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Article

Mathematics & Science Achievement in Texas Urban Schools: A Multilevel Multinomial Logistic Regression Analysis

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Abstract

In Texas urban schools, there has been a persistent gap in academic performance in mathematics and science. Discussions about student performance often overlook sociocultural factors contributing to these disparities. This study examines mathematics and science achievement in Texas urban schools using a multilevel multinomial logistic regression analysis and the conceptual framework of the opportunity gap. Data from the Texas Education Agency for the 2018-2019 school year was analyzed to examine relationships between student achievement and within- and between-school characteristics. The findings reveal significant disparities in science achievement (i.e., Biology) and mathematics achievement (i.e., Algebra I). Female students outperform males in Algebra I but underperform in Biology. Students eligible for free or reduced lunch (FRL) consistently underperform in both subjects. Course tracking also plays a critical role, with students on accelerated tracks showing higher achievement, while those in off-track courses are more likely to underperform. School-level factors, such as the proportion of FRL-eligible, Black, or Latinx students, further contribute to lower achievement outcomes across mathematics and science. These results highlight the need for targeted interventions, equitable resource allocation, and culturally responsive teaching practices to address persistent achievement gaps in urban education settings.

Keywords: mathematics achievement, science achievement, secondary education, urban education

Introduction

The Texas Education Agency (TEA) governs Texas public school education and oversees the state standardized assessments. The State of Texas Assessment and Academic Readiness (STAAR) and End of Course (EOC) exams are administered annually to all public school students in grades 3-12 (TEA, 2023) to measure mastery in core subjects. Not only are students evaluated by these exams, but STAAR and EOC outcomes also contribute to the school accountability ratings for Texas public schools. Lower accountability ratings can impact funding allocations, staffing, intervention programs, and public perception (Carnoy & Loeb, 2002). For example, a recent state take-over of a school district based on student academic achievement occurred in 2023 in Houston Independent School District (ISD; Mendez, 2023). Houston ISD has shown low academic achievement compared to the state average, specifically for mathematics and science (TAPR, 2023). In 2022, students enrolled in Houston ISD exhibited an average performance deficit of 7.5% and 8.5% on the Algebra I and Biology EOCs, respectively, compared to the statewide mean scores (TAPR, 2023). However, conversations related to education and achievement must include considerations of the socio, cultural, historical, spatial, and temporal factors that offer context as to why achievement for students has and continues to be different (Ladson-Billings, 2006).

According to the most recent U.S. Census Report (2020), roughly 80% of the United States population lives in or adjacent to an urban area. Texas is the fifteenth most urban state, with roughly 84% of the population living in urban areas (Brannen, 2023). Students in urban schools often face disproportionately high poverty rates and may face barriers to accessing educational resources and support (Boutte, 2012). Moreover, urban schools typically serve diverse student populations, with significantly higher numbers of Latinx and Black students (McKenzie et al., 2011). Given the rapid growth of urban schools in Texas, it is imperative that researchers re-examine the school-level factors that moderate students' mastery levels in science and mathematics achievement to account for opportunity gaps. Mathematics and science achievement impacts not only the trajectory of individual students, but also the trajectory of schools in Texas. This study aims to further examine the nuances of science and mathematics achievement in urban schools. More specifically, in this study, we examine the relationship between student achievement and *within-/between-*urban school characteristics in Texas. To examine variance in science and mathematics achievement within and between schools, we employ a multilevel multinomial logistic regression using data from the Texas Education Agency (TEA) from the 2018-2019 school year to address the research question: *What are the log odds of students demonstrating grade-level mastery in mathematics and science in urban schools accounting for within- and between-school characteristics?*

Literature Review

Student mathematics and science achievement is affected by student and school level characteristics (Bae et al., 2021; Petty et al., 2013). In this study, we examine the effects of student and school level characteristics within urban schools in Texas. In the following sections, we first situate the study in the context of urban education and then describe prior research on students' mathematics and science achievement.

Urban Education

Mathematics Achievement & Urban Schools

Urban education is a nebulous construct that is often described with deficit rhetoric and is multifaceted (Welsh & Swain, 2020). *Urban* has been used to indicate under performance (Welsh & Swain, 2020), and to perpetuate stereotypes of marginalized groups (Jacobs, 2015; Lankford et al., 2002; Milner, 2012). However, there is heterogeneity of urban schools with a variety of assets and achievements (Welsh & Swain, 2020). For instance, Welsh and Swain (2020) posit that urban education is a continuum of conditions: 1) *characteristics*, 2) *challenges*, and 3) *context*.

Characteristics describes the school and student body. Urban schools may be located in densely populated areas (Knox & McCarthy, 2011), have high enrollment numbers, and include a range of marginalized students (Welsch & Swain, 2020). Students from marginalized communities (e.g., Black, Latinx) are more likely to receive disciplinary action (Vincent et al., 2012) and more harsh disciplinary action than their White classmates (Anyon et al., 2014). For example, Black girls are disciplined at higher rates than their peers (Government Accountability Office, U. S. 2018; Williams et al., 2022a). However, research on school discipline and Black girls has highlighted that there is no correlation between Black girls enacting more deviant behaviors than their peers (Hines-Daitiri & Carter Andrews, 2020) as most of the discipline infractions include non-violent incidents pertaining only to student disposition (Wun, 2016). While school discipline is not unique to urban schools, the effects are more consequential as disciplinary actions (e.g., suspensions) due to hyper-(re)segregation (Williams, 2024).

Further, urban schools face *challenges* such as qualified teacher retention (Berry et al., 2021; Ronfeldt, 2013) and funding (Martin et al., 2022) on a larger scale than schools in rural and suburban areas (Truscott & Truscott, 2005). Moreover, Ingersoll (2008) found that access to qualified teachers in urban characteristic schools varies by subject (e.g., mathematics, science). Students attending a school with a high percent of Black or Latinx students were more likely to have a mathematics teacher with no mathematics background compared to students attending a school with a low percent of Black or Latinx students (Ingersoll, 2008). Furthermore, students who attend schools with high percentages of students qualifying for free and reduced lunch and high percentages of students of color are three to ten times more likely to have uncertified and under qualified teachers (i.e. teaching outside of their field; Castro et al., 2018). Teacher retention and qualifications have been identified as critical to student achievement in urban schools (e.g., Isenberg et al., 2022; Ronfeldt et al., 2023).

Lastly, urban schools exist in the *context* of economic and social factors that have drawn immigration (Welsh & Swain, 2020). In Texas, economic opportunities surrounding energy have played a vital role in the growth of urban areas (Guo & Zhang, 2023). Williams and colleagues (2022b) found within urban areas in the Houston metropolitan area (e.g., Spring ISD) family income within school districts was segregated by artificial barriers (e.g., highways). For example, in Spring ISD, families living below the Cypress Creek Parkway (FM 1960) had a median income bracket of $38,000 to $60,000, while families living above FM 1960 had a higher median income by $2,000 to $60,000 (Williams et al., 2022b). This continuum of conditions of urban schools lends to examining academic achievement as a product of opportunities.

Mathematics Achievement & Urban Schools

In K-12 schools, math achievement is significantly influenced by factors at both the student and school levels (Petty et al., 2013). Research indicates that taking Algebra I before high school is associated with higher mathematics achievement (Lee & Maro, 2021). However, mathematics remains one of the most tracked subjects in PK-12 schools (Loveless, 2013; Tyson, 2013), often marginalizing certain student groups. Studies have shown that early enrollment in Algebra I leads to higher mathematics achievement, but these accelerated tracks tend to contain disproportionately lower representation of students from lower socio-economic status (SES) and students of color compared to those who take Algebra on the standard schedule or later (Batruch et al., 2019; Irizarry, 2021). In addition to tracking, economic status has been found to influence mathematics achievement, even in advanced settings, but its impact varies from school to school (Schreiber, 2002). Specifically, there is a clear relationship between economic disparities and success in mathematics. Davenport and Slate's (2019) study of third-grade students in Texas demonstrated that as socioeconomic status decreased, performance on the third-grade state assessment also declined. This trend underscores the pervasive influence of economic inequities on educational outcomes. Addressing these disparities requires more targeted interventions and support for students form low-income households. Historically, research has shown that students of color and low SES students have lower math achievement rates (Tate, 1997; Gonzalez et al., 2020). Furthermore, mathematics achievement in urban schools is influenced by factors and challenges often unique to these schools.

Biological sex has also been identified as a student level factor affecting mathematics achievement. Studies have shown that gender differences in mathematics performance can emerge as early as elementary schools, with boys often outperforming girls in standardized testing (Hyde, 2014). While it is documented that boys perform better on standardized tests, Voyer and Voyer's (2014) study noted that on average girls outperform boys in overall achievement and grades in mathematics. Moreover, research also suggests that over time, the gender gap narrows or even reverses as girls receive more support and encouragement in their mathematical education (Hyde & Mertz, 2009). This evolving trend is supported by Quest et al.'s (2010) meta-analysis, which concluded that there were small to no differences in the mean gender difference in mathematics achievement on the Trends in International Mathematics and Science Study (TIMSS). The same study also analyzed Program for International Student Assessment (PISA) data and found that boys did outperform girls but only with an small overall effect size ($d = 0.11$; Quest et al., 2010). As the understanding of gender differences in mathematics achievement continues to evolve, more research is necessary to continue the analysis.

Discipline is another student-level factor that influences mathematics achievement often in urban schools. Research has shown that students of color, particularly Black and Latinx students, are more likely to receive harsher disciplinary actions, such as suspensions, compared to their White peers (Ibrahim & Johnson, 2020; Skiba et al., 2011). This disproportionate use of discipline removes students from the classroom which leads to lost classroom time and can negatively influence their academic growth (Gregory et al., 2010). In Ibrahim and Johnson's (2020) study on the relationship between suspensions and mathematics outcomes, they highlighted the adverse effects of suspensions on mathematics performance, particularly for racially diverse groups of students. Ibrahim and Johnson (2020) not only provide insights into the disproportionate suspension rates among these groups but also underscore the need for new discipline policies to mitigate the lasting impacts on mathematics learning. Collectively, these student-level factors highlight the complex interplay between disciplinary practices, SES, tracking, and biological sex, all which significantly effect mathematics achievement.

In addition to student factors, research shows that school-level factors, such as teacher effectiveness, school locations, school size, and resources, also predict mathematics achievement (Ramirez et al., 2018; Schreiber, 2002; Tomul et al., 2021). A comparative study using TIMSS data from the United States and Australia found significant variance in mathematics achievement at the classroom and school levels (Lamb & Fullarton, 2010). When controlling for student-level factors, a hierarchical linear model showed that there was significant variance in achievement at the classroom and school levels. Key factors included teacher tenure, teacher practices, school size, class size, mean SES, and time spent on math (Lamb & Fullarton, 2010). Notably, in the

United States, the data analysis indicated that increased teacher tenure positively correlated with student math achievement. Additionally, in a study using the PISA data, Forgasz and Hill's (2013) analysis found that students from higher SES backgrounds who attended metropolitan schools scored higher than those in non-metropolitan schools, linking school type directly to student SES. These findings underscore the importance of school-level factors in influencing student mathematics achievement, highlighting the need for further analysis of these school-level factors. Furthermore, school-level factors intensify challenges in urban schools (Dolph, 2017), including larger class sizes, limited resources, and frequent teacher turnover (McKenzie et al., 2011). Research has shown that larger urban schools in Texas experience higher rates of teacher and administrator turnover, which contributes to instability in educational environments (Ingersol & Perda, 2009; McKenzie et al., 2011). These factors create additional hurdles that can impede students' mathematics achievement.

Science Achievement & Urban Schools

In K-12 school settings, student academic achievement in science is widely affected by both student- and school-level factors (Bae et al., 2021). For example, Sun et al. (2012) revealed that at the student level, student biological sex, SES, motivation, self-efficacy, and parental education and involvement affected student achievement in science. That is, male students, those from high SES backgrounds, students with higher motivation and self-efficacy, and those whose parents place a high value on science are more likely to excel in science. Furthermore, science achievement is also associated with whether students are placed in more advanced teaching and learning environments. For instance, Venville & Oliver (2015) examined the effects of a cognitive acceleration program on science students in an academically selective high school. The results showed that the science cognitive acceleration program not only resulted in student cognitive improvements, but also positively influenced students' science achievement. Students who participated in the cognitive acceleration program demonstrated higher levels of understanding and performance in science compared to their peers who did not participate in the program. Judson (2017) examined science growth and achievement of students who enrolled in science advanced placement (AP) courses and found that there were notable differences in performance based on demographics such as race/ethnicity, socioeconomic status, and biological sex. For instance, underrepresented minority students and those from lower SES backgrounds tend to have lower scores on AP science exams compared to their peers. This highlights ongoing equity issues in education, where access to high-quality preparation and resources is not uniformly distributed. In addition, science achievement can also be severely affected by disciplinary referrals. Wang et al. (2023) investigated the effects of exclusionary discipline on students' science engagement and achievement over the course of a school year. The study revealed that higher rates of suspensions for minor infractions were associated with lower science achievement. This negative impact is partly due to decreased overall student engagement and the creation of a disruptive learning environment in classrooms with frequent suspensions.

At the school level, differences in science achievement can be attributed to factors such as school enrollment size, quality of science teachers and science curriculum, the socioeconomic composition of the student body, and the amount of instructional time dedicated to science each week (Sun et al., 2012; Tatar et al., 2016). In addition, a much recent study by Lee and Ha (2024) echoed previous findings, when examining the factors affecting science achievement among middle school students pre- and mid-COVID-19 interruptions , they found that student-level factors, such as self-efficacy, the affective domain of science learning (e.g., self-confidence in science, value recognition of science, interest, motivation), and self-study time, consistently had significant impacts on science achievement over the years. In contrast, school-level factors, including principal supervision, school climate, and science teacher efficacy, showed significantly positive effects on science achievement specifically in 2020, following the COVID-19 interruptions. That said, both student- and level-factors play a crucial role in influencing science achievement in K-12 settings. While individual attributes such as self-efficacy, motivation, and parental involvement consistently impact student performance, school-level elements like principal supervision, school climate, and teacher efficacy have shown particularly significant effects during disruptive periods, such as the COVID-19 pandemic.

Studies on urban science education highlight a myriad of factors that contribute to disparities in students' science achievement in urban schools. At the student level, race/ethnicity and SES were significant determinants. Lower-income and minority students often faced barriers such as limited access to resources and lack of parental involvement, which contributed to lower science achievement (Ruby, 2006). Moreover, Black students frequently encountered negative stereotypes questioning their potential success in science, which adversely affected their self-efficacy and academic performance (Brand et al., 2006). Furthermore, school-level factors are equally critical. These include the quality of science teachers and instruction, sources of school funding, teacher attrition rates, the science curriculum, and professional development opportunities for educators (Ingersoll & Perda, 2010; Tobin et al., 2005). Proweller and Mitchener (2004) argued that many urban science teachers lacked both robust science content knowledge and cultural competence. Even teachers with strong content knowledge often struggled to bridge cultural divides, which could undermine effective science teaching (Emdin, 2010). To enhance student learning, science teachers in urban settings are often encouraged to adopt sociocultural theories and culturally responsive teaching practices. Implementing these approaches could significantly improve student engagement and achievement in science. Research has shown that culturally relevant and contextually appropriate teaching methods were crucial for better science education outcomes, particularly for students from diverse urban backgrounds. Engaging students in science activities that were meaningful to their lives could lead to improved academic performance (Parsons, 2008; Rivera Maulucci et al., 2014; Upadhyay et al., 2017; Warren & Rosebery, 2008; Yu, 2022). Unfortunately, urban schools with high percentages of minority and low-income students experienced high rates of teacher attrition (Ingersoll & Perda, 2010). Many teachers left the profession due to stress and burnout, which affected their mental health and job performance, exacerbating the issue of high turnover (Camacho et al., 2021). Stress from insufficient social-emotional support in urban schools was linked to poorer student outcomes (Elliott et al., 2024; Herman et al., 2018). Addressing these multifaceted challenges requires a holistic approach that enhances the quality of science education and provides supportive environments for both students and teachers in urban schools.

The Present Study

Thus, our study further examines mathematics and science achievement through a multilevel multinomial analysis of Texas EOC exams (i.e., Algebra I, Biology) in urban schools. We use Welsch and Swain's (2020) continuum of urbanicity to frame our analysis in regard to *characteristics, challenges,* and *context* of urban school mathematics and science achievement in Texas to answer the research question: *What are the log odds of students demonstrating grade-level mastery in mathematics and science in urban schools accounting for within- and between-school characteristics?*

Method

Sample

This study utilized TEA data from the 2018-2019 school year. This sample includes students from n = 1,205 urban schools in Texas (see Table 1).

Table 1
Student Demographics

	Algebra I		*Biology*	
Characteristic	*N*	*Percent*	*N*	*Percent*
Overall	168,471	100.00	161,111	100.00
Biological Sex				
Female	80,877	48.01	78,452	48.69
Male	87,594	51.99	82, 657	51.31
Race				
Asian	6,985	4.15	7,008	4.35
Black	23,801	14.13	22,120	13.73
Latinx	105,777	62.79	100,511	62.39
Other	3,722	2.21	3,746	2.33
White	28,186	16.73	27,726	17.21
Grade				
6th	43	0.03	16	0.01
7th	4,017	2.38	145	0.10
8th	46,013	27.31	3,467	2.15
9th	105,384	62.55	132,715	82.38
10th	9,140	5.43	18,484	11.47
11th	2,878	1.71	4,958	3.08
12th	990	0.59	1,314	0.82
FRL Status	110,937	65.90	104,270	64.80

**Note.* FRL = free-or-reduced lunch

Measures

Mathematics and science achievement were measured in the May administration in the State of Texas Assessment of Academic Readiness End of Course Exams (STAAR EOC) for Algebra I and Biology. Table 2 describes the two assessments. These standardized exams test students over state content standards (Texas Essential Knowledge and Skills; TEKS). Student exam scores are categorized into four outcomes: 1) does not approach grade level, 2) approaches grade level, 3) meets grade level, and 4) masters grade level. The passing standard for EOC exams is set at approaches grade level (i.e., Algebra I, 39%, Biology, 40%). Students who score in the *does not approach grade level* category, must re-take the exam.

Table 2

Algebra I & Biology EOC Exams

Exam	*Algebra I*	*Biology*
No. Items	54	50
Does Not Approach Grade Level	0-20 items correct	0-19 items correct
Approaches Grade Level*	21-32 items correct	20-29 items correct
Meets Grade Level**	33-40 items correct	30-40 items correct
Masters Grade Level	41-54 items correct	41-50 items correct

Note. * = passing standard, ** = reference standard

Variables

Dependent Variables

The categorical dependent variable for mathematics and science achievement represents the Algebra I and Biology EOC assessment outcome. *Meets grade level* is the reference outcome and represents a student fulfilling the criteria of 33-40 items correct for the Algebra I EOC (i.e., 61-74%) or 30-40 items correct for the Biology EOC (i.e., 60-80%). The relative risk of scoring *does not approach, approaches, and masters grade level* are compared relative to *meets grade level*.

Independent Variables

This study examines student and school-level characteristics to determine the relative risks of mathematics and science achievement in urban schools. Using TEA enrollment data from the 2018-2019 school year, we created the student variables of biological sex, race, course track, and FRL status. More specifically, we examine the log odds of mathematics and science achievement for female, Black, Latinx, and FRL-eligible students. Further, we examine the effect of course track (i.e., accelerated, off-track). Students who are on the accelerated track take the Algebra I and/or Biology EOC exams before 9th grade. Students who take the Algebra I and/or the Biology EOC exams after 9th grade were classified as off-track. Using TEA school discipline data, we created a discipline variable to reflect if students received a discipline referral in the 2018-2019 school year. To capture school-level characteristics, we used TEA teacher data to create variables to reflect the proportion of Black and Latinx teachers as well as years of experience and tenure. Teacher variables were merged to the student data using the unique scrambled district and scrambled school identification numbers.

Analysis

This study used multilevel multinomial logistic regression analyses of science and mathematics achievement using Biology and Algebra I EOC scores (e.g., meets, masters). A multilevel multinomial logistic regression approach is appropriate for nested data with more than two categorical outcomes (Rabe-Hesketh & Skrondal, 2012; Raudenbush & Byrk, 2002). This is appropriate for estimating the relative risk ratios for students in urban schools to score within the categories: does not approach, approaches, meets grade level, and masters grade level. We used Stata 18.0's mlogit command paired with the clustering command (i.e., vce(cluster)) to create a two-level model with level one within school factors and level two between school factors. Guided by O'Connell and McCoach's (2008) recommendations for model building, we first added within-school, level-one predictors (e.g., the proportion of female students group mean centered), then added school predictors at level two (e.g., the proportion of female students grand mean centered). For this analysis, we do account for nesting with the clustering command. The following represents the full, conditional model:

$$log[\frac{\varphi_{mi}}{\varphi_{Mij}}] = \gamma_{00(m)} + \gamma_{01(m)}(female_{gmc}) + \gamma_{02(m)}(Blkstu_{gmc}) + \gamma_{03(m)}(Latstu_{gmc}) + \gamma_{04(m)}(FRL_{gmc}) + \gamma_{05(m)}(acc_{gmc}) + \gamma_{06(m)}(off_{gmc}) + \gamma_{07(m)}(disc_{gmc}) + \gamma_{08(m)}(exp_{gmc}) + \gamma_{09(m)}(tenure_{gmc}) + \gamma_{010(m)}(Blktch_{gmc}) + \gamma_{011(m)}(Lattch_{gmc}) + \gamma_{10(m)}(female_{cwc}) + \gamma_{20(m)}(Blkstu_{cwc}) + \gamma_{30(m)}(Latstu_{cwc}) + \gamma_{40(m)}(FRL_{cwc}) + \gamma_{50(m)}(acc_{cwc}) + \gamma_{60(m)}(off_{cwc}) + \gamma_{70(m)}(disc_{cwc}) + u_{0j(m)}$$

where the outcome at level one is the log-odds of mathematics/science achievement (i.e., does not approach, approaches, and meets grade level) relative to *M,* meets grade level (Raudenbush & Byrk, 2002). The intercept $\gamma_{00(m)}$ is the unadjusted average mathematics/science achievement log odds across urban schools.

Within School Predictors

At level-one, within-school predictors are group-mean centered (i.e., cwc) to represent the average expected difference in log odds for students within schools. The first level-one predictor, $\gamma_{10(m)}$, represents the expected difference in log odds of mathematics and science achievement between female and male students. Similarly, $\gamma_{20(m)}$ and $\gamma_{30(m)}$ represent the expected change in log-odds of mathematics/science achievement for Black and Latinx students. The next predictor $\gamma_{40(m)}$ represents the difference in log odds for mathematics/science achievement for students eligible for FRL and those not eligible for FRL. Further, the predictors $\gamma_{50(m)}$ and $\gamma_{60(m)}$ represent the expected change in log-odds in mathematics/science achievement for students who are accelerated and off-track. The predictor $\gamma_{70(m)}$ represents the expected difference in log odds in mathematics/science achievement for having a discipline referral.

Between School Predictors

At level two, between-school predictors are grand-mean centered (i.e., gmc) to represent the expected change in log odds in urban school mathematics/science achievement. For example, $\gamma_{01(m)}$ represents the expected difference log-odds of mathematics/science achievement for an all-female school compared to a school with an all-male school. The predictors $\gamma_{02(m)}$ and $\gamma_{03(m)}$ represent the expected change in log-odds based on the change of the proportion of Black and Latinx students in a school. The next predictor $\gamma_{04(m)}$ represents the expected change in the school mathematics/science achievement log odds for the change of the proportion of students eligible for FRL. Further, the predictors $\gamma_{05(m)}$ and $\gamma_{06(m)}$ represent the expected change in school log-odds in mathematics/science achievement for the change in the proportion of students taking accelerated and off-track mathematics and sciences courses. The predictor $\gamma_{07(m)}$ represents the expected difference in log odds in school mathematics/science achievement for a change in the proportion of students with discipline referrals. Lastly, between schools the effects of teachers are described by experience ($\gamma_{80(m)}$), tenure ($\gamma_{90(m)}$), and race (i.e., Black teachers $\gamma_{100(m)}$, Latinx teachers $\gamma_{110(m)}$). Teacher experience and tenure are grand-mean centered to represent to change in log-odds in school mathematics/science achievement for a change in teacher experience/tenure relative to the mean across urban schools. The predictors $\gamma_{010(m)}$ and $\gamma_{011(m)}$ represent the change in log odds in school mathematics/science achievement for a change in the proportion of Black and Latinx teachers in the school.

Results

Table 3 includes descriptive statistics for the sample. The majority of urban school students scored within the *masters grade level* category (i.e., 37%) on the Algebra I EOC, while the majority of urban school students scored within the *meets grade level category* (i.e., 36%) for Biology.

Table 3
Descriptive Statistics Across Urban Schools in Texas

Factor	***Algebra I***		***Biology***	
	N	*M(SD)*	*N*	*M(SD)*
School Averages	1,205	-	833	-
Does Not Approach Grade Level	1,205	0.19(0.39)	833	0.21(0.41)
Approaches Grade Level	1,205	0.17(0.38)	833	0.26(0.44)
Meets Grade Level	1,205	0.20(0.40)	833	0.29(0.45)
Masters Grade Level	1,205	0.45(0.50)	833	0.24(0.43)
Proportion of Female Students	1,205	0.49(0.37)	833	0.47(0.33)
Proportion of Black Students	1,205	0.15(0.18)	833	0.15(0.18)
Proportion of Latinx Students	1,205	0.63(0.27)	833	0.62(0.27)
Proportion of Students Eligible for FRL	1,205	0.68(0.38)	833	0.68(0.35)
Proportion of Students Taking Acc-Track	1,205	0.48(0.49)	833	0.25(0.42)
Proportion of Students Taking Off-Track	1,205	0.10(0.23)	833	0.15(0.26)
Proportion of Students with Discipline Referrals	1,205	0.27(0.24)	833	0.25(0.24)
Average Teacher Experience	1,191	10.00(6.00)	823	10.22(6.19)
Average Teacher Tenure	1,191	6.76(5.06)	823	6.97(5.07)

Proportion of Black Teachers	1,205	0.17(0.25)	833	0.16(0.24)
Proportion of Latinx Teachers	1,205	0.29(0.31)	833	0.28(0.30)

Interpreting Log Odds & Relative Risk Ratios

Results from the unconditional model are shown in Table 4. Log odds and relative risk ratios (RRR) are reported for each mathematics/science achievement outcome. A positive coefficient (*B*) indicates that as the predictor increases, the log odds of being within the outcome category, *m* (e.g., approaches grade level), relative to the reference category, increase. Similarly, if a RRR is greater than 1, this indicates a higher risk of students scoring within the outcome categories (i.e., *does not approach, approaches, and masters grade level*) (Rabe-Hesketh & Skrondal, 2012). Further, if a coefficient (*B*) is less than 0, as the predictor decreases, the log odds of the outcome category *m* decrease relative to the reference category (i.e., *meets grade level*). A RRR of less than 1 indicates a decreased risk of students not scoring within the *meets grade level category*. A coefficient (*B*) of 0 and a RRR equal to 1 indicate no effect of the predictor variable on the outcome.

Unconditional Models

Results from the unconditional models for Algebra I and Biology are included in Table 4. Compared to the outcome of *meets grade level*, there were statistically significantly lower unadjusted log odds for being within the *masters grade level* category. Across each alternative Biology achievement level (i.e, does not approach, approaches, and masters grade level), there were statistically significantly lower unadjusted log odds for being within the *meets grade level category.*

Table 4
Results from the Unconditional Multilevel Multinomial Logistic Regression Models

	Algebra I		
Intercept	***B(Robust SE)***	***RRR***	***95%CI RRR LL, UL***
Does Not Approach Grade Level	-0.04(0.04)	0.96	0.88, 1.05
Approaches Grade Level	-0.00(0.02)	1.00	0.96, 1.05
Masters Grade Level	0.56(0.03)***	1.75	1.65, 1.87
	Biology		
Intercept	***B(Robust SE)***	***RRR***	***95%CI RRR LL, UL***
Does Not Approach Grade Level	-0.82(0.04)***	0.44	0.40, 0.48
Approaches Grade Level	-0.35(0.02)***	0.70	0.67, 0.74
Masters Grade Level	-0.42(0.04)***	0.65	0.61, 0.71

Conditional Models

Results from the conditional model for mathematics achievement (i.e., Algebra I) is shown in Table 5. Results for science achievement (i.e., Biology) is shown in Table 6. We outline the following sections by content area (i.e., mathematics, science) and by achievement outcome (i.e., does not approach, approaches, and masters grade level).

Table 5

Results from the Conditional Multilevel Multinomial Logistic Regression Models

	Algebra I Achievement																	
	Does Not Approach Grade Level						Approaches Grade Level						Masters Grade Level					
	B	Robust SE	p	RRR	95% CI RRR		B	Robust SE	p	RRR	95% CI RRR		B	Robust SE	p	RRR	95% CI RRR	
Factor					LL	UL					LL	UL					LL	UL
Intercept	0.23	0.10	0.031	1.25	1.02	1.54	0.16	0.04	0.00	1.18	1.09	1.27	0.18	0.04	0.00	1.19	1.10	1.29
Within Schools																		
Female Students (cwc)	-0.50	0.02	0.000	0.61	0.58	0.63	-0.15	0.02	0.00	0.86	0.83	0.89	0.12	0.01	0.00	1.13	1.10	1.17
Black Students (cwc)	0.01	0.04	0.745	1.01	0.94	1.08	0.00	0.03	0.98	1.00	0.94	1.06	-0.01	0.03	0.81	0.99	0.94	1.05
Latinx Students (cwc)	0.01	0.03	0.840	1.01	0.95	1.06	-0.02	0.03	0.44	0.98	0.93	1.03	-0.01	0.02	0.48	0.99	0.95	1.03
Students Eligible for FRL (cwc)	0.18	0.04	0.000	1.20	1.11	1.29	0.15	0.02	0.00	1.16	1.11	1.22	-0.27	0.02	0.00	0.76	0.73	0.80
Students taking Acc-Trak A1 (cwc)	-0.65	0.29	0.025	0.52	0.30	0.92	-0.17	0.14	0.24	0.84	0.64	1.12	0.50	0.15	0.00	1.65	1.23	2.21
Students taking Off-Track A1 (cwc)	2.48	0.08	0.000	11.89	10.25	13.78	1.25	0.06	0.00	3.48	3.10	3.91	-0.90	0.07	0.00	0.41	0.35	0.47
Students Recieving Discipline Referrals (cwc)	1.13	0.03	0.000	3.09	2.90	3.31	0.51	0.02	0.00	1.67	1.59	1.75	-0.71	0.03	0.00	0.49	0.46	0.52
Between Schools																		
Proportion of Female Students (gmc)	-0.61	0.18	0.000	0.54	0.38	0.76	-0.29	0.08	0.00	0.75	0.65	0.87	0.22	0.08	0.01	1.24	1.06	1.45
Proportion of Black Students (gmc)	-0.46	0.54	0.395	0.63	0.22	1.82	-0.13	0.25	0.61	0.88	0.54	1.43	-0.68	0.28	0.01	0.50	0.29	0.87
Proportion of Latinx Students (gmc)	-0.79	0.33	0.016	0.45	0.24	0.86	-0.35	0.16	0.04	0.71	0.51	0.98	-0.11	0.18	0.55	0.90	0.64	1.27
Proportion of Students Eligible for FRL (gmc)	0.41	0.21	0.052	1.51	1.00	2.29	0.38	0.11	0.00	1.47	1.18	1.82	-0.39	0.09	0.00	0.68	0.57	0.80

Proportion of Students taking Acc-Trak A1 (gmc)	-0.61	0.17	0.000	0.54	0.39	0.77	-0.50	0.06	0.00	0.61	0.54	0.69	1.03	0.06	0.00	2.80	2.48	3.15
Proportion of Students taking Off-Track A1 (gmc)	3.68	0.29	0.000	39.75	22.61	69.87	1.84	0.18	0.00	6.28	4.45	8.86	-1.59	0.25	0.00	0.20	0.13	0.33
Proportion of Students Receiving Discipline Referrals (gmc)	-0.22	0.21	0.290	0.80	0.53	1.21	0.01	0.12	0.94	1.01	0.80	1.27	-0.24	0.15	0.10	0.78	0.59	1.04
Average Teacher Experience (gmc)	0.02	0.01	0.094	1.02	1.00	1.05	0.01	0.01	0.20	1.01	0.99	1.03	-0.01	0.01	0.12	0.99	0.97	1.00
Average Teacher Tenure (gmc)	-0.04	0.02	0.041	0.96	0.93	1.00	-0.02	0.01	0.02	0.98	0.96	1.00	0.03	0.010	0.00	1.03	1.02	1.05
Proportion of Black Teachers (gmc)	0.24	0.26	0.340	1.28	0.77	2.11	0.08	0.15	0.59	1.08	0.81	1.45	0.17	0.15	0.26	1.19	0.88	1.60
Proportion of Latinx Teachers (gmc)	-0.15	0.21	0.496	0.86	0.57	1.31	-0.11	0.11	0.30	0.90	0.73	1.10	0.15	0.12	0.22	1.16	0.91	1.47

Biology Achievement

	Does Not Approach Grade Level						***Approaches Grade Level***						***Masters Grade Level***					
	B	***Robust SE***	***p***	***RRR***	***95% CI RRR***		***B***	***Robust SE***	***p***	***RRR***	***95% CI RRR***		***B***	***Robust SE***	***p***	***RRR***	***95% CI RRR***	
Factor					***LL***	***UL***					***LL***	***UL***					***LL***	***UL***
Intercept	-1.89	0.15	0.000	0.70	0.67	0.73	-0.64	0.08	0.00	0.97	0.94	1.00	-0.67	0.08	0.00	0.86	0.84	0.89
Within Schools																		
Female Students (cwc)	-0.36	0.02	0.000	1.04	0.97	1.11	-0.03	0.01	0.03	1.03	0.97	1.09	-0.15	0.02	0.00	1.04	0.99	1.10
Black Students (cwc)	0.04	0.03	0.294	1.00	0.95	1.05	0.03	0.03	0.30	1.00	0.96	1.04	0.04	0.03	0.11	1.01	0.97	1.04
Latinx Students (cwc)	0.00	0.03	0.959	1.93	1.78	2.09	0.00	0.02	1.00	1.58	1.50	1.65	0.01	0.02	0.70	0.53	0.50	0.55
Students Eligible for FRL (cwc)	0.66	0.04	0.000	0.52	0.24	1.13	0.45	0.02	0.00	0.78	0.50	1.23	-0.64	0.02	0.00	1.34	0.88	2.04
Students taking Acc-Track Bio (cwc)	-0.66	0.40	0.096	6.88	5.99	7.89	-0.24	0.23	0.29	2.68	2.46	2.93	0.29	0.22	0.18	0.58	0.48	0.71

Students taking Off-Trak Bio (cwc)	1.93	0.07	0.000	3.90	3.63	4.18	0.99	0.04	0.00	2.26	2.16	2.36	-0.54	0.10	0.00	0.35	0.33	0.38
Students Recieving Discipline Referrals (cwc)	1.36	0.04	0.000	0.54	0.40	0.73	0.81	0.02	0.00	0.87	0.74	1.02	-1.04	0.04	0.00	0.83	0.66	1.04
Between Schools																		
Proportion of Female Students (gmc)	-0.62	0.15	0.000	3.28	1.66	6.49	-0.14	0.08	0.09	2.17	1.45	3.26	-0.19	0.12	0.10	0.26	0.14	0.48
Proportion of Black Students (gmc)	1.19	0.35	0.001	1.79	1.18	2.73	0.78	0.21	0.00	1.35	1.04	1.75	-1.34	0.31	0.00	0.45	0.32	0.64
Proportion of Latinx/Hispanic Students (gmc)	0.58	0.22	0.007	2.83	2.04	3.92	0.30	0.13	0.02	2.01	1.66	2.43	-0.79	0.17	0.00	0.44	0.34	0.57
Proportion of Students Eligible for FRL (gmc)	1.04	0.17	0.000	0.08	0.04	0.15	0.70	0.10	0.00	0.33	0.24	0.45	-0.82	0.13	0.00	2.49	1.89	3.29
Proportion of Students taking Acc-Track Bio (gmc)	-2.52	0.30	0.000	9.43	5.83	15.26	-1.12	0.16	0.00	4.18	3.06	5.70	0.91	0.14	0.00	0.36	0.21	0.61
Proporion of Students taking Off-Trak Bio (gmc)	2.24	0.25	0.000	0.83	0.60	1.14	1.43	0.16	0.00	0.99	0.81	1.20	-1.03	0.28	0.00	0.75	0.55	1.01
Proportion of Students Recieving Discipline Referrals (gmc)	-0.18	0.16	0.257	1.00	0.98	1.02	-0.01	0.10	0.88	1.00	0.99	1.01	-0.29	0.16	0.06	0.99	0.98	1.01
Average Teacher Experience (gmc)	0.00	0.01	0.889	0.98	0.95	1.01	0.00	0.01	0.85	0.99	0.97	1.01	-0.01	0.01	0.55	1.02	1.00	1.05
Average Teacher Tenure (gmc)	-0.02	0.02	0.296	2.13	1.47	3.10	-0.01	0.01	0.17	1.33	1.07	1.66	0.02	0.01	0.07	1.01	0.65	1.57
Proportion of Black Teachers (gmc)	0.76	0.19	0.000	1.31	0.93	1.84	0.29	0.11	0.010	1.25	1.06	1.49	0.01	0.22	0.96	0.73	0.60	0.90
Proportion of Latinx/Hispanic Teachers (gmc)	0.27	0.17	0.122	0.15	0.11	0.20	0.23	0.09	0.01	0.53	0.45	0.61	-0.31	0.10	0.00	0.51	0.44	0.59

Mathematics Achievement: Algebra I

Based on the likelihood ratio chi-square test [LR (54) = 5,961.97, $p < 0.001$], the conditional model is a better fit for Algebra I achievement. Further, an improvement in model fit statistics from the unconditional model was demonstrated (AIC = 395883.4, BIC = 396455.3).

Does Not Approach Grade Level

The first possible outcome for mathematics and science achievement was *does not approach grade level* compared to *meets grade level* (see Table 5). *Does not approach grade level* represents not meeting the minimum passing level of achievement on the Algebra IEOC exam.

Compared to the outcome of *meets grade level* for the Algebra I EOC, there were statistically significantly higher unadjusted log odds for average mathematics achievement in urban schools for *does not approach grade level* (B = 0.23, $p < 0.05$). Female students were expected to have a statistically significant decrease in log odds of 0.50 ($p < 0.001$) and were less likely to *not approach grade level* in Algebra I achievement compared to male students (i.e., 0.23 -0.50 = -0.27). Accounting for all other predictors, a student who was eligible for FRL had a statistically significant difference in the log odds of scoring *does not approach grade level* than students who were not eligible for FRL (B = 0.18, $p < 0.00$). Students who were eligible for FRL had an expected log odds of 0.41 (i.e., 0.23 + 0.18 = 0.41) and were more likely to score *does not approach grade level* than *meets grade level.* Course track (i.e., accelerated, off-track) were statistically significant predictors of mathematics achievement. Students on the accelerated track (B = -0.65, $p < 0.05$) were statistically significantly less likely to score within the *does not approach grade level* than *meets grade level* compared to students on the standard track (i.e., taking Algebra I in 9th grade) with an expected log odds of -0.42 (i.e., 0.23 - 0.65 = -0.42). Whereas students in the off track had a statistically significant expected increase (B = 2.48, $p <$ 0.001) in the log odds of scoring within the *does not approach grade level* category compared to students in standard track Algebra I. Students in off-track Algebra I were more likely to score within the *does not approach grade level* category than *meets grade level* with a log odds of 2.71 (i.e., 0.23 + 2.48 =2.71). Further, students who received a discipline referral (B = 1.13, $p <$ 0.001) had a statistically significant log odds of 1.36 (i.e., 0.23 + 1.13 = 1.36) of scoring within the *does not approach grade level category*.

Between urban schools, for a 10% increase in the proportion of female students there was an expected statistically significant decrease of 0.061 (i.e., B = -0.61, $p < 0.001$, $\frac{0.61}{10} = 0.061$) in the log odds of average school Alegbra 1 achievement falling within the *does not approach* category compared to *meets grade level.* Urban schools with a proportion 10% above the grand mean of proportion of female students have an expected logg odds for *does not approach grade level* of approximately 0.17 (i.e., 0.23 - 0.061 = 0.169) and are more likely to have a school average mathematics achievement of *does not approach grade level* compared to *meets grade level.* Interestingly, the effect for the proportion of accelerated track students is the same (see Table 5). There is a statistically significant expected decrease in log odds of school average of mathematics achievement for an increase in the proportion of Latinx students (B = -0.79, $p <$ 0.05). Further, for a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected increase of 0.041 (i.e., B = 0.41, $p = 0.05$, $\frac{0.41}{10} = 0.041$) in the log odds school average Algebra I performance falling within the *does not approach grade level* category compared to *meets grade level*. The largest effect for the log odds of average school Algebra I achievement in urban schools in Texas was the proportion of students in off-track

Algebra I (B = 3.68, *p* < 001). Urban schools with a proportion of students in off-track Algebra I 10% above the average proportion of students in off-track Algebra I in urban schools in Texas are expected to have a log odds of approximately 0.60 (i.e., 0.23 + [$\frac{3.68}{10}$] = 0.598) and are more likely to have a school average achievement of *does not approach grade level.* Of note there were no statistically significant effects for school average proportion of students with discipline referrals, Black teachers, and Latinx teachers. Moreover, there was no statistically significant effect of school average teacher experience. However, for a one unit increase in school average teacher tenure, there was an expected decrease of 0.04 (p <0.05) in log odds of school average mathematics achievement scoring within *does not approach grade level* compared to *meets grade level.*

Approaches Grade Level

The next possible outcome for mathematics and science achievement was *approaches grade level* compared to *meets grade level* (see Table 5). *Approaches grade level* represents the the minimum passing level of achievement on the Algebra I and Biology EOC exams.

Compared to the outcome of *meets grade level* for the Algebra I EOC, there were statistically significantly higher unadjusted log odds for average mathematics achievement in urban schools for *approaches grade level* (B = 0.16, p < 0.001). Female students were expected to have a statistically significant lower in log odds of 0.15 (p < 0.001) of Algebra I achievement *approaching grade level* compared to *meets grade level* than male students. Accounting for all other predictors, a student who was eligible for FRL had a statistically significant difference in the log odds of *scoring approaches grade level* than students who were not eligible for FRL (B = 0.15, p < 0.001). Students in off-track Algebra I had a statistically significant expected increase (B = 1.25, p < 0.001) in the log odds of scoring within the *approaches grade level* category compared to students in standard track Algebra I. Students in off-track Algebra I were more likely to score within the *approaches grade level* category than *meets grade level* with a log odds of 1.41 (i.e., 0.16 + 1.25 = 1.41). Further, students who received a discipline referral (B = 0.51, p < 0.001) had a statistically significant log odds of 1.36 (i.e., 0.16 + 0.51 = 0.67) of scoring within the *approaches grade level* category compared to *meets grade level*.

Between urban schools, for a 10% increase in the proportion of female students there was an expected statistically significant decrease of 0.035 (i.e., B = -0.35, p < 0.001, $\frac{-0.35}{10}$= -0.035) in the log odds of average school Alegbra 1 achievement falling within the *approaches grade level* category compared to *meets grade level*. There is a statistically significant expected decrease in log odds of school average of mathematics achievement for an increase in the proportion of Latinx students (B = -0.35, p < 0.05). Further, for a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected increase of 0.038 (i.e., B = 0.38, p < 0.001, $\frac{0.38}{10}$ = 0.038) in the log odds school average Algebra I performance falling within the *approaches grade level* category compared to the *meets grade level* category. Furthermore, for a 10% increase in the proportion of students taking accelerated Algebra I relative to the grandmean across urban schools in Texas, there is an expected decrease (B = -0.50, *p*< 0.001) in the log odds of school average mathematics achievement being within the *approaches grade level* category compared to *meets grade level.* Urban schools with a proportion of students in off-track Algebra I 10% above the average proportion of students in off-track Algebra I in urban schools in Texas are expected to have a log odds of approximately 0.34 (i.e., B = 1.84, *p* < 0.001, 0.16 + [$\frac{1.84}{10}$] = 0.184) and are statistically significantly more likely to have a school average achievement of *approach grade level* than *meets grade level*. Of note there were no statistically significant effects for school average proportion of students with discipline referrals, Black teachers, and Latinx teachers. Moreover, there was no statistically significant effect of school average teacher experience. However, for a one unit increase in school average teacher tenure, there was an expected decrease of 0.02 ($p < 0.05$) in log odds of school average mathematics achievement scoring within *approaches grade level* compared to *meets grade level*.

Masters Grade Level

The last outcome for mathematics and science achievement was *masters grade level* compared to *meets grade level* (see Table 5). *Masters grade level* represents the student achievement exceeding *meets grade level* category and is the highest level of achievement on the Algebra I EOC exam.

Compared to the outcome of *meets grade level* for the Algebra I EOC, there were statistically significantly higher unadjusted log odds for average mathematics achievement in urban schools for *masters grade level* ($B = 0.18$, $p < 0.001$). There was a statistically significant difference between the log odds of female students and male students achieving *masters grade level* compared to *meets grade level* ($B = 0.12$, $p < 0.001$). For instance, female students had a log odds of 0.30 (i.e., $0.18 + 0.12 = 0.30$) and were more likely to score within the *masters grade level* category than male students. Accounting for all other predictors, a student who was eligible for FRL had a statistically significant difference in the log odds of *scoring masters grade level* than students who were not eligible for FRL ($B = -0.27$, $p < 0.001$). Students in accelerated-track Algebra I were more likely to score within the *masters grade level* category than *meets grade level* with a log odds of 0.68 (i.e., $B = 0.50$, $p < 0.001$, $0.18 + 0.50 = 0.68$).Students in off-track Algebra I had a statistically significant expected decrease ($B = -0.90$, $p < 0.001$) in the log odds of scoring within the *masters grade level* category compared the *meets grade level* category compared to students in standard track Algebra I. Further, students who received a discipline referral ($B = -0.71$, $p < 0.001$) had a statistically significant log odds of -0.53 (i.e., $0.18 - 0.71 = -0.53$) of scoring within the *masters grade level* category and were more likely to score within the *meets grade level* category compared to students without a discipline referral.

Between urban schools, for a 10% increase in the proportion of female students there was an expected statistically significant increase of 0.022 (i.e., $B = 0.22$, $p < 0.001$, $\frac{0.22}{10} = 0.022$) in the log odds of average school Alegbra 1 achievement falling within the *masters grade level* category compared to *meets grade level*. Of note, there was no statistically significant effect for the proportion of Latinx students on school average mathematics achievement (see Table 5). However, there is a statistically significant expected decrease in log odds of school average of mathematics achievement for an increase in the proportion of Black students ($B = -0.39$, $p < 0.001$). Further, for a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected decrease of 0.039 (i.e., $B = -0.39$, $p < 0.001$, $\frac{-0.39}{10} = -0.039$) in the log odds school average Algebra I performance falling within the *masters grade level* category compared to the *meets grade level* category. Furthermore, for a 10% increase in the proportion of students taking accelerated Algebra I relative to the grandmean across urban schools in Texas, there is an expected increase of 0.103 (i.e., $B = 1.03$, $p < 0.001$, $\frac{1.03}{10} = 0.103$) in the log odds of school average mathematics achievement being within the *masters grade level* category compared to *meets grade level.* Urban schools with a proportion of students in off-track Algebra I 10% above the average proportion of students in off-track Algebra I in urban schools in Texas are expected to have a log odds of approximately 0.021 (i.e., B = 1.84, p < 0.001, 0.18 + [$\frac{-1.59}{10}$] = 0.021) of school average mathematics achievement within *masters grade level* compared to *meets grade level*. For a one unit increase in school average teacher tenure, there was an expected increase of 0.03 (p =0.01) in log odds of school average mathematics achievement scoring within *masters grade level* compared to *meets grade level*.

Science Achievement: Biology

Based on the likelihood ratio chi-square test [LR (54) = 6394.40, p < 0.001], the conditional model is a better fit for Biology achievement. Further, an improvement in model fit statistics from the unconditional model was demonstrated (AIC = 381765.6, BIC = 382334.5).

Does Not Approach Grade Level

Compared to the outcome of *meets grade level* for the Biology EOC, there were statistically significantly lower unadjusted log odds for average mathematics achievement in urban schools for *does not approach grade level* (B = -1.89, p < 0.05). Female students were expected to have a statistically significant decrease in log odds of 0.36 (p < 0.001) and were less likely to *not approach grade level* than *meets grade level* in Biology achievement compared to male students (i.e., -1.89 - 0.36 = -2.25). Accounting for all other predictors, a student who was eligible for FRL had a statistically significant difference in the log odds of scoring *does not approach grade level* than students who were not eligible for FRL (B = 0.66, p < 0.001). There was no statistically significant effect of taking accelerated track Biology for the log odds of scoring within *does not approach grade level.* Whereas students in the off track Biology had a statistically significant expected increase (B = 1.93, p < 0.001) in the log odds of scoring within the *does not approach grade level* category compared to students in standard track Biology. Students in off-track Biology were more likely to score within the *does not approach grade level* category than *meets grade level* with a log odds of 0.04 (i.e., -1.89 + 1.93 = 0.04). Further, there was a statistically significant difference in log odds of scoring within the *does not approach grade level* category in Biology compared to *meets grade level* between students who received a discipline referral (B = 1.36, p < 0.001) and students who did not..

Between urban schools, for a 10% increase in the proportion of female students there was an expected statistically significant decrease of 0.062 (i.e., B = -0.62, p < 0.001 , $\frac{0.62}{10} = -0.062$) in the log odds of average school Biology achievement falling within the *does not approach* category compared to *meets grade level.* For a 10% increase in the proportion of Black students in an urban school in Texas, there is a statistically significant expected increase of 0.191 (B = 1.19, p < 0.001, $\frac{1.19}{10} = 0.191$) in the log odds of average school Biology achievement. Further, there is a statistically significant expected increase in the log odds of school average of science achievement for an increase in the proportion of Latinx students (B = 0.58, p < 0.01). Further, for a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected increase of 0.1041 (i.e., B = 1.04, p = 0.05, $\frac{1.04}{10} = 0.104$) in the log odds school average Biology performance falling within the *does not approach grade level* category (i.e., -1.89 + 0.104 = -1.79) compared to the *meets grade level* category. The largest effect for the log odds of average school Biology achievement in urban schools in Texas was the proportion of students in accelerated-track Biology (B = -2.52, p < 001). Urban schools with a proportion of students in accelerated-track Biology 10% above the average proportion of students in accelerated-track Biology in urban schools in Texas are expected to have a log odds of approximately -2.14 (i.e., -1.89 + [$\frac{-2.52}{10}$] = -2.142) and are less likely to have a school average achievement of *does not approach grade level* compared to *meets grade level.* Whereas schools with 10% more students taking off-track Biology (i.e., after 9th grade) had an expected 0.024 increase (i.e., B = 2.24, p <0.001, [$\frac{2.24}{10}$] = 0.224) in the log odds of school average Biology achievement falling within *does not approach grade level* compared to *meets grade level.* For a 10% increase in the proportion of Black teachers relative to the mean proportion of Black teachers across urban schools in Texas, there is an expected 0.076 change (i.e., B = 0.76, p <0.001, [$\frac{2.24}{10}$] = 0.224) in the log odds of school average Biology achievement falling within the *does not approach grade level* category compared to *meets grade level.*

Approaches Grade Level

Compared to the outcome of *meets grade level* for the Biology EOC, there were statistically significantly lower unadjusted log odds for average mathematics achievement in urban schools for *approaches grade level* (B = -0.64, p < 0.001). Female students were expected to have a statistically significant decrease in log odds of -0.03 (p < 0.05) and were less likely to score within *approaches grade level* than *meets grade level* in Biology compared to male students (i.e., -0.64 - 0.04 = -0.68). There was a statistically significant difference (B = 0.45 p < 0.001) in log odds for students who were eligible for FRL and students who were not eligible for FRL scoring *approaches grade level* compared to *meets grade level*. Students in the off track Biology had a statistically significant expected increase (B = 1.93, p < 0.001) in the log odds of scoring within the *approaches grade level* category compared to students in standard track Biology. Students in off-track Biology were more likely to score within the *approaches grade level* category than *meets grade level* with a log odds of 0.35 (i.e., -0.64 + 0.99 = 0.35) compared to students in the standard Biology track. Further, students who received a discipline referral (B = 1.36, p < 0.001) had a statistically significant log odds of 0.17 (i.e., -0.64 + 0.81 = 0.17) and were more likely to score within the *approaches grade level category* in Biology compared to *meets grade level* than students without a discipline referral.

For a 10% increase in the proportion of Black students in an urban school in Texas, there is a statistically significant expected increase of 0.0.78 (B = 0.078, p < 0.001, $\frac{0.78}{10} = 0.078$) in the log odds of average school Biology achievement falling within *approaches grade level* compared to *meets grade level*. Further, there is a statistically significant expected increase in the log odds of school average of science achievement within the *approaches grade level* compared to *meets grade level* for an increase in the proportion of Latinx students (B = 0.30, p < 0.05). For a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected increase of 0.07 (i.e., B = 1.04, p = 0.05, $\frac{0.70}{10} = 0.07$) in the log odds school average Biology performance falling within the *approaches grade level* category compared to the *meets grade level* category. There was a statistically significant decrease in the log odds of average school Biology achievement in urban schools falling within *approaches grade level* compared to *meets grade level* for an increase i the proportion of students in accelerated-track Biology (B = -1.12, p < 001). Whereas schools with 10% more students taking off-track Biology (i.e., after 9th grade) had an expected increase of 0.143 (i.e., B = 1.43, p <0.001, [$\frac{1.43}{10}$] = 0.143) in the log odds of school average Biology achievement falling within *approaches grade level* compared to *meets grade level.* There was an expected statistically significant increase in the log odds of school average Biology achievement falling within the *approaches grade level* category compared to the *meets grade level* category for an increase in the proportion of Black teachers within a school (B = 0.29, p = 0.01).

Masters Grade Level

Compared to the outcome of *meets grade level* for the Biology EOC, there were statistically significantly lower unadjusted log odds for average mathematics achievement in urban schools for *masters grade level* (B = -0.67, $p < 0.001$). Female students were expected to have a statistically significant decrease of -0.15 ($p < 0.05$) in log odds and were less likely to score withing *masters grade level* than *meets grade level* in Biology compared to male students (i.e., -0.67 - 0.15 = -0.82).There was a statistically significant difference (B = -0.64 $p < 0.001$) in log odds for students who were eligible for FRL and students who were not eligible for FRL scoring *masters grade level* compared to *meets grade level*. Students in the off-track Biology had a statistically significant expected decrease (B = -0.54, $p < 0.001$) in the log odds of scoring within the *masters grade level* category compared to students in standard track Biology. Further, students who received a discipline referral (B = -1.04, $p < 0.001$) had a statistically significant log odds of -1.71 (i.e., -0.67 - 1.04 = -1.71) and were less likely to score within the *masters grade level category* in Biology compared to *meets grade level* than students without a discipline referral.

For a 10% increase in the proportion of Black students in an urban school in Texas, there is a statistically significant expected decrease of 0.134 (B = 0.078, $p < 0.001$, $\frac{-1.34}{10} = \; - 1.34$) in the log odds of average school Biology achievement falling within *masters grade level* compared to *meets grade level*. There is a statistically significant expected decrease in the log odds of school average of science achievement within the *masters grade level* compared to *meets grade level* for an increase in the proportion of Latinx students (B = -0.79, $p < 0.001$). For a 10% increase in the proportion of students eligible for FRL in an urban school, there is an expected decrease of 0.082 (i.e., B = -0.82, $p < 0.001$, $\frac{-0.82}{10} = \; - 0.082$) in the log odds school average Biology performance falling within the *masters grade level* category compared to the *meets grade level* category. There was a statistically significant decrease in the log odds of average school Biology achievement in urban schools falling within *masters grade level* compared to *meets grade level* for an increase in the proportion of students in accelerated-track Biology (B = 0.91, $p < 001$). Whereas schools with 10% more students taking off-track Biology (i.e., after 9th grade) had an expected decrease of 0.103 (i.e., B = 1.03, $p < 0.001$, $[\frac{1.03}{10}] = 0.103$) in the log odds of school average Biology achievement falling within *masters grade level* compared to *meets grade level.* There was an expected statistically significant decrease in the log odds of school average Biology achievement falling within the *masters grade level* category compared to the *meets grade level* category for an increase in the proportion of Latinx teachers within a school (B = -0.31, $p < 0.001$).

Summary of Findings

Examining the log odds of mathematics and science achievement across urban schools, there was variability within and between schools. Recall that the log odds of achievement were compared to the outcome *meets grade level*, which indicates that students passed the respective EOC exam (e.g., Algebra I, Biology) and met grade-level criteria.

Within Urban Schools

Examining student characteristics such as biological sex, FRL eligibility status, course track, and discipline referrals, we found statistically significant differences in the log odds of Algebra I and Biology outcomes (see Table 5). A key difference in the log odds for Algebra I and Biology existed for biological sex (see Table 5). For Algebra I achievement, female students were more likely to score higher than their male peers across each achievement outcome. However, for Biology achievement, female students were more likely to score within *meets grade level* across each outcome (i.e., does not approach, approaches, masters). Female students in Biology were less likely than their male peers to demonstrate higher levels of grade level mastery (see Table 5).

Further, Algebra I and Biology students with a discipline referral were more likely to score within *does not approach grade level* and *approaches grade level* than *meets grade level* than students without a discipline referral. Moreover, course track (i.e., accelerated, off) had the largest effects on a change in log odds at the student level. More specifically, students taking off-track Algebra I and Biology were consistently, statistically significantly more likely to score within lower achievement outcomes (see Table 5). Of note, within schools, there was no statistically significant difference in log odds of mathematics and science achievement regarding student race (see Table 5).

Between Urban Schools

Interestingly at the school level there was no statistically significant effect for the proportion of discipline referrals and average teacher experience. Across both Algebra I and Biology, the proportion of students eligible for FRL and students taking off-track as well as average teacher tenure were statistically significant predictors of log odds. Of note, the proportion of female students in an urban school was a statistically significant predictor of log odds in favor of the higher Algebra I achievement outcome (i.e., meets or masters grade level). Regarding Biology achievement, the proportion of Black and Latinx students as well as the proportion of Black and Latinx Teachers had a statistically significant effect on the log odds (see Table 5).

Probabilities of Mathematics and Science Achievement Across Urban Schools

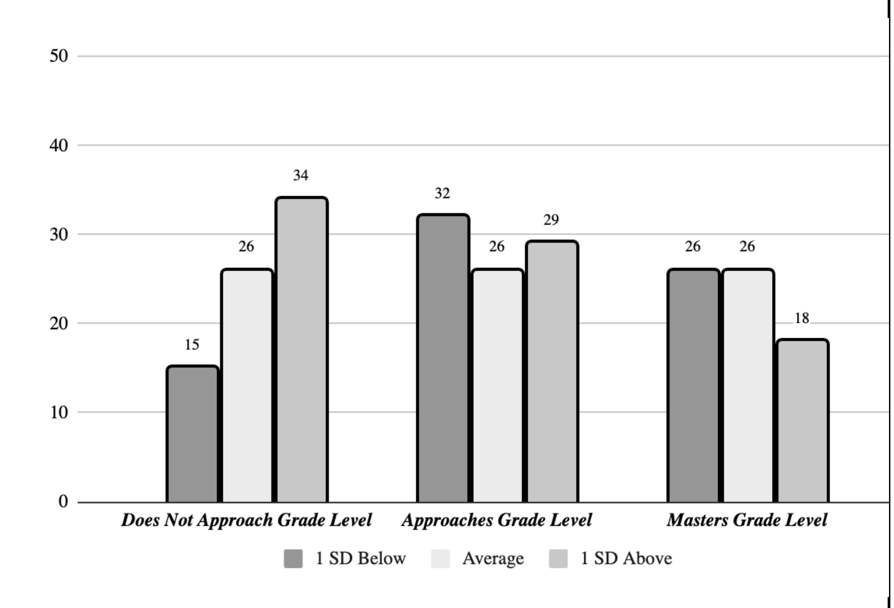
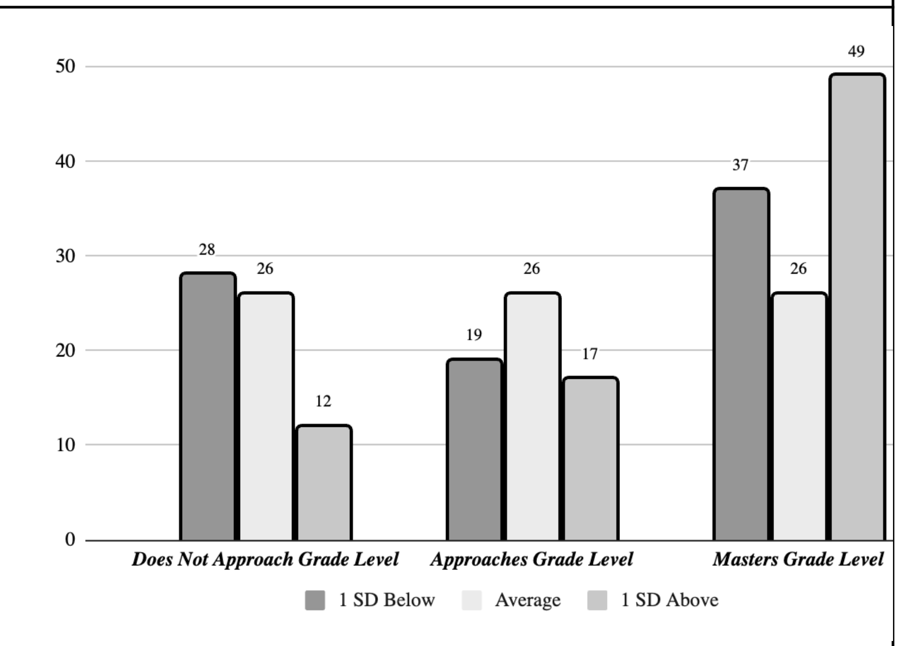
Using the log odds, relative risk ratios were calculated to create the probabilities of sample cases of student achievement in urban schools in Texas to capture the between-school effects (see Figures 1 & 2). See the appendix for probabilities of the reference outcome (i.e., *meets grade level*).

Mathematics Achievement: Tracking

Figure 1 illustrates the difference in probabilities of Algebra I achievement by the proportion of students enrolled in off- and accelerated-track Algebra I for one standard deviation below, one standard deviation above, and at the grand mean. For an urban school with the proportion of students enrolled in off-track Algebra I one standard deviation (0.23) below the grand mean, there was a low probability of students not passing the Algebra I EOC (15%) and students were statistically significantly twice as likely to score within the minimum passing standard (i.e., approaches grade level, 32%). However, if an urban school was one standard deviation (0.23) above the grand mean of the proportion enrolled in off-track Algebra I, students were statistically significantly more likely to not pass the Algebra I EOC (see Figure 1). For an urban school with the proportion of students enrolled in accelerated-track Algebra I one standard deviation (0.49) below the grand mean, there was an expected higher probability (28%) of not passing the Algebra I EOC compared to a school at the grand mean (26%) and a school one standard deviation above the grand mean (12%). Furthermore, students at an urban school with the proportion of students enrolled in accelerated-track Algebra I one standard deviation above the grand mean, had a 49% probability of scoring within the masters grade level achievement category.

Figure 1

Mathematics Achievement Probabilities Across Urban Schools

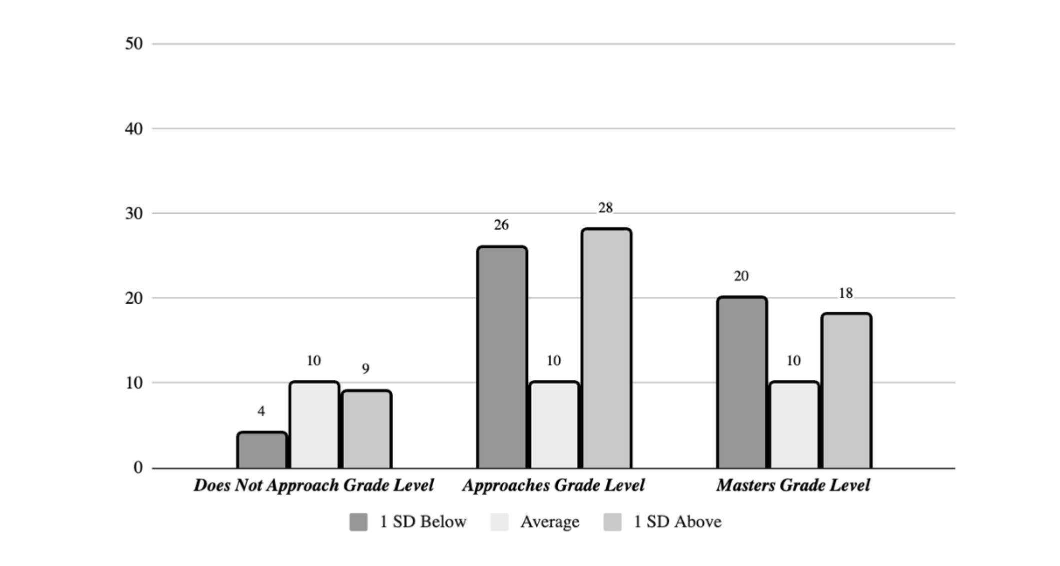
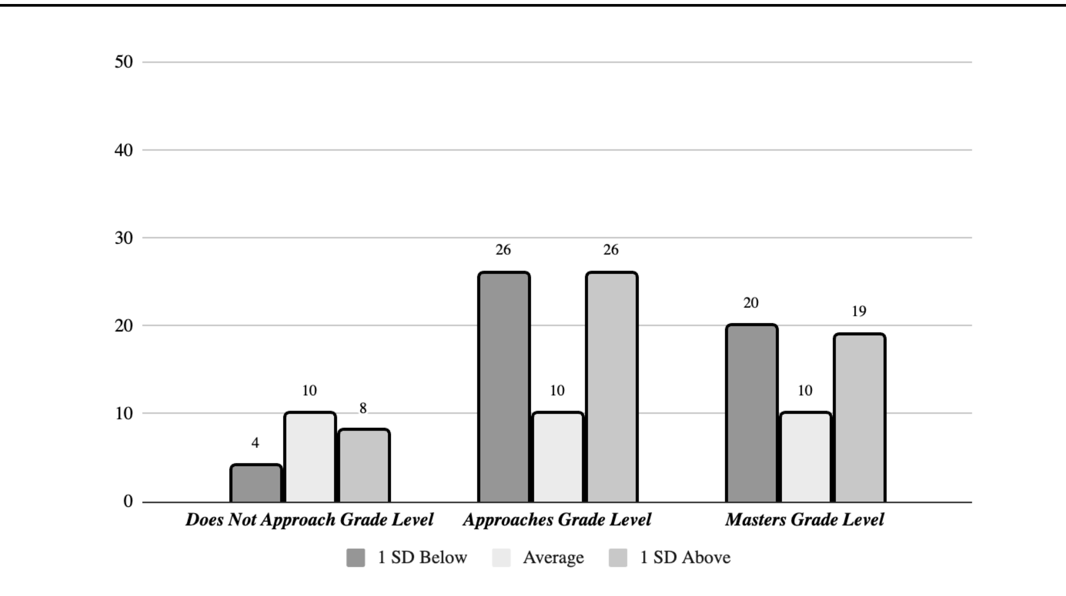
Proportion of Students in Urban Schools Taking Off-Track Algebra I	
Proportion of Students in Urban Schools Taking Accelerate d-Track Algebra I	

Science Achievement: Proportion of Black & Latinx Students

Figure 2 illustrates the difference in probabilities of Biology achievement by the proportion of Black and Latinx students for one standard deviation below, one standard deviation above, and at the grand mean. Although the proportion of Black students in an urban school was a statistically significant predictor of the log odds of science achievement (see Table 5), there are similar probabilities for schools with a proportion of Black students one standard deviation (0.18) below and above the grandmean for approaches grade level and masters grade level (see Figure 2). Furthermore, there is a similar trend across urban schools for the proportion of Latinx students and the probabilities of science achievement (see Figure 2).

Figure 2

Science Achievement Probabilities Across Urban Schools

Proportion of Black Students in Urban Schools	
Proportion of Latinx Students in Urban Schools	

**Note.* SD = standard deviation

Discussion & Implications

The purpose of our study was to examine the log odds of mathematics and science achievement in urban schools in Texas. The following sections outline the results of the multilevel multinomial logistic regression analysis by content area and provide implications for research and practice.

Mathematics Achievement

Within Urban Schools

In urban schools, our study found that student characteristics including biological sex, FRL status, discipline referrals, and course track significantly affect the likelihood of students achieving various proficiency levels in Algebra I.

Female students had a higher likelihood of achieving *masters grade level* compared to *meets grade level* relative to male students. This finding suggests that female students in Algebra I are more likely to reach the highest level of achievement in Algebra I compared to male students. Recent literature indicates that the gender gap in matheamatics achievement in narrowing (Quest et al., 2010). Our findings align with this trend as we see female students outperforming their male counterparts in achieving *masters grade level* compare to just *meets grade level*. While previous literature indicates that male students perform better than female students on standardized testing (Hyde, 2014), our findings support the notion of the narrowing gender gap in mathematics (Quest et al., 2010).

Students eligible for FRL were more likely to achieve *does not approach grade level* and were less likely to achieve *masters grade level* compared to *meets grade level*. This finding aligns with previous research indicating students from low SES households tend to have lower mathematics achievement (Gonzales et al., 2020; Duncan & Magnuson, 2005; Tate, 1997). Prior research has shown that developing strong student-teacher relationships (Olsen & Huang, 2021), organization of classtime for mathematics instruction (Desimone & Long, 2010), and teacher beliefs (Haataja et al., 2024) are instrumental to supporting students from low SES backgrounds.

Regarding discipline referrals, students who received referrals during the school year were more likely to achieve *does not approach grade level* compared to *meets grade level*. While prior reserach does not specifically report the relationship between school referrals and mathematics achievement, studies analyzing school suspension and mathematics achievement exist (e.g., Bell & Puckett, 2023; Jabbari & Johnson, 2023; Lewis et al., 2010). School suspensions are considered a possible outcome school referrals, indicating that our findings are consistent with that research (Ibrahim & Johnson, 2020). This underscores the significance of school referrals, which can have important consequences for students in urban schools, such as missing class time and falling behind in class, and educator push-back for providing instructional support for missed classtime (Bell & Puckett, 2020). Prior studies have shown that providing teachers with continuous training and mentoring in culturally responsive classroom management (Weinstein et al., 2004) strategies fosters educators' development of maintaining learning environments that are conducive to supporting students socioemotional and academic needs (Everson & Weinstein, 2006). However, the present state policies in place limit the support and enactment of culturally responsive classroom management practices in schools and districts (Williams et al., 2023). Thus, teachers are left with little to no support and guidance. This calls for re-evaluation of state policy as the short- and long-term effects of school discipline on academic achievement cannot wait.

Course track was a statistically signficant factor for both off-track and accelerated-track students in Algebra I. Students taking off track Algebra I were more likely to achieve *does not approach grade level* compared to *meets grade level* relative to standard track students. Our finidings indicate that off-track enrollment in Algebra I has a substantial relationship with lower mathematics achievement on the Algerba 1 EOC. This finding aligns with Dockx et al.'s (2019) results from a longitudinal study of mathematics tracking were students who were off-track demonstrated lower levels of mathematics achievement than their peers who were on standard and accelerated tracks. Students in off-track mathematics courses are more likely to have novice teachers while standard-track and advanced-track courses are taught by more experienced teachers (Nirode & Boyd, 2023). Further, teacher beliefs regarding students' mathematics abilities influence the instructional choices and student achievement (Alam & Mohanty, 2023; Gentrup et al., 2020; Heyder et al., 2020). Conversley, students taking accelerated track Algebra

I had a higher likelihood of *masters grade level* compared to *meets grade level* relative to standard track students. Although the effect size was not as strong as off track Algebra I, it still indicates a moderately positive relationship between accelerated track and achieving *masters grade level*. These findings are important to understand the influence of tracking in mathematics and to highlight the need for strategic education practices to support all learners.

Between Urban Schools

In addition to within school predictors, our findings suggest that between school predictors also have a significant effect on the likelihood of students achievement in different proficiency levels in Algebra I. Similarly to within school, as the proportion of female students increases we can expect to see an increase in the likelihood of *masters grade level* compared to *meets grade level* in relation to the proportion of male students. Again, this aligns with literature indicating that the gender gap between male and female students if relativley small, if not narrowing altogheter (Quest et al., 2020).

While student race was not statistically significant as a within school predictor, our analyses revealed that there were statistically significant effects on the log odds of mathematics achievement related to the proportion of Black and Latinx students within urban schools in Texas. Specifically, we found that an increase in the proportion of Latinx students in an urban school was related to an increase in the log likelihood of students scoring within the *does not approach grade level* and *approaches grade level* categories compares to *meets grade level.* Of note, this effect was strongest for *does not approach grade level*. Additionally, an increase in the proportion of Black students in an urban school in Texas had an expected, statistically significant decrease in the log likelihood of students scoring within the *masters grade level* category compared to *meets grade level*.was also a negative factor for *masters grade level*. This finding underscores the importance of an evaluation of state policy for curriculum and instruction as well as bolstering educator professional development to support Black and Latinx students. For example, culturally responsive mathematics curriculum and instruction has been shown to support students' engagement in learning (Hammond, 2015) and mathematics content mastery through high expectations (Rubie-Davies et al., 2014). Through practicing culturally responsive mathematics teaching, educators reflect on their beliefs about their students' race, ethnicity, and culture as well as the relationship between student characteristics and learning experiences (Howard, 2003). Some would argue that this is simply a part of good teaching. However, teaching evaluation standards, teacher preparation program standards, and state academic standards must make cultural responsiveness a *requirement, not an optional or illegal practice*.

Furthermore, the proportion of students eligible for FRL was a statistically significant predictor of mathematics achievement between schools. An increase in the proportion of students eligible for FRL in urban schools indicated an increase in the likelihood of the school average falling into *does not meet grade level* or *approaches* while it decreased the likelihood of *masters grade level* compared to *meets grade level*. This is significant because it underscores the influence of SES on academic performance. Schools with higher levels of lol SES face greater challenges, highlighting the need for additional resources to support students. These findings align with Forgasz and Hill's (2013) study indicating students with higher SES backgrounds scored higher on the PISA. Further, the introduction of early numeracy support in early grades (Starkey et al., 2022) and mentoring programs (May et al., 2021) in schools are shown to bolster students' mathematics achievement. Addressing this disparity is crucial for promoting educational equity and ensuring that students eligible for FRL can lead to better long-term outcomes.

Course tracking between schools emerged as another stastitically significant predictor for off track and accelerated track students in relation to the average of standard track students. We found that an increase in the proportion of off track students, increase the likelihood of *does not approach grade level* and *approaches grade level*. It also predicted a lower likelihood of *masters grade level* compared to *meets grade level*. For accelerated track students between schools, the findings were opposite. When the proportion of accelerated track students increased we revealed that the average of students were more likely to achieve *masters grade level* and less likely to achieve *does not approach grade level* or *approaches grade level*. These results support Lee & Maro's (2021) findings that taking Algebra I earlier is related to higher mathematics achievement. However, taking Algebra I earlier for all students is an approach based on equality not equity (Domina et al., 2015). Providing students with targeted intervention and/or acceleration with flexible tracks has been shown to support students' mathematics achievement (Dietrichson et al., 2021; McEachin et al., 2020; Robinson et al., 2021). Furthermore, examining the criteria and pathways in which students are identified for acceleration is critical for equitable mathematics instruction (Irizarry, 2021; Peters et al., 2021; Xu et al., 2021).

Lastly, average teacher tenure was a statistically significant factor. Our findings indicate that as average teacher tenure in urban schools increases, the average of students mathematics achievement is less likely to fall into *does not approach grade level* and *approaches grade level* compared to *meets grade level*. Further, students average achievement was more likely to be in *masters grade level* compared to *meets grade level* when average teacher tenure increase. The implications of this finding are consistent with existing literature on the positive effects of teacher retention on student mathematics achievement (Lamb & Fullarton, 2010). This suggests that retaining teachers in urban schools could be beneficial to improving students mathematical achievement.

Science Achievement

Within Urban Schools

Within urban schools, similar to mathematics achievement, our study also found that student characteristics such as biological sex, FRL status, discipline referrals, and course track had notable, statistically significant effects on the log odds of student achievement.

Male students were more likely to be in the *masters grade level* category than the *meets grade level category* whereas female students were more likely to fall within the *meets grade level* category than *does not approach level* category. This finding suggests that male students are more likely to excel in science compared to their female counterparts. This finding is aligned with existing research, highlighting the persistent discrepancy of science achievement between male and female students (Sun et. al., 2012). This consistent underperformance of female students compared to their male counterparts highlights the need for targeted interventions to support and encourage female students in science. Urban schools should consistently implement inclusive teaching practices and create an inclusive environment that fosters the interest and success of female students in science subjects.

Similarly, students eligible for FRL were less likely to be in the *masters grade level* category, suggesting that SES remains one of the important determining factors of student achievement in science in urban schools. A similar finding was reported by Ruby (2006). This significant impact of SES on student achievement underscores the importance of providing additional resources and support for FRL-eligible students. Further, the proportion of students eligible for FRL in an urban school was a statistically significant predictor of science achievement. Policymakers and educators should continue to prioritize equitable access to high-quality science instructional materials, tutoring, and enrichment programs to help bridge the achievement gap for economically disadvantaged students.

Our study attends to a gap in the literature regarding the influence of school discipline on science achievement. Although school discipline has been recognized as having negative effects on acadmic achievement broadly (e.g., Wang et al., 2023), school discipline in urban schools (e.g., Losen & Skiba, 2010), and discipline regarding achievement in other subjects such as mathematics (Jabbari & Johnson, 2023) specifically, there is a dearth of empirical analyses of the relationship between school discipline and students' science achievement. The effect of receiving a discipline referral on science achievement was similar to the effect on mathematics achievement as on average, students who received a discipline referral were more likely to have lower science achievement across each achievement category.

Concerning course track in Biology, students who were not in the accelerated track were found to have lower science achievement compared to those in the accelerated track. This finding suggests that perhaps in urban schools, high-quality instructional approaches and resources may be predominantly allocated to support students in accelerated tracks. Consequently, students in off-track courses do not receive the necessary support to excel in science, leading to consistently lower science achievement. Urban schools should consider different alternatives to support all students regardless of their tracks. For instance, to enhance science achievement for all students, principal and science teachers should shift their focus from traditional science teaching to teaching science through and as inquiry. Teaching science through and as inquiry has been proven to be effective to increase student achievement in science. Marshal & Alston (2014) found that inquiry-based instruction was highly effective in promoting higher science proficiency among students in diverse, high minority schools.

Between Urban Schools

At the school level, our finding on Biology achievement emphasizes the importance of representation and the potential impact of racial congruence between teachers and students on academic performance. In schools with higher proportions of Black and Latinx students and teachers, there were statistically significant effects on the likelihood of achieving various levels of proficiency in subjects like Biology. This is likely due to the ability of Black and Latinx teachers to employ culturally responsive science teaching. This cultural insight enables these educators to implement culturally responsive teaching strategies more effectively (Berlak and Moyenda, 2001; Coffey & Farinde-Wu, 2016). This finding is further supported by Castro & Calzada (2021)'s study in which they found that teacher ethnicity predicts teacher's culturally responsive teaching self-efficacy. That is, Latinx teachers employ more culturally responsive teaching with their Latinx students (Castro & Calzada 2021). These findings are consistent with previous research that such teaching methods are essential for improving science outcomes, especially for students from diverse urban backgrounds (Brown et al., 2018; Parsons, 2008; Rivera et al., 2014). That said, to better support students in urban schools, it is crucial to not only increase the recruitment of Black and Latinx teachers but also to develop strategies for retaining them.

Conclusions

Our study provides insights mathematics and science achievement in the fifteenth most urban state in the U.S. (i.e., Texas; Brannen, 2023). We examined the characteristics of urban schools along with challenges in the Texas context to situate mathematics and science achievement. Mathematics and science achievement is critical for career trajectory (Lee, 2012) as well as holding implications for schools and communities (Green et al., 2017). While this study highlights areas for improvement for bolstering mathematics and science achievement in urban schools, in order for change to happen education policy makers and stake holders must attend to several key issues such as but not limited to school discipline, acceleration placement criteria, and teacher retention.

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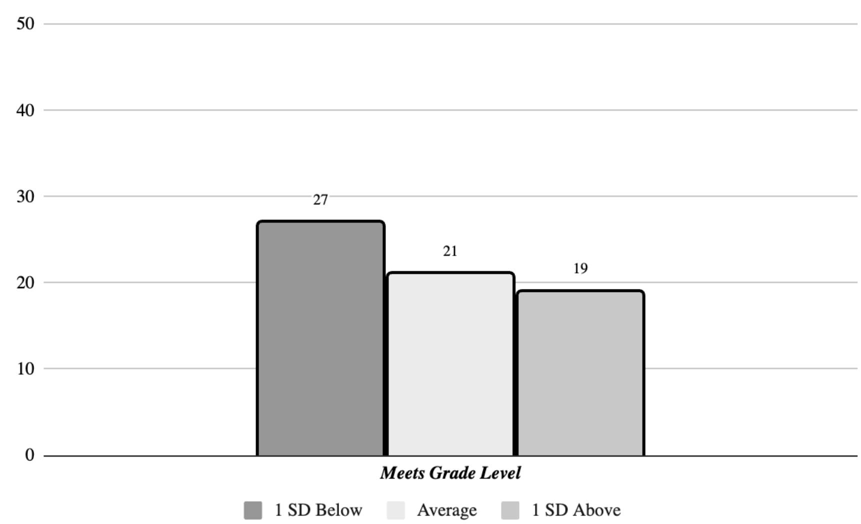
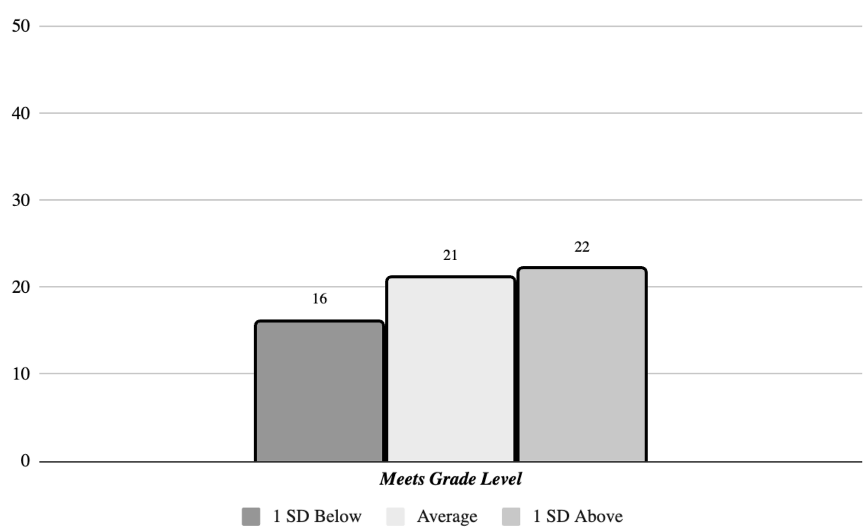
APPENDIX

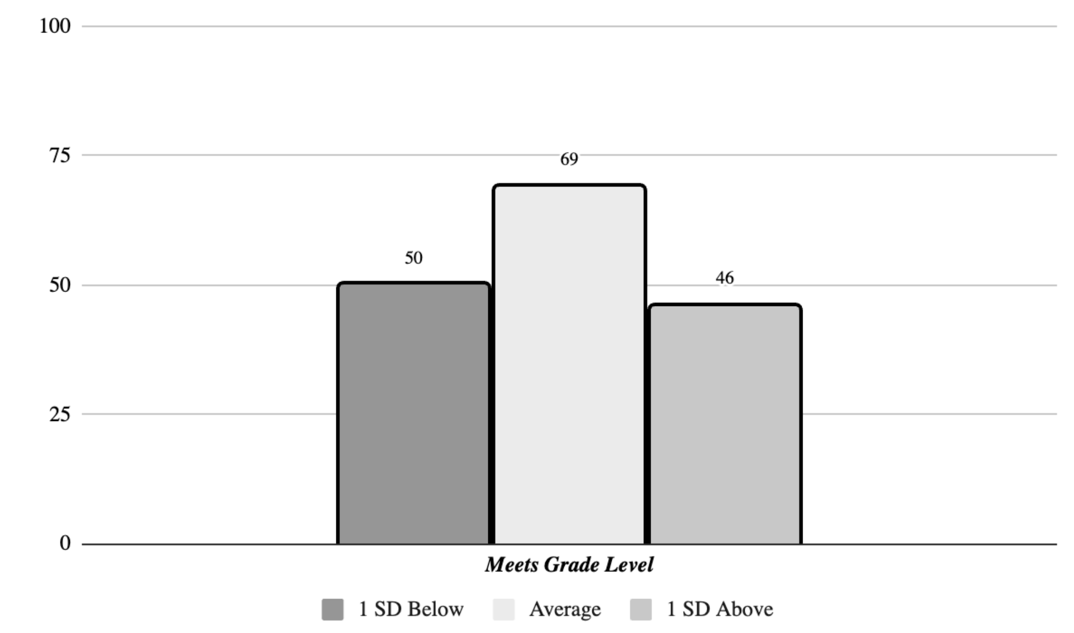
Mathematics Achievement by Proportion of Students in Urban Schools Taking Off-Track Algebra I



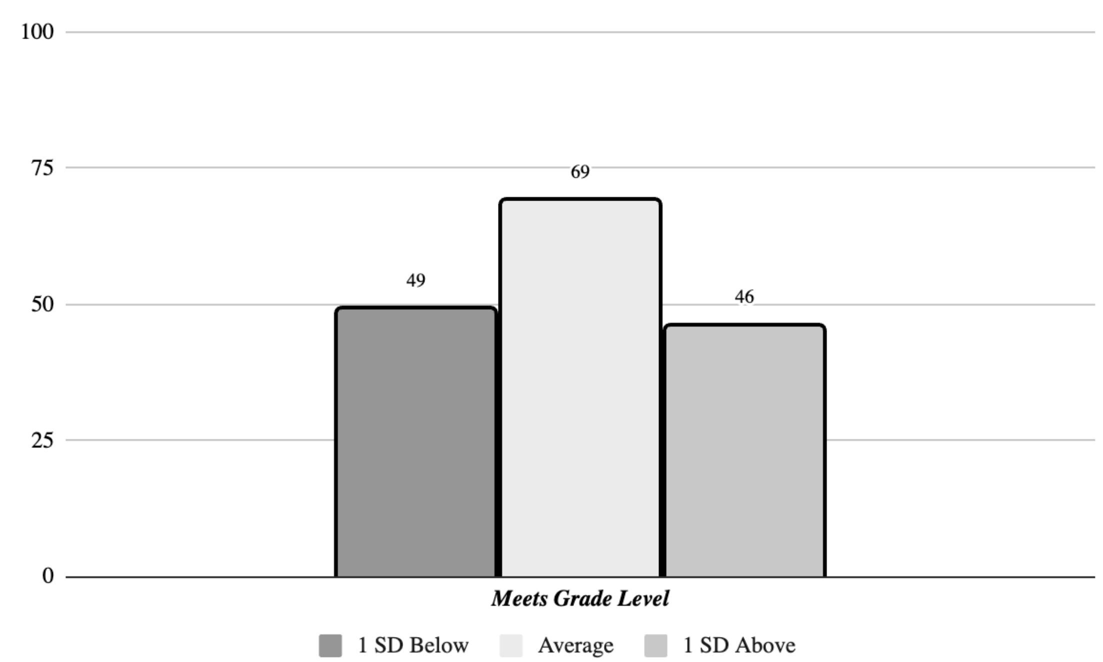
Mathematics Achievement by Proportion of Students in Urban Schools Taking Accelerated-Track Algebra I



Science Achievement by Proportion of Black Students in Urban Schools



Science Achievement by Proportion of Latinx Students in Urban Schools



**Note.* SD = standard deviation