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Examining the Relationship Between Math Scores and English Language Proficiency

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Multiple studies propose that English proficiency dictates English language learners' (ELLs) performances on mathematics assessments. The current study investigates the predictive power of English proficiency on mathematics scores, while controlling for gender, socioeconomic status (SES), and grade level among ELLs at a south Florida elementary school. Krashen's theory of comprehensible input as a precursor to second language acquisition provides the framework for this quantitative, correlation study. Mathematics scores from the Florida Comprehensive Assessment Test for Grade 3–5 ELLs ($N = 177$) were analyzed using multiple linear regression. Analysis reveals 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. Gender and SES have no significant moderating influence.

Keywords: *English language learner, ELL, English proficiency, math assessments, math scores*

Introduction

Children of immigrants accounted for 23% of all U.S. children in 2010 (Tienda & Haskins, 2011) and the largest growing population segment in U.S. public schools regardless of the language spoken (Fortuny & Chaudry, 2011). Many non-English-speaking immigrant parents entering the United States with limited knowledge of the English language and culture remained in the United States to work and raise families (Gandara & Rumberger, 2009). Over the years, the percentage of non-English-speaking students in classrooms increased exponentially (Gandara & Rumberger, 2009), and public schools quickly became more culturally diverse as students who spoke a language other than English increased. Consequently, an estimated 11.2 million English language learners (ELLs) were registered in public schools for the 2008–2009 school year, representing 21% of the total public school student enrollment in the United States at that time (Department of Education, 2011; Census Bureau, 2010).

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Problem Statement

In 2011, the National Assessment of Educational Progress (NAEP) disclosed that 42% of Grade 4 ELLs nationwide had failed the mathematics assessment compared to 15% of Grade 4 non-ELLs (National Center for Educational Statistics, 2011). These scores were representative of Florida, where 42% of Grade 4 ELLs failed the NAEP assessment compared to 14% of Grade 4 non-ELLs. Attributing ELLs' underachievement in mathematics to any one factor is difficult, as numerous studies have associated multiple factors to low scores. For example, students' mathematics anxiety (Geist, 2010), teacher mathematics anxiety (Beilock, Gunderson, Ramirez, & Levine, 2009), attention deficit hypersensitivity disorder (Hart et al., 2010), and gender (Lindberg, Hyde, Petersen, & Linn, 2011) influenced low mathematics scores. Additional studies suggested that socioeconomic status (SES; Hoff & Tian, 2005; Krashen & Brown, 2005), native language (Callahan, Wilkinson, & Muller, 2010), and time immersed in second language acquisition (Dekeyser, Alfi-Shabtay, & Ravid, 2010) also restricted the rate of second language acquisition and the proficiency required for effective mathematics achievement. Martiniello (2008) explained that mathematics assessments presume that a student's test score accurately reflected mastery of the mathematical content. However, ELLs might have achieved a low score on a mathematics assessment because they did not understand the wording of questions. Therefore, were ensuing low mathematics scores due to a lack of content mastery, limited English proficiency, or both? Researchers (Beal, Adams, & Cohen, 2010; Kieffer, Lesaux, Rivera, & Francis, 2009) have observed relationships between English language proficiency and mathematics achievement, with Carrasquillo, Kucer, and Abrams (2004) asserting that ELLs require increasing literacy demands as they advanced in grade level. As classroom instruction and texts changed, literacy abilities that were functional in the primary grades abruptly became inadequate. Carrasquillo et al. (2004) observed further that texts became longer to read and consumed more time, thereby increasing the difficulty for ELLs already struggling with reading. Textbooks in the higher grades eventually became the primary means for teaching and learning, shifting the focus from learning to read to reading to learn.

Florida Comprehensive Assessment Test (FCAT) demographic reports revealed that mathematics proficiency scores for two cohorts of ELLs at a south Florida school declined over three successive annual assessments. Table 1 shows the percentage of mathematics proficiency for two cohorts of ELLs at the school, the district, and the state levels.

Table 1: *ELLs Achieving Mathematics Proficiency for Cohorts A and B*

Year	Grade	School	District	State
Cohort A				
2007	3	43	48	52
2008	4	20	39	45
2009	5	10	27	27
Cohort B				
2008	3	51	51	55
2009	4	48	47	31
2010	5	32	32	32

Note. ELLs = English language learners. School, district, and state data represent percentages. Adapted from "Student Performance Reports: School Math Demographic Report," Florida Department of Education. Retrieved from https://app1.fldoe.org/FCATDemographics

This study investigates the predictive power of English proficiency on mathematics scores for ELLs and how well SES, gender, and grade level moderate the influence of English proficiency on mathematics scores.

Theoretical Background

Krashen (1981) theorized the relationship between second language acquisition and the academic achievement of language learners. Krashen's theory of comprehensible input as a precursor to second language acquisition formed the framework for this quantitative correlational study. Krashen explained that individuals acquired a second language in a predictable sequence by receiving logical input under conditions of high self-confidence, self-esteem, and motivation. Low self-confidence, self-esteem, and motivation were inclined to create mental blocks that prevented individuals from processing comprehensible input to acquire language. According to Krashen, camaraderie promoted conditions of high self-confidence, self-esteem, and motivation. Students mastered language acquisition while interacting verbally with other students whose camaraderie they appreciated (Krashen, 1981). Krashen noted that language acquisition and language learning were completely different concepts regarding ELLs. He argued that learning occurred when teachers instructed and assessed, whereas acquisition occurred when ELLs became proficient without realizing they were achieving proficiency. In other words, ELLs acquiring a language would speak or write correctly without consciously considering grammatical rules. Rather, the process occurred naturally and without a burden. Language learning, conversely, was a conscious effort of learning rules associated with a new language. Therefore, high levels of language proficiency could not occur without comprehensible input (Krashen, 1981).

English Language Proficiency

Administering assessments written in English to students currently learning English complicates the learning experience for those students because of their weak English proficiency skills (Abedi & Herman, 2010; Solórzano, 2008). Such challenges to learning validated Cummins' (1979) assertion that ELLs require 5 to 7 years to master the requisite language proficiency skills for performing effectively on academic assessments. Other studies have suggested a relationship between English language proficiency and mathematics performance (Beal et al., 2010; Brown, Cady, & Lubinski, 2011; Kieffer et al., 2009). In 2009, 87% of children of immigrants were born in the United States (Fortuny & Chaudry, 2009) and 11% of those children enrolled in U.S. public schools in 2009 needing to acquire English proficiency to succeed academically (Department of Education, 2011). Low levels of English proficiency were probably linked to the fact that these children usually resided in homes where 67% of adults aged 18–65 years old spoke no English; 18% of children 5–17 years old and 15% of adults over 65 years old spoke no English, as well (Census Bureau, 2010). The increasing number of ELLs in public schools has paralleled the increase in ELLs' low mathematics performance (Beal et al., 2010; Brown et al., 2011; National Center for Educational Statistics, 2011). Kieffer et al. (2009) recognized that mathematics assessments in the United States required English proficiency for all test takers, implying that students with weak English proficiency skills experienced more difficulties on mathematics assessments than students who were English proficient. Students who read English very well achieved higher mathematics scores than those students who did not (Abedi & Lord, 2004; Beal et al., 2010; Han, 2011; Jordan, Kaplan, & Hanich, 2002).

Socioeconomic Status

Hoff and Tian (2005) viewed language acquisition as a culmination of mental processes working on the input children received during speech interactions. According to Hoff and Tian, speech interactions linked to children's language development, suggesting that children who were slower in language acquisition did not necessarily lack requisite tools for language acquisition. Rather, some children were deficient in supportive learning experiences due to their parents' SES. Krashen and Brown (2005) discovered that the faster students acquired language proficiency, the faster they improved academically. Krashen and Brown also observed that faster rates of language acquisition were closely associated with parents' higher SES. Language learners with higher SES enjoyed greater access to extensive reading material and had more highly educated parents (Aikens & Barbarin, 2008; Krashen & Brown, 2005; Orr, 2003). Blending the high SES and higher education motivated active parental involvement in ELLs' education. Active parental involvement stimulated higher literacy development in students, greater understanding of subject matter, expansive background knowledge, and higher language proficiency.

Gender

Historically, gender has significantly influenced students' mathematics performances (Erden & Akgul, 2010; F. Liu, 2008; Rosas & Campbell, 2010; O. L. Liu & Wilson, 2009), with attitudes toward mathematics contributing to students' choices in pursuing math-related courses and careers (Cheryan & Plaut, 2010). Boys were more likely to continue studying mathematics beyond compulsory education, despite girls outperforming boys at computation in elementary and middle school (Chow & Salmela-Aro, 2011; Lindberg et al., 2011). Additional research (Lindberg et al., 2011; Robinson & Lubienski, 2011) found that boys eventually outperformed girls in complex problem solving in high school, despite a lack of gender difference in the early elementary years. In a 1988 study conducted by Yee and Eccles, parents of boys had higher expectations of their boys' mathematics ability than parents of girls had for their girls from as early as elementary school. Parental influences probably extended to their children, thus affecting the children's mathematics performances. Also, teachers who endorsed gender stereotypes influenced students' mathematics performances (Keller, 2001), with girls doubting their mathematical abilities and boys flourishing from positive teacher feedback (Chow & Salmela-Aro, 2011). Gender issues do influence students' mathematics achievement. ELLs comprise boys and girls whose low mathematical performances might relate to issues associated with their gender.

Grade Level

MacSwan and Pray (2005) observed a group of ELLs to determine if older students learned English faster than younger students. The researchers discovered that older ELL students achieved English proficiency parity with native English speakers within a range of 1–6 years and at an average of 3 years. Cummins (1979) emphasized the importance of time in developing two types of language skills: basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP). Cummins explained that ELLs required 2–3 years to develop BICS for use in social settings and 5–7 years to develop CALP for use in academic settings. Achieving CALP within 5–7 years, as Cummins suggested, implies that a kindergarten ELL might not accomplish CALP until he or she had entered the fifth or sixth grade. ELLs enrolled as kindergarteners at the south Florida elementary school take the FCAT mathematics assessment for the first time in the third grade, or after only 4 years of English instruction. Observing other kindergarten ELLs as they progressed to the eighth grade, Halle, Hair, Wandner, McNamara, and Chien (2012) discovered that the students demonstrated annual improvement in English and mathematics assessments as they progressed through each grade. These findings suggested a reliance of ELLs' academic success upon the length of their exposure to English as they advanced in grade.

Research Questions

Current study investigated the predictive power of English proficiency on ELLs' low mathematics scores and how well SES, gender, and grade level moderated the influence of English proficiency on mathematics scores. The following research questions guided the study:

1. How well can mathematics scores be predicted by English proficiency alone?
2. How well can mathematics scores be predicted by English proficiency and gender?
3. How well can mathematics scores be predicted by English proficiency and SES?
4. How well can mathematics scores be predicted by English proficiency and grade level?

Figure 1 displays a model of the variables and research questions.

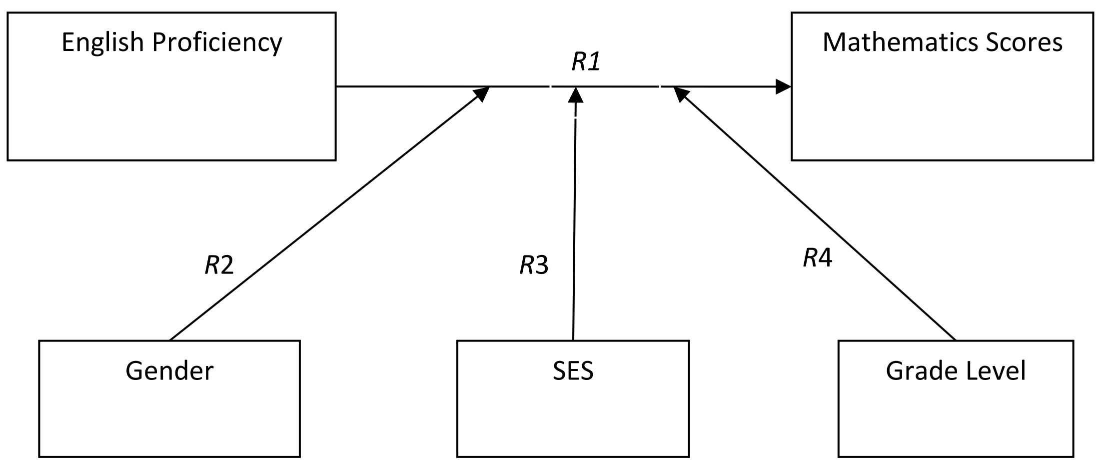

Figure 1: *Research Model of Variables and Research Questions*

Methodology

The philosophical approach taken in engaging the research process determines the research design (Creswell, 2009). Quantitative research supports examining the relationship among variables, while strengthening the probability of generalizing and replicating studies (Creswell, 2009; Lodico et al., 2010). This study examines the relationship between English proficiency and mathematics scores, while determining how well gender, SES, and grade level moderate the influence of English proficiency on the relationship.

Setting and Sample

Approximately 1,200 economically and culturally diverse students attended the south Florida elementary school, with 90% receiving free and reduced-priced meals. Hispanic students made up 87% of the student population, with Black (non-Hispanic) accounting for 9%, White (non-Hispanic) accounting for 3%, and Asian/Pacific Islander/other accounting for 1%. Additionally, 14% of the total student population were students with disabilities, 42% were ELLs, and 4% were classified as "gifted." Females accounted for 53% of the student population, and males accounted for 47%. Students who were administered the FCAT during the 2008–2010 period were the only ones eligible to participate in the study. Additionally, students must have attended the south Florida elementary school and taken the mathematics portion of the FCAT in third, fourth, and fifth grades. ELLs not enrolled in the English for Speakers of Other Languages program during the year preceding the FCAT administration did not participate in the study. The sample constituted archival data for Grade 3–5 ELLs (N = 177) taking the FCAT during 2008–2010. Demographic frequencies and percentages for each variable in the sample are displayed in Table 2.

Table 2: *Demographic Frequencies and Percentages of the Sample*

Distribution	*N**	%
Grade		
Third graders	68	38
Fourth graders	63	36
Fifth graders	46	26
Gender		
Third grade male	41	23
Third grade female	27	15
Fourth grade male	32	18
Fourth grade female	31	18
Fifth grade male	25	14
Fifth grade female	21	12
Socioeconomic status		
Free lunch	141	80
Paid lunch	36	20
Total males	98	55
Total females	79	45
Overall total	177	

Note. * Number of students in distribution category.

Data Collection Instruments

FCAT data measures the criterion variable, mathematics scores. Eligible students in Grades 3–5 take the FCAT annually in April. The Comprehensive English Language Learner Assessment (CELLA) data measures the predictor variable, English proficiency. ELLs are administered the CELLA in March. Florida has used the FCAT and CELLA assessment instruments over several years. According to Lodico et al. (2010), validity defines whether an instrument has achieved its intended purpose, whereas reliability defines the consistency of the instrument. The ideal situation exists when an instrument is both reliable and valid (Creswell, 2008). Cronbach's alpha determines the internal consistency of items in an instrument to gauge its reliability (Santos, 1999). The Cronbach's alpha reliability coefficient normally ranges between 0 and 1, with a Cronbach's alpha coefficient closer to 1.0 depicting the greater the internal consistency or reliability (Santos, 1999).

Cronbach's alpha measurements on FCAT mathematics assessments were 0.91 for Grades 3–6 (Department of Education, 2011). FCAT and CELLA reports are published separately, but both reports display the requisite data for the criterion and predictor variables. The data were available in Developmental Scale Scores (DSS) format for each student. DSS measure student academic growth over each assessment from Grades 3 to 10, with increases in DSS suggesting improvement in student achievement. Mathematics proficiency scores are categorized into five achievement levels ranging from 100 to 500 points. English proficiency scores are also categorized into five achievement levels ranging from 800 to 2,460 points.

Measurement Scales

Creswell (2008) highlighted two basic types of measurement scales, categorical and continuous. Creswell advised that understanding measurement scales was vital in identifying the appropriate statistics to use in data analysis. Mathematics proficiency scores that measured the criterion or dependent variable are continuous and interval. English proficiency scores that measured a predictor variable are continuous and interval. Gender as a dichotomous variable was recoded 1 for female and 0 for male. School lunch codes provided the basis for students' SES and were identified as students paying for lunch (high SES, recoded as 1) and students receiving free lunch (low SES, recoded as 0). Participating grades levels were third, fourth, and fifth grades. Grade level was recoded into two different dummy variables to accommodate regression analysis.

Results

Morgan (2004) recommended the validation of multiple regression assumptions prior to running inferential statistics for predictions. Green and Salkind (2011) asserted that at a minimum, scatterplots between each predictor and the criterion must be scrutinized for nonlinear relationships. Linearity assumes that if two variables are plotted in a scatterplot graph, then the data will fall in a straight line or in a cluster that is reasonably straight. The following scatterplot graphs allow visualization of the relationship between the predictor variables and the criterion variable. Figures 2 and 3 show the linear relationship between grade level and mathematics scores.

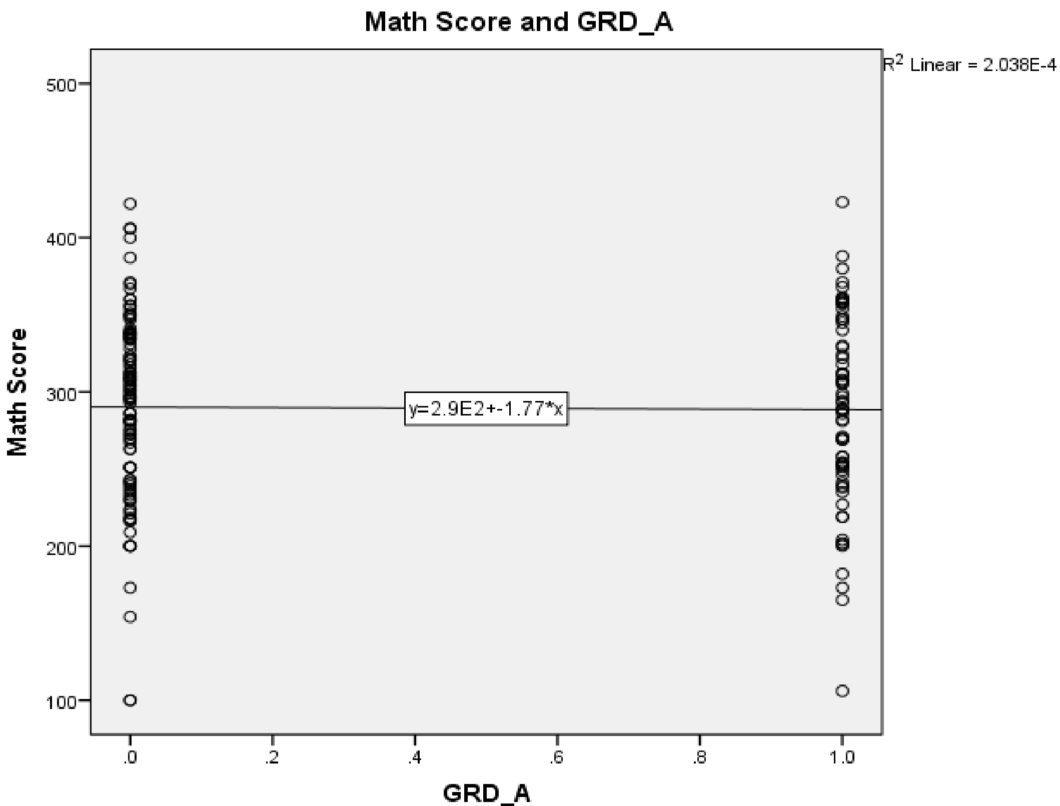

Figure 2: *Scatterplot Showing Linear Relationship Between Math Scores and Grade A (GrdA)*

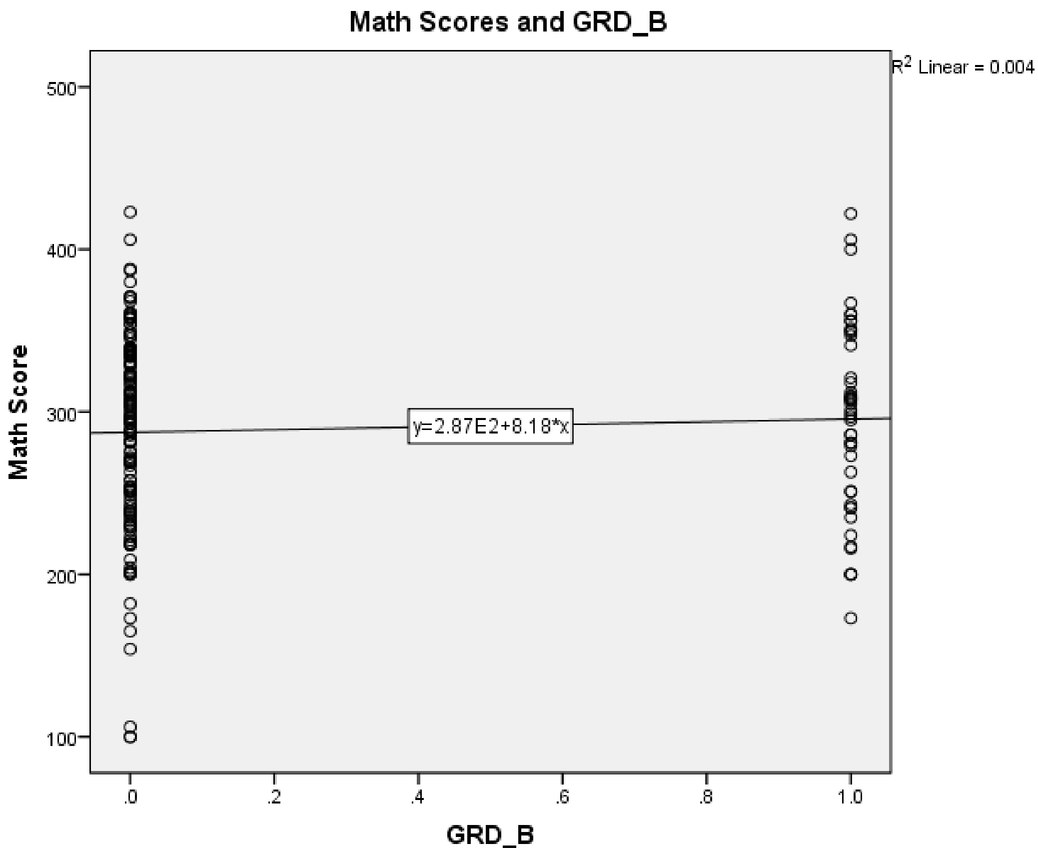

Figure 3: *Scatterplot Showing Linear Relationship Between Math Scores and GrdB*

A linear relationship between English proficiency and mathematics scores is shown in Figure 4, and another between SES and mathematics scores in Figure 5. Figure 6 displays the linear relationship between gender and mathematics scores.

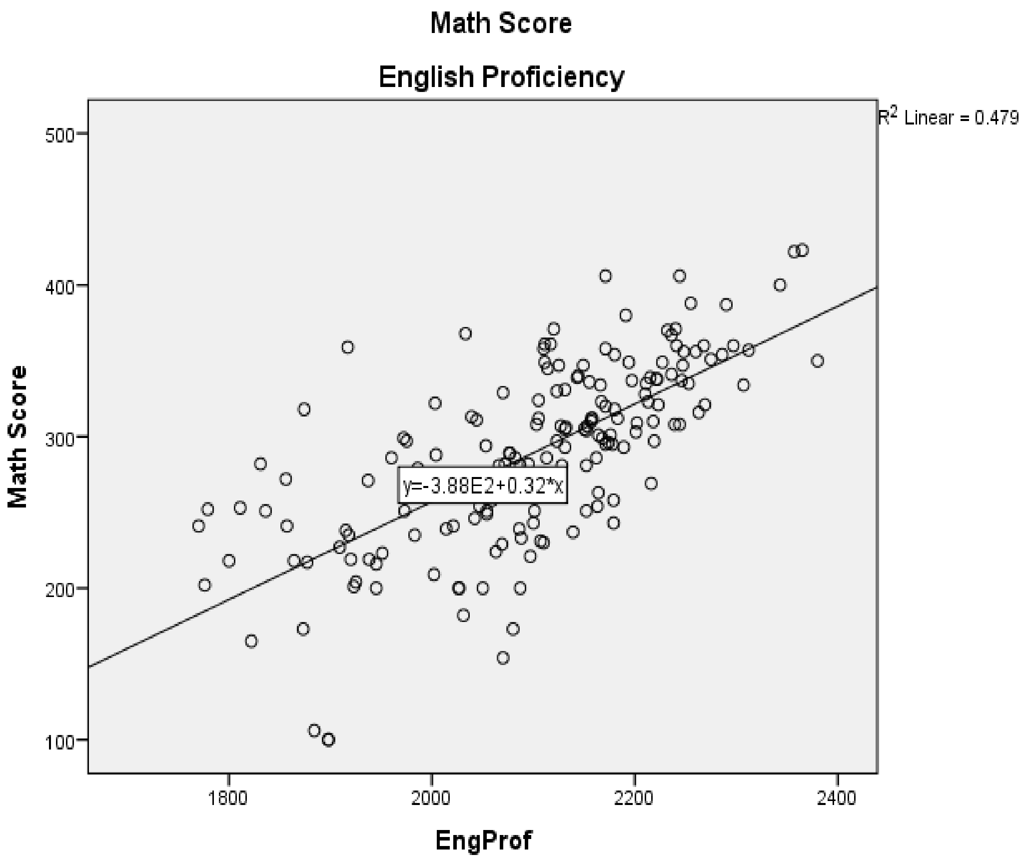

Figure 4: *Scatterplot Showing Linear Relationship Between Math Scores and English Proficiency (EngProf)*

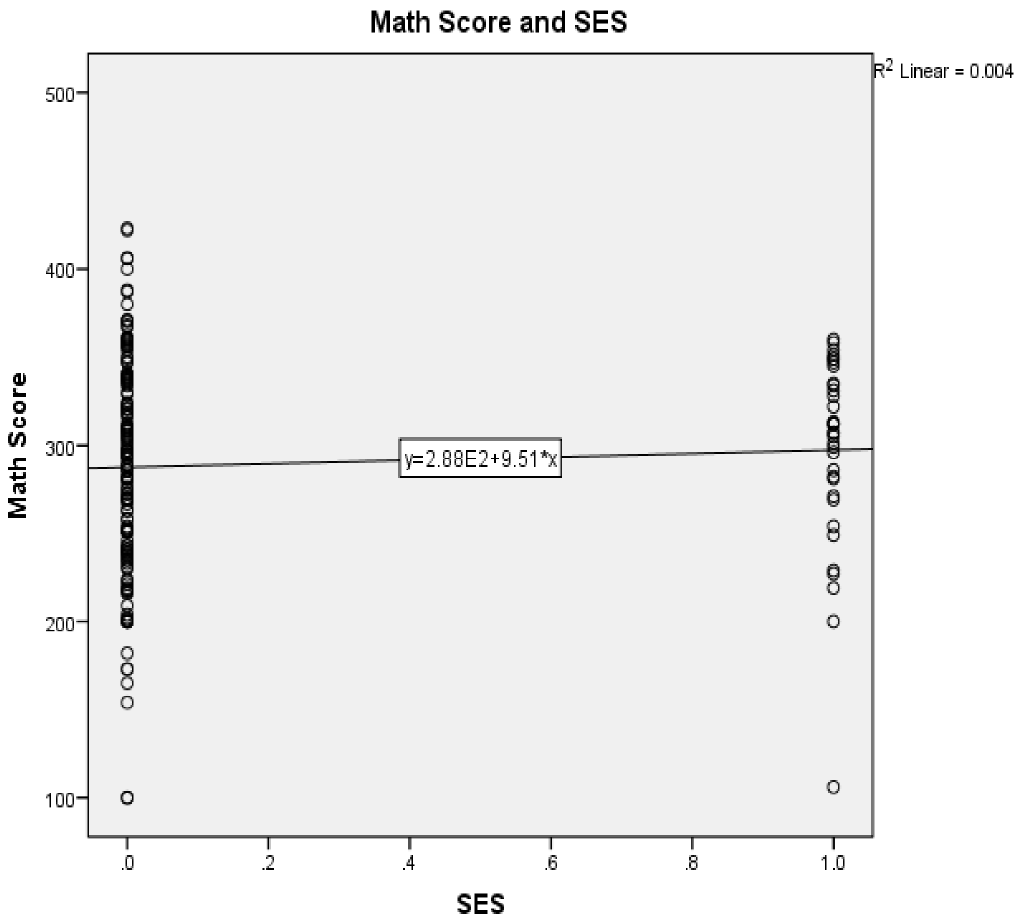

Figure 5: *Scatterplot Showing Linear Relationship Between Math Scores and Socioeconomic Status (SES)*

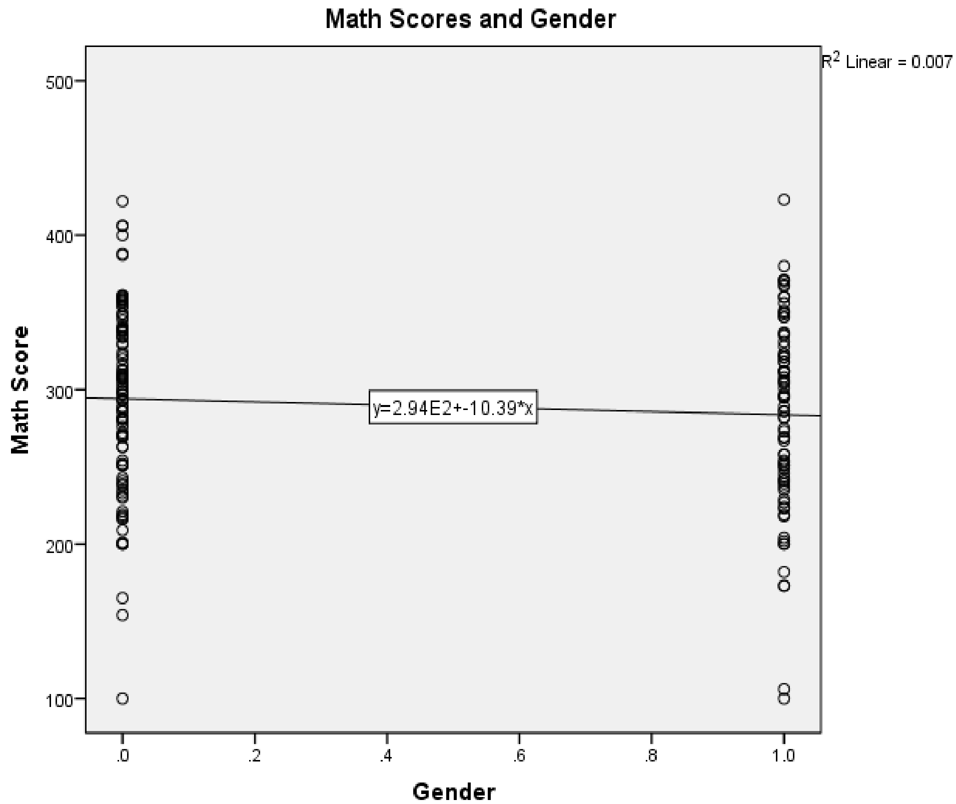

Figure 6: *Scatterplot Showing Linear Relationship Between Math Scores and Gender*

Descriptive statistics and correlations for the criterion and predictor variables are displayed in Tables 3 and 4.

Table 3: *Descriptive Statistics for the Criterion and Predictor Variables*

Distribution	Mean	Standard Deviation
Mathematics	289.51	60.347
English proficiency	2100.68	129.424
Socioeconomic status	.19	.395
GrdA	.36	.480
GrdB	.26	.440
Gender	.44	.498

Note. N = 177. GrdA and GrdB = grade level contrast variables.

Table 4*: Matrix Showing Correlation Among the Predictor and Criterion Variables*

	Math	Eng Prof	Gender	GrdA	GrdB	SES
Math	1	.692**	–.086	–.040	.060	.085
Eng prof	.692**	1	–.036	.154*	.171*	.106
Gender	–.086	–.036	1	.053	.019	.087
GrdA	–.040	.154*	.053	1	–.441**	–.033
GrdB	.060	.171*	.019	–.441**	1	–.027
SES	.085	.106	.087	-.033	–.027	1

Note. Eng prof = English proficiency; GrdA and GrdB = grade level contrast variables; SES = socioeconomic status. **Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.*

Multiple linear regression analyses were conducted to evaluate (a) how well English proficiency alone predicted mathematics scores and (b) how well gender, SES, and grade level individually moderated the influence of English proficiency on mathematics scores.

Research Question 1

A standard multiple linear regression analysis was conducted to evaluate how well English proficiency predicted mathematics scores. The output revealed a strong correlation between English proficiency and mathematics scores, $r = .692$. The model summary highlighted $R^2 = .479$, adjusted $R^2 = .476$, $F(1,175) = 160.8$, $p < 0.01$, indicating statistically strong predictive capability of English proficiency on mathematics scores. The statistics indicate that English proficiency alone explained 47.9% of the total variance in mathematics scores. A coefficient value of $\beta = .323$ suggested that for every one unit increase in English proficiency, mathematics scores increased by .323 points, with other predictive variables held constant.

Research Question 2

A hierarchical regression analysis was conducted to evaluate how well English proficiency and gender predicted mathematics scores. Model 1 maintained the statistics for English proficiency as expected, $R^2 = 0.479$, adjusted $R^2 = 0.476$. Model 2 revealed that English proficiency and gender explained 48.3% of the total variance in mathematics scores ($R^2 = 0.483$, adjusted $R^2 = 0.477$) and had statistically strong predictive capability, $F(2,174) = 81.2$, $p < .01$. Gender alone accounted for only 0.4% of the total variance in mathematics scores ($R^2 = .004$) and was not statistically significant (p = .264). A coefficient value of β = –7.412 explains that for every additional female student, mathematics scores will decrease seven points, other predictors held constant.

Research Question 3

A hierarchical regression analysis was conducted to evaluate how well English proficiency and SES predicted mathematics scores. Statistics on English proficiency remained constant in Model 1 (R^2 = 0.479, adjusted R^2 = 0.476). Model 2 indicated that English proficiency and SES explained 47.9% of the total variance in mathematics scores (R^2 = 0.479, adjusted R^2 = 0.473). Adding SES to the regression model did not alter the predictive capability of English proficiency. SES did not predict any of the variance in mathematics scores. A coefficient value of β = 1.761 indicates that for every additional high-SES student, mathematics scores will increase by 1.76 points.

Research Question 4

A hierarchical regression analysis was conducted to evaluate how well English proficiency and grade level predicted mathematics scores. Grade level was recoded into two contrast variables, GrdA and GrdB, to accommodate regression analysis. In evaluating English proficiency and GrdA, statistics remained constant for English proficiency in Model 1 (R^2 = 0.479, adjusted R^2 = 0.476). Model 2 highlighted that English proficiency and GrdA accounted for 50.1% of the total variance in mathematics scores (R^2 = 0.501, adjusted R^2 = 0.495). GrdA alone explaining 2.2% of the total variance in mathematics scores (R^2 = 0.022). A coefficient value of β = –18.849 predicts that for each additional third-grade student that advances to fourth grade, mathematics developmental scale scores will decrease by 19 points on their fourth-grade assessment. In analyzing English proficiency and GrdB, Model 1 remained constant for English proficiency (R^2 = 0.479, adjusted R^2 = 0.476). Model 2 showed English proficiency and GrdB explaining 48.2% of the total variance in mathematical scores (R^2 = 0.482, adjusted R^2 = 0.476). A coefficient value of β = –8.267 predicts that mathematical scale scores for each additional fourth-grade student advancing to fifth grade will decrease by eight points on the fifth-grade assessment. The finding predicts that a third-grade student's mathematics developmental scale scores will decrease 27 points by the end of fifth grade.

Discussion

The current study examined how well English proficiency predicted mathematics scores and how well gender, SES, and grade level moderated the influence English proficiency on mathematics scores. Multiple regression analyses provided strong evidence of English proficiency as a strong predictor of ELLs' mathematics scores. This finding is consistent with Abedi and Lord's (2004) assertion that students who read English very well achieved higher mathematics scores or that students who excel in literacy skills achieve higher mathematics scores than students who do not (Beal et al., 2010). Additional studies (Jordan et al., 2002; Zakaria & Aziz, 2011) affirmed that English proficiency precedes mathematics proficiency, especially when the language of instruction is English. Learning the language of instruction simultaneously with mathematics content complicates ELLs' academic learning experiences locally and nationwide. Numerous NAEP reports have confirmed that fourth-grade ELLs locally and nationwide consistently achieve low mathematics scores when compared to non-ELL competitors.

Gender

Although boys outperformed girls in the current study, gender had no significant predictive impact on mathematics scores. Previous research (Lindberg et al., 2011; Hyde, Fennema, & Lamon, 1990) confirmed that gender influences ELLs' mathematics performances from elementary through high school, sometimes favoring boys and sometimes favoring girls. A more exigent concern is the fact that gender underscores students' attitudes toward mathematics that contributes to choices in pursuing careers (Cheryan & Plaut, 2010). Boys are more likely to continue studying mathematics beyond compulsory education (Chow & Salmela-Aro, 2011; Lindberg et al., 2011). This study offers insights to improving how ELLs are taught mathematics, and more importantly removing barriers that tend to favor boys more than girls. Female students' lower mathematics performance in this study might be linked to a combination of factors that impact all female students nationwide, but the impact is more severe on ELL females who struggle with language acquisition.

Socioeconomic Status

Students inherit their parents' SES and everything associated with the status. High-SES ELLs usually enjoy a combination of greater access to extensive literature and increased active parental involvement that contribute to higher achievement levels (Aikens & Barbarin, 2008; Krashen & Brown, 2005). Conversely, low SES tends to promote lower education, poverty, and poor health (Aikens & Barbarin, 2008). Students' initial literacy correlates with the home literacy environment and availability of books (Aikens & Barbarin, 2008), and parents might be unable to afford the requisite resources to create a positive literacy environment (Orr, 2003). In the current study, SES had no significant impact on mathematics scores. Students' SES correlated to changes in parental SES that might have paralleled concurrent economic crises affecting many families during the assessment period. Eighty percent of the sample in this study was of low SES. However, some of these low-SES students were probably reclassified from high SES to low SES for the assessment period. Prior-affluent parents applying for free lunch due to economic constraints will not have necessarily affected their children's strong literacy and mathematics abilities. Parental affluence, or a lack of it, does not necessarily correlate to children's academic abilities.

Grade Level

Grade level significantly predicted mathematics scores in this study. Findings showed that mathematics performances were stronger at the third-grade level. The higher proficient performance might be attributed to fewer and/or easier word problems rather than superior English proficiency skills. Perhaps the assessment language was commensurate to the language of instruction at that level. The findings revealed mathematics proficiency decreasing significantly as students advanced from third grade to fifth grade, suggesting a disconnect between expected English proficiency and mathematics scores. The dilemma might be attributed to either increased difficulty in mathematics textbook language as students advance in grade, ineffective comprehensible input from teachers, or ELLs' first language and culture, to name a few. Such factors obstruct ELLs' pathway to upward mobility. Cummins (1979) asserted that ELLs require 5–7 years of input to achieve the requisite CALP for academic success. ELLs not receiving the requisite CALP as they progress through the grades from kindergarten to fifth might have difficulty on standardized mathematics assessments. Pertinent to the discussion is the fact that ELLs in Florida are administered their initial standardized assessment in the third grade, or after 4 years of English proficiency input. Educators might consider restricting ELLs' mathematics assessments to mathematics calculation only, until students have acquired the requisite CALP for interpreting word problems.

Limitations of the Study and Implications for Further Research

Convenience sampling was used in this study because data were readily available. However, the sampling technique has restricted generalizability of the findings beyond the initial sample. Furthermore, greater than 90% of ELLs in this study were of Hispanic ethnicity enrolled in a public school. Therefore, using participants from another majority ethnic group might not produce similar results. Additional research could evaluate the effects of first language and culture on second language acquisition, as ELLs vary in their rate of language acquisition and, by extension, academic achievements.

The current study did not consider teacher quality as a factor in low mathematics achievement. Conducting a study that considers teacher mathematics background and anxieties as predictors of ELLs low mathematics performance would be prudent. Basic reasoning suggests that language learners who improve in English proficiency as they advance in grade should achieve stronger mathematics performances. The findings of such a study might reveal that language proficiency is not as influential in predicting low mathematics scores as some studies have discovered. This study adds credence to investigating alternative factors that affect ELL performances nationwide, and methods of mathematics instruction come to mind. Numerous reports document low ELL performances nationwide. Another limitation is the unavailability of data to compare whether ELLs would perform better or worse if assessed in their first language. A better performance in the first language would confirm the second language as a predictive factor, while a worse or similar performance might suggest a deficit in literacy. Such data would enlighten the perspective on ELLs' low mathematics performances nationwide.

Conclusion

This study examined the relationship between English proficiency and mathematics scores. Using multiple linear regression analyses, this study indicated that English proficiency predicted ELLs' mathematics scores and that grade level moderated the influence of English proficiency in predicting those mathematics scores. The study supports the notion that ELL students who read well perform better on mathematics assessments than those ELLs who do not. Teachers must recognize the differences between BICS and CALP to avoid erroneous diagnosis of ELLs' proficiency levels and abilities. Teachers do not control students' SES, gender, or grade level, but they do control how they teach mathematics. Targeting areas of deficiencies with positive instruction could subsequently improve student comprehensible input that is so critical to ELLs acquiring the requisite English proficiency for academic success.

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