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RESEARCH ARTICLE

Class Environment and Teacher Support for US Minority Students: Education Longitudinal Study Outcomes

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Abstract

The study analyzed nationally representative U.S. data to examine the effects of class environment and teacher support on high school students, with particular focus on their differential impacts on racial and linguistic minority students. Leveraging a large sample, the study conducted a series of preliminary analyses—including one-way ANOVA, Kruskal-Wallis tests, independent samples t-tests, and Mann-Whitney tests—followed by a full structural equation model. The results indicated that class environment was negatively associated with math performance. Unexpectedly, teacher support also showed a negative association with math performance. Among White students, those from higher-SES families reported greater teacher support than their middle-SES counterparts. However, in three minority groups—Asian, Black, and Hispanic—higher-SES students reported lower teacher support than middle-SES White students. Additionally, two linguistic minority groups, Black and Hispanic LOTE (Languages Other Than English) dominants, reported higher teacher support scores than White English-dominant students.

1. Introduction

As prior research has shown, class environment and teacher support are significant predictors of students' math performance(Nelson & DeBacker, 2008; Roorda et al., 2011). Given that students' math performance in the U.S. has traditionally lagged behind that of other countries, research on the role of teachers in math class environment is crucial. Additionally, examining the impact of those variables on students at academic risk is of utmost importance. In response to the needs in math education, this study investigates the effects of the classroom environment and teacher support on math efficacy and performance outcomes, taking into account various student backgrounds. Drawing from literature, the study interprets the effects of diverse paths and outcomes based on racial, linguistic, social, and gender backgrounds through a socio-cultural lens. A sociocultural perspective emphasizes the critical role of social interaction in shaping perception and knowledge. Understanding students' experiences at home and in school is vital to grasping their math efficacy and performance. Consequently, differences in math efficacy and performance can be viewed as systematic sociocultural responses to their environment.

Home and school environments are major predictors of disparities in students' academic outcomes. Marginalized students, including those from low-income families and minority groups, are less likely to be exposed to mathematical ideas, receive quality

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instruction, or benefit from individualized attention in mathematics (Sirin, 2005). Additionally, these students often have limited access to educational resources and receive less instructional support from both parents and schools (Aikens & Barbarin, 2008; Orr, 2003a). As a result, they are more likely to fall behind, leading to low math efficacy and decreased engagement in math learning (Chang et al., 2009). Furthermore, disadvantages in the home environment are often exacerbated by unequal opportunities in schooling (Sirin, 2005).These factors create a cycle of cause and effect, reinforcing patterns of disengagement and low expectations. For instance, school segregation by social class impacts both student motivation and their access to high-quality resources and qualified teachers (Corcoran & Evans, 2008; Vigdor & Ludwig, 2008).

Given these backgrounds, the following literature review and the study's analysis aim to explore the effects of the classroom environment and the teacher's role in shaping students' math efficacy and performance across diverse backgrounds—areas that remain underexplored.

2. Literature Review

2.1 Minority Students' Math-Efficacy and Performance

According to Spencer et al., (2016), differences in students' math efficacy can be understood as systematic sociocultural reactions from the environment that influence their self-efficacy. The authors explain that a student's preexisting beliefs about their ethnic or racial group membership can impact academic performance. This occurs through an internalizing process, where students associate group performance with their individual abilities and interest in a subject. This can lead to negative outcomes such as stigmatization, increased doubts and anxieties, and poor math performance (Lee & Nass, 2012). Stevens et al., (2004) showed that Hispanic high school students displayed significantly less confidence than White students in their ability to effectively use their skills and knowledge to solve math problems.

Sociocultural stereotypes also interact with the relationship between math efficacy and performance. Ambady et al. (2001)found that Asian-American girls aged 5-7 and 11-13 years old scored higher on a math test when their positively stereotyped Asian identity was subtly activated. Conversely, they showed lower scores when their negatively stereotyped female identity was activated, compared to a control group with no identity activation. On the other hand,Cheema and Skultety (2017) analyzed data from a nationally representative sample of 15-year-old U.S. students and found that Black and Hispanic students consistently overestimated their abilities in science and mathematics, whereas White students consistently underestimated theirs. Whang and Hancock (1994) discovered that Asian American students, despite having higher math achievement, displayed significantly lower self-concepts regarding their math abilities compared to non-Asian students. Thus, the effects of math self-efficacy on performance vary across racial groups, and the sociocultural factors within each racial group play a crucial role in this process.

Differences in math efficacy and performance also exist between English Language Learners (ELLs) and non-ELLs. Research shows that ELL students typically begin with much lower academic self-efficacy than their non-ELL peers, and this lower self-efficacy is associated with slower growth in math and reading through middle school (Soland & Sandilos, 2021). In a study of fifth graders, Sandilos et al. (2020) found that students who had not yet reached English proficiency exhibited lower performance and self-efficacy in mathematics compared to their English-proficient peers.

2.2 Different Math Efficacy and Performance Caused by Home and School Environments

Several studies show that wealth influences achievement by affecting the amount of cultural capital to which a child is exposed. Since minorities generally have less wealth than their White peers, income can help explain part of the racial achievement gap. These findings are discussed in several studies (Atkins et al., 2014; Orr, 2003b). For example, Black students are three times more likely to live in poverty than White students (de Brey et al., 2019), and the academic performance gap is largely attributable to low socioeconomic status (SES) (Magnuson et al., 2008).

Additionally, differences in school-based experiences between minoritized students and their White peers have been used to explain the achievement gap. According to Ancis et al. (2000), Black students often perceive racial prejudice in academic settings, and this perception of bias increases emotional stress while decreasing motivation to learn. As a result of these differences in school experiences, Black students tend to have fewer opportunities to learn and interact with high-achieving peers (Grissmer & Eiseman, 2008). In other words, minoritized students face more barriers at school and have fewer opportunities to learn at home compared to their White counterparts.

2.3 Class Environment for Math Efficacy and Math Performance

The math class environment encompasses a range of contexts, including both the classroom setting and the social environment. A growing body of research indicates that student behavior and peer climate are associated with students' motivation, engagement(Nelson & DeBacker, 2008; Patrick et al., 2007; Ryan & Patrick, 2001), and academic achievement (MacNeil et al., 2009; Milam et al., 2010). When students perceive their schools as pleasant and supportive, they are more likely to dedicate their time to academic activities. In these environments, teachers spend less time disciplining students and more time teaching.

As a contextual factor within math classrooms, this study explores the effects of class environment that can promote learning and reinforce effective teaching. Behavioral engagement in favorable class environment promotes a student effort for academic tasks—characterized by academic persistence, concentration, and interest—has been a significant predictor of student performance(Fredricks et al., 2004). Ford et al. (2008)and (Peterson et al., 2016; Peterson-Lewis and Bratton (2004)attributed minority students' lower performance to disengaged behavior and low levels of behavioral engagement in undesirable class environment. On the other hand, as an indicator of behavioral engagement, completed homework has been linked to high math performance in both middle and high schools (Aksoy & Link, 2000; Eren & Henderson, 2008, 2011; Kalenkoski & Pabilonia, 2017).

2.4 Teacher Support in Math Class

As the most influential role models in school settings, teachers play a vital role in students' engagement with learning activities (Patrick et al., 2007) and academic achievement (Roorda et al., 2011), as well as in the development of students' math self-efficacy and performance (Johnson, 2008; Karabenick & Sharma, 1994). Teacher support through various instructional practices has proven to be a powerful tool in motivating students and boosting their math self-efficacy. Marchant et al. (2001)also highlighted that teacher responsiveness to student needs in a supportive environment fosters students' motivation and self-efficacy, which in turn influences academic performance. Students' self-efficacy is often shaped by social comparisons with peers and feedback from teachers and other adults(Bandura, 1997, 2012). As teachers' belief in a student's math competence and engagement increases, so does the student's interest in math. Moreover, when teachers are flexibleand more experienced, students tend to show more interest in mathematics.

A sociocultural perspective further explains that the development of self-efficacy and motivation is influenced by the feedback of teachers and peers. Therefore, the interrelationships among the social and conceptual domains of self-efficacy, motivation, and engagement depend on the social learning environment and may vary considerably according to students' racial backgrounds (Cobb & Hodge, 2002; Jacobs & Simpkins, 2005; Milner, 2012).

From another socio-cultural perspective, minority students are more likely to perceive discrimination in relation to teacher treatment, school suspension, unfair policies enforced by school authorities, and police treatment at school (Ruck & Wortley, 2002). Lubienski and Bowen (2000)argued that to understand the achievement gap, researchers must focus on how schooling experiences contribute to these disparities. In the context of school mathematics, Martin (2000) analyzed 35 high-achieving Black students in grades 7 through 9 and confirmed earlier findings that Black students face numerous obstacles in and out of school that hinder their success. However, if they are able to navigate these challenges, they are likely to persist and achieve academic and mathematical success.

3. Method

3.1 Data

We used data from the Education Longitudinal Study (ELS), collected by the National Center for Education Statistics (NCES). Although ELS is a longitudinal study, we focused on the first wave of data, which includes a nationally representative sample of 16,197 10th-grade students from 752 high schools (Ingels et al., 2004). ELS employed a two-stage random sampling process for data collection: at the first stage, schools were selected with probability proportional to size (PPS), and at the second stage, students were randomly selected from each selected school. Initially, ELS included 1,221 eligible public and private schools from a population of approximately 27,000 schools with 10th-grade students. From the list of 10th graders in each school, approximately 26 students per school were chosen for data collection. A total of 762 schools and 16,197 students participated in the 2002 data collection (Ingels et al., 2004). The database includes a broad range of student-level data, including domain-specific self-efficacy, teaching perceptions, school environment, and demographic information.

3.2 Variables

From the initial database, we extracted data for four racial groups: Asian, Black, Hispanic, and White. Although the original data included seven other racial groups, these were not analyzed in this study due to small sample sizes. The variables were created as dummy variables (Asian, Black, Hispanic, and White). In the ELS data, there were 1,654 students identified as Asian (10.8%), 2,168 as Black (14.2%), 2,433 as Hispanic (15.9%), and 9,034 as White (59.1%).

We used the continuous composite variable of socio-economic status (SES), which NCES collected and standardized. For language status, we defined LOTE as languages other than English, and categorized students into two groups: English-dominant (LOTE = 0) and non-English-dominant (LOTE = 1). There were 12,524 English-dominant students (81.9%) and 2,765 students who spoke a language other than English as their dominant language (18.1%). The sample included 7,632 males (50.1%) and 7,657 females (49.9%).

As a mediator variable linking students' demographic variables to teacher support, we included class environment, which influences the quality of teacher support and math class environments. The class environment score was a latent variable built upon three indicator variables using structural equation modeling (SEM). In this study, a higher score indicated a less desirable class environment. The measurement model of SEM, which involved confirmatory factor analysis (CFA), produced the loadings for each indicator item. These loadings are presented in the results section and in Table 1. The three indicator items had four response options (1 = never, 2 = seldom, 3 = often, and 4 = usually). To ensure the consistency of these three items, we conducted reliability analyses using McDonald's omega (w = .819) and Cronbach's alpha (α = .813), both of which indicated sufficient item consistency. For the preliminary analyses examining group differences in class environment, we created separate composite variables using exploratory factor analysis (EFA) with Bartlett scores. The cumulative variance of the factors was sufficient (93.25%), and the loadings were adequate (see Table 1 for detailed information on indicators, reliabilities, and loadings from EFA).

The main predictor of the study was teacher support in math classrooms, which was specified as a second mediator in the SEM analyses. The measurement model of SEM produced the loadings for each indicator item, which are provided in the results section and in Table 1. Teacher support was treated as a latent variable composed of five indicator items, with response options ranging from 1 = strongly disagree to 4 = strongly agree. We found sufficient item consistency, as indicated by McDonald's omega reliability (*w* = .712) and Cronbach's alpha (α = .711). Using EFA and Bartlett scores, we also created a composite variable to compare various groups in the preliminary analyses (see Table 1 for indicators, reliabilities, and loadings from EFA).

Table 1. *Reliability Statistics, Items, and Loadings of Exploratory Factor Analysis for Class Environment and Teacher Support*

Class Environment		Teacher Support	
Reliability McDonald's w Cronbach Alpha	.819 .813	Reliability McDonald's w Cronbach Alpha	.712 .711
Items	Loading	Items	Loading
How often goes to class without pencil/paper.	.969	Teachers expect success in school.	.691
How often goes to class without books.	.970	Teachers praise effort.	.691
How often goes to class without homework done.	.958	Teachers are interested in students.	.729
		Classes are interesting &challenging.	.690
		School rules are fair.	.613

The math self-efficacy score in this study was specified as the third mediator variable, hypothesized to significantly influence math performance. Self-efficacy scores were created by NCES through principal components factor analysis and reported in a standardized score format (mean = 0, standard deviation = 1), reflecting students' overall beliefs in their math abilities. The indicator variables assessed students' confidence in performing tasks such as doing an excellent job, understanding math textbooks, mastering skills in math courses, and excelling in math assignments. NCES reported the reliability coefficient (alpha) as .65.

The outcome (endogenous) variable of the study was students' math performance, which was collected directly by NCES. Math scores were obtained through a two-stage assessment with multiple-choice items based on Item Response Theory (IRT), estimating students' math abilities (Ingels et al., 2004, 2011). The mean math score for all students was 43.21 (SD = 14, range = 13.74 - 82.03). Tables 2 and 3 provide the subgroup means and standard deviations.

3.3 Analytical Methods

The study's analyses consisted of two sections: preliminary analyses and main analyses. The preliminary analyses involved a series of univariate outcomes, where the effects of other variables were not accounted for. In contrast, the main analyses provided results after considering the effects of other variables.

In the preliminary analyses, we examined group differences on the single outcome by conducting t-tests (assuming homogeneity of variance) and Mann-Whitney (MW) tests (for violations of homogeneity) for two groups. For multiple groups, we used one-way ANOVA (assuming homogeneity of variance) and Kruskal-Wallis (KW) tests (for violations of homogeneity).

In the main analysis, we employed structural equation modeling (SEM) to examine the differential effects of teacher support as a mediator for various racial, linguistic, SES, and gender groups on math performance, with class environment and math self-efficacy as mediators. To avoid collinearity issues among race, linguistic status, and SES variables, we incorporated interaction terms in the SEM analysis.

4. Results

4.1 Preliminary Analyses

Table 2 presents the detailed results of descriptive statistics, one-way ANOVA, and Kruskal-Wallis (KW) tests for racial group comparisons regarding the following variables: students' SES, class environment, teacher support, math self-efficacy, and math performance. Table 3 provides results using t-tests and Mann-Whitney (MW) tests for two-group comparisons for the same variables.

The first preliminary analysis comparing SES across four racial groups revealed significant differences. Consistent with prior studies (de Brey et al., 2019), our analyses showed that Hispanic and Black students had significantly lower SES than Asian and White students. When comparing two groups based on language status using MW, we found that LOTE dominant students had significantly lower SES than English-dominant students.

Regarding students' class environment scores, Asian students had the lowest scores, indicating fewer barriers, while Hispanic and Black students scored in the middle, and White students had the highest scores, indicating they experienced more unfavorable class environments. We found that LOTE-dominant students perceived a significantly better class environment (lower scores) than English-dominant students. Additionally, females perceived a more unfavorable class environment than males.

In terms of teacher support, we found that Asian and Hispanic students reported higher teacher support scores than Black and White students. LOTE-dominant students also reported higher teacher support than their English-dominant peers, and females had higher teacher support scores than males.

For math self-efficacy, Asian students reported higher scores than Black, White, and Hispanic students. The two language groups did not show significant differences, though males had higher math self-efficacy than females.

In terms of math performance, Asian and White students had the highest scores, followed by Hispanic and Black students. LOTE-dominant and female students displayed significantly lower performance compared to their counterparts.

Table 2. *Descriptive Statistics, One-Way ANOVA, and Kruskal-Wallis (KW) Tests for Racial Group Comparisons with SES, Class Environment, Teacher Support, Math-Efficacy, and Math Performance.*

Outcome Variable	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Levene's F	Statistics
	Asian	Black	Hispanic	White		
SES	.013 (.85)	-.209 (.66)	-.365 (.72)	.027 (.70)	*F* = 67.154**	*KW=1404.451***
Class Environment	-.150 (1.15)	-.056 (1.14)	-.060 (1.14)	.047 (.89)	*F* = 171.480**	*KW=46.555***
Teacher Support	.163 (.94)	-.017 (.94)	.091 (1.00)	-.035 (1.00)	*F* =4.170*	*F=56.180***
Math-Efficacy	.206 (.97)	.022 (.96)	-.039 (.97)	.021 (1.01)	*F* =6.041**	*KW=38.516***
Math Performance	47.354 (14.97)	34.418 (11.31)	36.512 (12.81)	46.468 (13.14)	*F* = 65.873**	*KW=2025.688***

*Note: KW indicates the H-value of Kruskal Wallis tests; * indicates significant at 0.05, and ** indicates significant at 0.01*

Table 3. *Descriptive Statistics, Independent Samples T (t) and Mann-Whitney (MW) Tests for Linguistic and Sex Group Comparisons with SES, Class Environment, Teacher Support, Math-Efficacy, and Math Performance.*

	Mean(SD)	Mean(SD)	Levene's F	Statistics	Mean(SD)	Mean(SD)	Levene's F	Statistics
	English	LOTE			Male	Female		
SES	.106 (.72)	-.290 (.80)	*F* = 70.472**	*MW = -25.601***	.051 (.74)	.022 (.76)	*F* =171.480**	*t =2.446**
Class Environment	.022 (.96)	-.104 (1.17)	*F* = 244.227**	*MW = - 2.488**	-.006 (1.06)	.006 (.94)	*F* =102.188**	*MW=-9.604***
Teacher Support	-.036 (1.00)	.180 (.98)	*F* = 8.501**	*MW = -9.154***	-.066 (1.04)	.065 (.95)	*F* = 47.611**	*MW =- 6.808***
Math-Efficacy	.020 (1.01)	.069 (.97)	*F* = 7.136*	*t = -1.831*	.182 (.98)	-.112 (.99)	*F* = .727	*t =15.115***
Math Performance	43.856 (13.71)	40.092 (14.90)	*F* = 32.335**	*MW = -13.505***	43.989 (14.41)	42.429 (13.35)	*F* = 35.036**	*MW = -6.538***

Note: *LOTE indicates Language Other Than English Dominants; t indicates the t-value of independent samples t-test; MW indicates the Z-value of Mann-Whitney tests; * indicates significant at 0.05; and ** indicates significant at 0.01.*

4.2 Structural Equation Modeling (SEM) Results

Our SEM model included a two-stage modeling process: a measurement model at the first step and a full structural model at the second stage (see indicators and loadings in Table 4). The SEM models displayed acceptable fit statistics: (X^2 = 1610.991, $p < 0.01$; RMSEA = 0.029 < 0.08, CFI = 0.955, TLI = 0.926, SRMR = 0.025).

Class environment indicators showed sufficient loadings (.767 to .997) with an anchoring item. Teacher support, also a latent variable, displayed adequate loadings across all indicator items, ranging from .922 to .992. In the full structural model, we used the class environment variable as the first mediator, teacher support as the second mediator, and math efficacy as the third mediator.When comparing male class environment scores across the four racial groups using structural equation modeling, we observed significant differences. Male students from three minority groups (Asian, Black, and Hispanic) reported a better class environment score than White male students.

The SES variable was a significant predictor of class environment. White students from high-SES families perceived a significantly better class environment. We also observed significant interactions between minority groups and SES. Compared to White middle-class students, Asian students from higher-SES families tended to report a better class environment.

In the comparison of language groups, Asian LOTE (Languages Other Than English) dominants reported a better class environment, while Black LOTE dominants reported a less favorable class environment than White English dominants. White females had a more favorable class environment than White males.

For teacher support, Asian males reported higher scores than White males. White students from higher-SES families displayed higher teacher support scores than White students from middle-SES families. However, students with higher SES in three minority groups (Asian, Black, and Hispanic) had lower teacher support scores than White students from middle-SES families.

Two linguistic minority student groups, Black and Hispanic LOTE dominants, displayed higher teacher support scores than White English dominants. Teacher support scores were not consistent across male and female students. White and Asian female students had higher teacher support scores than White male students. Importantly, students' perception of class environment was associated with teacher support scores, indicating that students who perceived a negative class environment also reported lower teacher support scores.

White students from higher-SES families tended to have higher math self-efficacy scores than their middle-class counterparts. However, Black students from higher-SES families tended to show lower math self-efficacy compared to White middle-class students. Black LOTE-dominant students reported lower math self-efficacy than their White English-dominant peers. White female students had lower math self-efficacy than White male students, but Black female students had higher math self-efficacy than White male students. Students' unprepared class environment was negatively associated with math efficacy, while teacher support was positively associated with math efficacy.

Regarding math performance, Black and Hispanic males had significantly lower performance than White males. White students from higher-SES families had significantly higher math performance, while Black and Hispanic students from higher-SES families had lower math performance than White students from middle-SES families. White LOTE students performed significantly worse than White English dominants. Interestingly, Asian, Black, and Hispanic LOTE students displayed higher math performance than White English dominants. White females exhibited lower math performance than White males. Class environment scores were negatively associated with math performance, while teacher support scores were negatively associated with math performance. Math efficacy, however, was positively associated with math performance.

Table 4. *Results from Structural Equation Modeling.*

	Estimate	SE	P-Value
Class Environment By			
Class_Prep1 (Paper)	1.000	0.000	--
Class_Prep2 (Books)	0.997	0.013	0.000**
Class_Prep3 (Homework)	0.767	0.011	0.000**
Teacher Support By			
Teacher1 (Success)	1.000	0.000	--
Teacher2 (Value)	0.931	0.031	0.000**
Teacher3 (Respect)	0.954	0.035	0.000**
Teacher4 (Interesting)	0.992	0.023	0.000**
Teacher5 (Fair)	0.922	0.032	0.000**
Class Environment On			
Asian	0.151	0.054	0.005**
Black	0.176	0.034	0.000**
Hispanic	0.217	0.038	0.000**
SES	-0.052	0.012	0.000**
Asian*SES	-0.088	0.033	0.008**
Black*SES	-0.006	0.034	0.860
Hispanic*SES	-0.049	0.033	0.140
LOTE	0.097	0.059	0.102
Asian*LOTE	-0.172	0.082	0.035*
Black*LOTE	0.255	0.122	0.036*
Hispanic*LOTE	-0.032	0.074	0.660
Sex	-0.201	0.018	0.000**
Asian*Sex	0.036	0.054	0.500
Black*Sex	0.039	0.046	0.403
Hispanic*Sex	-0.044	0.045	0.332
Teacher Support By			
Asian	0.107	0.032	0.001**
Black	0.043	0.023	0.064
Hispanic	0.036	0.023	0.128
SES	0.073	0.008	0.000**
Asian*SES	-0.117	0.019	0.000**
Black*SES	-0.135	0.022	0.000**
Hispanic*SES	-0.089	0.019	0.000**
LOTE	-0.005	0.037	0.893
Asian* LOTE	0.067	0.049	0.168
Black* LOTE	0.188	0.069	0.006**
Hispanic* LOTE	0.121	0.044	0.006**
Sex	0.063	0.012	0.000**
Asian*Sex	-0.061	0.030	0.041*
Black*Sex	-0.048	0.028	0.086
Hispanic*Sex	0.014	0.026	0.603
Class Environment	-0.099	0.008	0.000**
Math-Efficacy On			
Asian	-0.012	0.061	0.841
Black	-0.005	0.046	0.915
Hispanic	-0.032	0.047	0.501

SES	0.194	0.017	0.000**
Asian*SES	0.038	0.039	0.320
Black*SES	-0.125	0.045	0.005**
Hispanic*SES	0.005	0.039	0.896
LOTE	0.094	0.07	0.179
Asian* LOTE	0.036	0.095	0.709
Black* LOTE	-0.345	0.158	0.029*
Hispanic* LOTE	-0.073	0.087	0.403
Sex	-0.372	0.024	0.000**
Asian*Sex	0.082	0.062	0.181
Black*Sex	0.169	0.061	0.005**
Hispanic*Sex	0.041	0.054	0.447
Class Environment	-0.057	0.014	0.000**
Teacher Support	0.689	0.033	0.000**
Math Performance On			
Asian	0.273	0.675	0.686
Black	-9.264	0.416	0.000**
Hispanic	-5.225	0.469	0.000**
SES	6.168	0.171	0.000**
Asian*SES	-0.463	0.407	0.256
Black*SES	-1.090	0.430	0.011*
Hispanic*SES	-1.320	0.382	0.001**
LOTE	-5.643	0.750	0.000**
Asian* LOTE	7.390	1.031	0.000**
Black* LOTE	3.740	1.391	0.007**
Hispanic* LOTE	3.658	0.901	0.000**
Sex	-0.487	0.247	0.048*
Asian*Sex	0.412	0.699	0.556
Black*Sex	-0.090	0.542	0.869
Hispanic*Sex	0.185	0.534	0.729
Class Environment	-1.910	0.147	0.000**
Teacher Support	-0.836	0.325	0.010**
Math-Efficacy	4.432	0.122	0.000**

5. Discussion and Conclusion

Based on prior research highlighting effective ways to enhance minority students' engagement in mathematics (Dotterer & Lowe, 2011), class environment and teacher support were adopted as the main variables. Their relationship to math efficacy and math performance was examined, with a focus on exploring differential effects across various racial, linguistic, and sex groups.

Using structural equation modeling, we confirmed that students' math efficacy was a significant predictor of math performance (Spencer et al., 2016). Consistent with prior studies, class environment was negatively associated with math performance (MacNeil et al., 2009; Milam et al., 2010). However, unexpectedly, teacher support was negatively associated with math performance, which contradicts previous findings(Patrick et al., 2007; Roorda et al., 2011).

Additionally, we observed high teacher support scores among Black and Hispanic LOTE (Languages Other Than English) dominants and White females, who, despite these high support scores, tended to show lower math performance. This suggests that while teachers may be making efforts to encourage students at academic risk, these efforts may not always translate into improved performance for those students.

The analysis of differential effects across diverse groups was a major contribution of this study. The results indicated that White and Asian students from high-SES families, as well as Asian LOTE dominants, perceived the class environment more positively compared to White middle-class students. However, Black LOTE students perceived the class environment less favorably.

In terms of teacher support, Asian males reported higher teacher support scores than White males. High SES had a positive effect on teacher support scores for White students, but a negative effect for racial minority students. Specifically, White students from high-SES families had higher teacher support scores compared to Asian, Black, and Hispanic students from high-SES families, who reported lower teacher support scores compared to White middle-class students.

For language groups, Black and Hispanic LOTE dominants, as well as White female students, reported higher teacher support scores, while Asian female students reported lower teacher support scores than White English-dominant male students.

Regarding math efficacy, White students from higher-SES families and Black female students reported higher math efficacy scores. In contrast, Black students from higher-SES families, Black LOTE dominants, and White female students tended to report lower math efficacy compared to White middle-class male students.

When examining math performance, White students with higher SES, along with Asian, Black, and Hispanic LOTE students, performed better than White middle-class, English-dominant students. Black and Hispanic males, White females, and White LOTE dominants displayed significantly lower performance compared to White males from middle-SES backgrounds and English-dominant groups. Additionally, Black and Hispanic students from higher-SES families showed lower math performance than White students from middle-SES families.

Another important finding was that Black LOTE-dominant students had lower math efficacy compared to White English-dominant students. As noted in prior research (Abedi & Herman, 2010; Cooke, 2019), linguistic and racial minority students face additional challenges in math classrooms, including the complexities of language learning. These challenges may explain the lower math efficacy observed in Black LOTE students. Interestingly, despite their lower math efficacy, Black LOTE students outperformed White English-dominant students. While some studies suggest that English learners struggle to perform well, our research shows that Black LOTE students maintained high performance levels.

Finally, the main outcome variable—math performance—confirmed the performance gap noted in prior research, with Black and Hispanic students performing lower than their White and Asian peers(Chang et al., 2015). Even students from high-SES families showed lower math performance than White middle-class students (Aikens & Barbarin, 2008). Notably, LOTE dominants in the Asian, Black, and Hispanic groups outperformed White English-dominant students, while White LOTE students performed worse than White English-dominant students. These findings challenge previous assumptions about the low performance of linguistic minority students (Sandilos et al., 2020), as they were able to surpass the performance levels of White English-dominant students.

6. References

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