scores, and the SBAC scores of Spring 2015. The researcher used these tests to determine a relationship/non-relationship between the scores. The researcher ran regression on the data and to identify a correlation coefficient and t-test for statistical significance.

### Treatment of the Data

The researcher analyzed the overall WELPA Spring 2015, SBAC Spring 2015, and MAP Spring 2015. The researcher analyzed overall WELPA as well as sub-test scores. The researcher used simple regression and correlational analyses.

### Summary

The relationship between English Language Learners language challenges and the outcome of their standardized test scores for mathematics were examined and researched using Correlational analysis. The research involved collecting data to determine whether, and to what degree, a relationship existed between two or more quantifiable variables. The research was conducted using the SBAC, MAP and WELPA state assessments. The researcher used these tests and determined the correlation between the three assessments. The participants for this study were 8<sup>th</sup> grade middle school math students who have not passed the WELPA assessment. All data were collected and analyzed by the researcher and the relationship was determined by the use of simple regression and correlational analyses.

## CHAPTER 4

### Analysis of the Data

#### Introduction

This chapter presents the findings and evaluation data analysis related to the research study. The analysis demonstrated a positive correlation between language proficiency and math achievement in ELL students. The researcher presents the magnitude of correlation between language proficiency and its student's academic performance in this chapter.

#### Description of the Environment

Students involved in this project were limited English speaking with minimal academic language exposure due to numerous factors (relocation, exposure), and students that were assessed on the WELPA, MAP and the SBAC.

The district where the research took place was a rural farming community. OSPI reported that the district demographics in the 2015-2016 academic year were 95% Hispanic, 61% transitional bilingual, 23% migrant, and 68.5% free and reduced meals. The school where the study took place was labeled as a high poverty school (OSPI, 2016).

#### Hypothesis/Research Question

English Language Learner Middle School students' academic performance in Math is affected by limited English Language Literacy.

#### Null Hypothesis

Language challenges for non-English speaking students do not affect math test performance scores. There is no connection between poor testing performance and non English speaking students' abilities in mathematical practices.

## Results of the Study

The results of the study demonstrated that language proficiency does correlate to math performance. The literacy score in the findings is expressed as the independent variable and the mathematics assessment score is the dependable variable. The researcher found that the hypothesis is truthful in that math achievement is dependent on literacy skills.

The researcher chose to use Regression to show the relationship between English language proficiency and mathematic assessment performance. Regression is a process for examining the relationship between independent and dependent variables and the relationships associated with the two variables. Regression is also used to determine a casual analysis, forecast a relationship between two variables, and examine a trend. Regression can be used to identify how the strength of independent variable might effect the dependent variable.

The correlation coefficient is a number between -1 and +1 that represents a relationship between two variables. In this study the researcher determined the correlation coefficient for the regression and was able to determine the correlation. The closer the coefficient correlation is to zero the lower the correlations and the closer it is to one the higher the positive (direct) correlation.

The data that was collected in this study showed a higher correlation between reading, writing and math performance levels on both the SBAC and the MAP assessments. In reading the coefficient correlation was a .48 on the MAP assessment and a .53 on the SBAC. In writing the coefficient correlation was a .56 on the MAP and a .58 on the SBAC. This data provides the information that concludes the hypothesis in that language proficiency, especially in the area of reading and writing is predictive of math performance on state standardized tests for ELL students.

The researcher presents the following tables to show the direct positive correlation between English language proficiency and mathematic assessment performance. The first grouping of tables presented illustrate the MAP assessment in correlation to the WELPA results. The second set of tables presents the SBAC assessment in correlation to the WELPA results.

The tables report three significant values: First, the correlation coefficient, this value should be less than 1 or closest to zero. The correlation coefficient signifies the the relationship between the two variables. Second, the t-test (probability) which should be less than 0.5. This value indicates the percentage in which your findings are true or false. Third, the R-Squared Value, this value explains the variability of the response. 0% indicates that the model explains none of the variability of the response data around its mean, and 100% indicates that the model explains all of the variability of the response data around its mean.

Table 1

*MAP Math Vs. WELPA Composite assessment results.*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	MAP_Math	Rows Processed	36
Independent Variable	WELPA_Composite	Rows Used in Estimation	36
Slope	0.1924	Sum of Frequencies	36
R-Squared	0.3179	Sum of Weights	36.0000
Correlation	0.5639	Coefficient of Variation	0.0515
T-Test	0.0003		

Table 2

*MAP Math Vs. WELPA Reading assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	MAP_Math	Rows Processed	36
Independent Variable	WELPA_Reading	Rows Used in Estimation	36
Slope	0.1875	Sum of Frequencies	36
R-Squared	0.2380	Sum of Weights	36.0000
Correlation	0.4878	Coefficient of Variation	0.0544
T-Test	0.0025		

Table 3

*MAP Math Vs. WELPA Writing assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	MAP_Math	Rows Processed	36
Independent Variable	WELPA_Writing	Rows Used in Estimation	36
Slope	0.1231	Sum of Frequencies	36
R-Squared	0.3242	Sum of Weights	36.0000
Correlation	0.5694	Coefficient of Variation	0.0512
T-Test	0.003		

Table 4

*MAP Math Vs. WELPA Speaking assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	MAP_Math	Rows Processed	36
Independent Variable	WELPA_Speaking	Rows Used in Estimation	36
Slope	0.0944	Sum of Frequencies	36
R-Squared	0.0984	Sum of Weights	36.0000
Correlation	0.3138	Coefficient of Variation	0.0592
T-Test	0.0624		

Table 5

*MAP Math Vs. WELPA Listening assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	MAP_Math	Rows Processed	36
Independent Variable	WELPA_Listening	Rows Used in Estimation	36
Slope	0.0958	Sum of Frequencies	36
R-Squared	0.1692	Sum of Weights	36.0000
Correlation	0.4114	Coefficient of Variation	0.0568
T-Test	0.0127		

The following tables listed below reflect the results of the SBAC in comparison to the WELPA assessment.

Table 6

*SBAC Math Vs. WELPA Composite assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	SBAC_Math	Rows Processed	36
Independent Variable	WELPA_Composite	Rows Used in Estimation	36
Slope	0.8766	Sum of Frequencies	36
R-Squared	0.2606	Sum of Weights	36.0000
Correlation	0.5105	Coefficient of Variation	0.0232
T-Test	0.0015		

Table 7

*SBAC Math Vs. WELPA Reading assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Variable	SBAC_Math	Rows Processed	36
Independent Variable	WELPA_Reading	Rows Used in Estimation	36
Slope	1.0395	Sum of Frequencies	36
R-Squared	0.2888	Sum of Weights	36.0000
Correlation	0.5374	Coefficient of Variation	0.0227
T-Test	0.0007		

Table 8

*SBAC Math Vs. WELPA Writing assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	SBAC_Math	Rows Processed	36
Independent Variable	WELPA_Writing	Rows Used in Estimation	36
Slope	0.6332	Sum of Frequencies	36
R-Squared	0.3388	Sum of Weights	36.0000
Correlation	0.5821	Coefficient of Variation	0.0219
T-Test	0.0002		

Table 9

*SBAC Math Vs. WELPA Speaking assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	SBAC_Math	Rows Processed	36
Independent Variable	WELPA_Speaking	Rows Used in Estimation	36
Slope	0.4434	Sum of Frequencies	36
R-Squared	0.0858	Sum of Weights	36.0000
Correlation	0.2929	Coefficient of Variation	0.0257
T-Test	0.0830		

Table 10

*SBAC Math Vs. WELPA Listening assessment results*

<b>Parameter</b>	<b>Value</b>	<b>Parameter</b>	<b>Value</b>
Dependent Variable	SBAC_Math	Rows Processed	36
Independent Variable	WELPA_Listening	Rows Used in Estimation	36
Slope	0.2759	Sum of Frequencies	36
R-Squared	0.0554	Sum of Weights	36.0000
Correlation	0.2354	Coefficient of Variation	0.0262
T-Test	0.1669		

Table 11

*Correlation Coefficients for WELPA/MAP and WELPA/SBAC*

<b>WELPA</b>	<b>MAP</b>	<b>SBAC</b>
Composite	0.56	0.51
Reading	0.49	0.54
Writing	0.57	0.58
Speaking	0.31	0.29
Listening	0.41	0.24

Findings

The researcher used this project to explore the relationship between English Language Literacy and math performance in ELL students. The researcher examined the relationship between English language literacy and mathematical scores on the SBAC and MAP assessments. The researcher found that there is a difficult challenge for ELL students with reading/comprehension and writing and their ability to understand mathematical concepts on tests administered in English.

The data showed that ELL students score lower on math assessments when they had the lower levels of English language proficiency. The correlation on each aspect of the SBAC and the MAPs assessment clearly note a correlation score of more than zero. The linear regressions results expressed a very high relationship between reading and writing on both the SBAC assessment and the MAP assessment. The Correlation value shows a relationship of .3-.5 when examining reading and writing on the MAP assessment. The Correlation value on the SBAC assessment shows a relationship of approximately .5 in value. The listening and speaking data was found to not be as pertinent. These results show that mathematics instruction and learning should emphasize the importance of English language development for ELL students.

## Discussion

As expected, the data provided evidence that language proficiency is correlated to math achievement. The results show that language proficiency is the key variable that can predict the math achievement gap in ELL students. Regression analysis revealed that language proficiency is predictive of math performance on the MAP and SBAC state assessments.

Some limitations may need to be considered in the research project. The researcher was unable to control the academic levels of the students selected as well as the English language proficiency level. The students were selected randomly from an 8<sup>th</sup> grade math class from the middle school. Each student within the focus group was given the same three state assessments (WELPA, MAP, and SBAC).

Another limitation is that the study was solely quantitative. Qualitative data would have provided additional information to illustrate student experience at the school.

## Summary

The study confirmed that language proficiency is a key variable that can predict the math achievement gaps between ELLs' and Non-ELLs. In addition, regression revealed that language does influence math achievement. There was a strong correlation between reading and writing and student math scores, and, there was a correlation of lesser magnitude between student's abilities in listening and speaking and their performance on the math assessments. The results from the study strongly suggest that the achievement gap within our schools today needs to be analyzed and evaluated with the importance of literacy and its impact on all content areas. The results of this study should be used to encourage every educator to recognize the importance of language acquisition strategies for English Language Learners so that students can maximize their potential and successfully

## CHAPTER 5

### Summary, Conclusions and Recommendations

#### Introduction

The purpose of the research was to examine the relationship between English Language proficiency and mathematic performance on state assessments in ELL middle school students. Regression analysis was used to determine the magnitude of correlation between students literacy skills and their scores on standardized math tests. The relatively large sample size, 36 students, ensured that the results were statistically significant.

#### Summary

The data were gathered by investigating the assessment scores and correlating the scores using a scale score and a scatterplot representation. The participants were students who were enrolled in the Walker School District in the 2016/2017 school year and were enrolled in the bilingual program. All students were considered Limited English students and had taken the SBAC, MAP, and the WELPA assessments in Spring 2015.

The researcher was able to see the comparison between the SBAC and the MAP assessments, and the closeness of the coefficient correlation data. Both the SBAC and the MAP tests showed similar scores in reading and writing, the coefficient correlation was significantly high ranging from .48-.53 in reading and .56-.58 in writing. Thus, the researcher was able to demonstrate that these two skills are correlated to performance on both of these math tests.

The data were collected, interpreted and presented on a scale level and the correlation was presented in the findings. The researcher was able to analyze a scale score from both assessments and a positive correlation was found between language proficiency and mathematic

assessment performance. From the data collected the researcher was able to conclude the hypothesis presented was valid.

### Conclusions

The data collected and analyzed confirmed that there is a correlation between language proficiency and math assessment performance. The regression shown in the display of data demonstrated a strong correlation between math and reading and writing, and a slight correlation between math and listening and speaking.

### Recommendations

Results from the study strongly suggests that the achievement gap within our schools today needs to be analyzed and evaluated with the importance of literacy and its impact on all content areas. The English language learner population in our schools continues to rise. It is crucial for teachers to continue to accommodate and serve linguistically diverse students. The classroom teacher must focus on ways to enhance English acquisition. The use of word walls, academic language/vocabulary focus, contextual lessons/instructional strategies, visuals, and dual language exposure are all strategies that should be part of every educators working knowledge.

Our education system needs to assist educators in making the best instructional decisions for ELL students. The results of this study should be used to encourage every educator to recognize the importance of language acquisition strategies for English language learners, especially reading and writing, so that students can maximize their potential and successfully transition to their next level of learning.

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