SUMMARY REPORT

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Exploring Patterns in Students' Math Mindsets and Experiences, and their Math Achievement

Presented by:
NORC at the University of Chicago

Presented to:
Scotch Plains-Fanwood Regional School District

INTRODUCTION

This research brief explores the relationship between how students responded to a survey about their math experiences and mindsets and how they performed on an end-of-year state standardized math assessment. For this study, NORC partnered with a racially diverse school district in the northeastern region of the United States. Educators in the district learned about NORC's Youth and Teen Math Mindset study (funded by the Bill and Melina Gates Foundation) and expressed interest in administering NORC's survey to get a better sense of what factors may underlie and influence students' math achievement. Together, NORC and the district administered the survey in the spring of the 2022-2023 academic year to students in the fourth through tenth grades.

DATA AND METHODS

To better understand student experiences studying math and other factors that may influence their math achievement, the survey asked students a series of questions about the following factors:

1. **Classroom climate** (teacher and peer interactions in math class)
2. **Math identity, beliefs, and motivation** (students' views of their math ability, how math ability develops, the importance of studying math, and persistence when studying math)
3. **Instructional practices and experiences** (students' experiences learning math and the usefulness of those experiences)
4. **Support from parents around math learning** (parental expectations and support)

Survey questions related to the factors listed above make up four subscales that we used in regression models to explore their association with standardized math achievement scores. The research questions guiding our analysis were:

1. Over and above demographic characteristics, are the subscales from the NORC Youth and Teen Math Mindset study associated with standardized math achievement scores in our partner district?
2. How much, if at all, does the association between standardized math achievement scores and the NORC Youth and Teen Math Mindset subscales differ across racial/ethnic subgroups?

For this analysis, we combined students' survey responses from the NORC 2023 Youth and Teen Math Mindset Study with demographic data and standardized math achievement data provided by the district using a common identifier. Math achievement data included students' raw scores on their 2022-2023 end-of-year standardized state math exam, with possible scores between 650 and 850, and their math proficiency level which included five categories: (1) did not meet expectations, (2) approached expectations, (3) partially met expectations, (4) met expectations, and (5) exceeded expectations. To maximize variation, we utilize raw scores from the standardized math exam as our outcome variable. The demographic data included students' grade level, their race and ethnicity, special education status, migrant status, English language learner status, and free and reduced-price lunch status. Each regression model includes one subscale as a predictor variable with demographic data listed above as control variables.

A note about our analytic approach: In our analysis, we chose each racial/ethnic group as its own reference group in our regression models. This approach aims to steer clear of "gap-gazing," a term used to describe the tendency in math education research to focus on differences between White students and students from marginalized groups. Such a focus can inadvertently reinforce misconceptions about inherent deficiencies among marginalized students and other misleading ideas about academic achievement (Gutierrez, 2008). In addition, given the varying sizes of racial and ethnic subgroup populations, direct comparisons between them may not be meaningful or appropriate. By focusing on each subgroup separately, we can understand the math beliefs and experiences of each subgroup in and of themselves, and thus support the advancement of research and interventions specifically tailored to foster effective teaching and learning environments for each subgroup.

DESCRIPTIVE ANALYSIS RESULTS

The final sample size for this study was 1,138 students (*N*=1,138). Tables 1-4 describe the demographic representation of the sample. This data set was 49% female and 51% male (see Table 1 in the Appendix), with 65% of the sample identifying as White, 6% identifying as Black, 12% identifying as Hispanic/Latinx, 12% identifying as Asian, and 6% identifying as more than one race (see Table 2 in the Appendix). The largest percentage of the sample was in fourth grade (24%) and ninth grade (26%), with smaller percentages in fifth (15%), sixth (13%), seventh (14%) and eighth (9%) grades (see Table 3 in the Appendix). While tenth graders completed the survey, they do not take a state standardized math exam in our partner district. As such, they were excluded from this analysis. 16% of the sample has a special education status (see Table 4). Less than 1% of the population had a migrant status or English language learner status, and less than 2% had free or reduced lunch, so these variables were excluded from the analyses.

Figure 1 (see Appendix) contains the distribution of standardized math achievement scores (our outcome variable) by race/ethnicity. Rather than simply showing means and standard deviations, we chose to highlight the distribution of standardized math achievement scores because it presents a more nuanced picture. The figure reveals that Asian students and students identifying with more than one race have the highest mean scores in our partner district, followed by White students, Black students, Hispanic/Latinx students and students identifying as American Indian or Pacific Islander. Also, there is an overlap across all the standardized math achievement scores for each racial/ethnic group. This indicates that even though the mean scores are higher for certain racial/ethnic subgroups, not all students in that group are scoring at or above the mean. We have also included distributions of scale scores for all our predictor variables (see Figures 2-6 in Appendix). The trend here is similar in that although we observe some differences in mean scale scores by race/ethnicity, we also observe overlaps in the distributions across racial and ethnic subgroups.

REGRESSION ANALYSIS RESULTS

Consistent with prior research that underscores the role of math experiences and identity in influencing math achievement (Bohrnstedt et al., 2020), we found statistically significant relationships between students' math scores and their (1) experiences in math classrooms, (2) math beliefs, and (3) perceptions of parent support for some or all racial and ethnic subgroups. Sample sizes allowed us to analyze data for White, Black, Hispanic, Asian, and Multiracial groups, but our sample size for Indigenous and Pacific Islander students was not large enough (n=5) to include in our analysis.

1. **Math Motivation: Across all racial and ethnic subgroups, students with higher motivation had higher math scores.**

Math motivation, or students' sense of value and purpose in math class, and their persistence despite challenging math content, positively influence students' engagement, classroom behavior, and math achievement (Stack & Dever, 2021). Previous research has shown that the impacts of math motivation differ across racial and ethnic subgroups (Hsieh, Simpkins, & Eccles, 2021).

Aligned with these findings, we found that math motivation predicts standardized math achievement scores for all students, regardless of race or ethnic group, and is the strongest predictor out of all the subscales (see Model 2 of Tables 5-9). This relationship was strongest for Black students, Asian students, and students who reported more than one race/ethnicity. Across all constructs measured (classroom experience, perceptions of instructional practice, parental support), increased motivation was associated with the largest increase in math scores for all subgroups. This indicates that changes in math motivation may have the greatest impact on math scores among these constructs. Interventions targeting math motivation may impact math scores for all racial and ethnic subgroups, but these impacts will likely be seen to differing extents across groups.

2. **Classroom climate: For White and Black students, students who were more positive about their experiences in their math classroom had higher math scores.**

Previous research indicates that teachers' beliefs and perceptions regarding students' math abilities influence student math outcomes (Strayhorn, 2010), and student-teacher relationships matter as well (McGrath & Van Bergen, 2015). Some research also indicates that students from racial and ethnic minority backgrounds experience fewer close student-teacher relationships (McGrath & Van Bergen, 2015). In addition, while research has shown that having a teacher of the same race often correlates with positive effects on students' achievement and course-taking, research also finds that Black and Hispanic students often have math teachers who are of a different race (Grissom, Kabourek, & Kramer, 2020; Joshi, et al., 2018; Shaw-Amoah, et al., 2020).

For all racial and ethnic subgroups, we explored math classroom climate (including student perceptions of feeling supported in the classroom and positive interactions with their teachers and peers), and the impact these experiences might have had on their standardized math achievement scores. As presented in Model 1 of Tables 5-9 we found that for Black and White students, math classroom climate had a clear impact on math scores. This relationship was especially strong for Black students, indicating that efforts to improve classroom experiences are likely to especially benefit Black students.

3. **Instructional Practices: For Black, White, and Hispanic students, students with more positive perceptions of instructional practices had higher math scores.**

Research suggests that students attending racially imbalanced and economically disadvantaged schools are provided less access to high-quality and student-focused math instruction (Rittle-Johnson et. al, 2021). To understand the impact of these observed inequities on student achievement, we explored the relationship between students' exposure to a variety of instructional practices and their math achievement. Students were asked about the frequency (ranging from a few times a year to almost every day) of a variety of instructional practices, including receiving clear instructions and ample time for completing assignments to engaging in interactive and collaborative work.

As presented in Model 3 of Tables 5-9, we found that for Black, White, and Hispanic students, students who reported higher rates of positive instructional practice had higher math scores. This association was strongest for Black students, and slightly higher for Hispanic students than for White students. This is in line with existing research that suggests that students in well-resourced and racially diverse schools, especially those schools focused on implementing equitable teaching practices, tend to learn and progress further in math (Boaler & Staples, 2008).

4. **Student Perceived Usefulness of Instructional Practices: For White students, students who reported higher usefulness of instructional practice had higher math scores.**

Additionally, because students' perceptions and experiences with instructional practices have important implications for their motivation and persistence in math (Lubienski, 2002), we explored student perceptions of the usefulness of these instructional practices in math class and the impacts these perceptions may have had on math achievement.

For all racial and ethnic subgroups, we explored students' views about the usefulness of instructional practices, including clear explanations, interactive and collaborative work, and sufficient time to complete assignments.

As presented in Model 4 of Tables 5-9, we found that White students who reported having ample time to practice math problems and to work with peers to solve problems had higher math scores on the state math assessment.

5. **Parental Support: White students who reported receiving higher levels of parental support had lower math scores.**

Parental support is a multidimensional concept, with prior research often examining specific facets such as communication, expectations, encouragement, and supervision of schoolwork (Castro et al., 2015). Previous research suggests that, generally, higher parental support is correlated with improved academic achievement. However, the strength of this association varies depending on the methods used to assess parental support and academic achievement (Wilder, 2014). Some studies have found negative or null relationships between parental engagement and academic achievement (Boonk et al., 2018).

For all racial and ethnic subgroups, we explored student experiences with parental support (expectations, homework help, engagement with course materials and content). As presented in Model 5 of Tables 5-9, we found that for White students, parental support had a clear, negative impact on math achievement, such that a perceived increase in parental support was associated with lower math scores. While this was the only subgroup for which parental support was significant, the relationship between parental support and math scores was negative for all racial and ethnic subgroups.

One possible explanation for higher parental engagement among students with lower math scores could be that higher levels of parental support are in response to students struggling with math. Parents may be more involved in their child's education when they perceive their child to be struggling academically, seeking to provide additional support and resources to improve their performance. The data does not provide insights about why this association might not be true for other racial and ethnic subgroups. Parental engagement may not emerge as a significant predictor of math scores for all racial and ethnic subgroups due to the presence of other variables in the model or confounding factors exerting a more substantial influence. The measurement of parental support utilized in this study may effectively predict other forms of academic achievement, such as grades. However, it might not be the optimal measure for standardized math scores as an outcome.

6. Demographic Variables

While our central focus was on the relationship between key subscales from the survey and standardized math achievement data, we also included demographic variables, such as gender, grade level, and individual education plan (IEP) in our models. In this section, we briefly describe some of the associations we found between math achievement scores and demographic variables.

Gender

Although prior research has found gender to play a role in student academic experiences and achievement (Jacobs, 2005), our regression models showed that gender was only a statistically significant predictor for White students in our partner district (See Table 5). Across all models, White female students had, on average, lower math scores than male students. Gender was also marginally statistically significant for some models in the Hispanic student subgroup analysis (see Table 6).

Gender appeared not to be a significant predictor of math scores for any other racial or ethnic subgroups, although the relationships between gender and math outcomes were negative for all models. This is consistent with other research highlighting that, despite some observed gender differences in math experiences and post-secondary achievement, gender matters less than race and other confounding factors in classroom grades and standardized test outcomes (Else-Quest et al., 2013).

Grade-Level Findings

Another interesting pattern emerges when we look at the grade-level control variable for all students in our sample. Our analysis here focuses on patterns across racial/ethnic subgroups, given that the sample size did not include large numbers of students at each grade level within the subgroups. Our models show that, on average, for all students in our partner district, math scores decrease as grade level increases. We consistently observe the largest decreases for students from fifth to sixth grade and from eighth to ninth grade.

Consistent with previous research (Akos, 2015; Benner, 2011), it appears that these large decreases occur at transition years for students. Although 5th graders in our partner district experience a transition into middle school buildings, the math curriculum changes in sixth grade and then in 9th grade. Therefore, we suspect that the large decreases we observed correspond with a curricular change in math from fifth to sixth grade and both a physical transition and curricular change from eighth to ninth grade.

Other Demographic Considerations

The association between other control variables and math scores in our models performed as expected. Students with an individualized education plan (IEP) had lower scores on average than students who did not have an IEP. Small subsample sizes prevented us from drawing any meaningful conclusions about the associations between math scores and other demographic variables in our regression models such as free- and reduced-priced lunch status, migrant status or English-language learner status.

CONCLUSION

There are a few limitations to this study to note as we consider implications and next steps. First, our study design prevents us from making any causal claims about the relationships between the subscales and standardized math achievement scores. Secondly, and as mentioned earlier in the brief, small subsample sizes did not permit us to report associations or draw any conclusions about some of the relationships we explored for this study. Although our partner district is racially diverse, certain subgroups, such as Indigenous students, were not large enough in number to include in our regression models. This was also the case for gender-nonconforming/nonbinary students, non-native English-speaking students and students who receive free- or reduced-priced lunch. Therefore, the findings from our study do not adequately capture the relationships between our subscales and math achievement for those student subgroups in our partner district. Due to the limited size of these subgroups, our partner district should investigate alternative research designs and methodologies to gain a comprehensive understanding of their experiences.

Despite the limitations mentioned, our findings show that motivation, classroom climate and instructional practices (but not parental support) have a positive association with standardized math achievement score for some, if not all, students in the sample. Our novel methodological approach, involving separate analyses for each racial and ethnic subgroup rather than selecting one group as a comparison group for all other groups, provided a nuanced analysis of math achievement in our partner district. In our model that contained all students, each subscale was positively associated with math score. When we examined results by racial/ethnic subgroup, the trend we discovered for the overall sample continued to hold across racial/ethnic subgroups.

Although this was not a causal study, there may be useful implications for interventions aimed at increasing math achievement scores. This study suggests that a district-wide intervention to increase math motivation for students may positively impact all student math achievement scores, although subgroups may see these impacts to differing degrees. Interventions geared towards other constructs, such as classroom climate or instructional practice, may see more targeted increases for specific racial and ethnic subgroups.

Future research should explore reasons math achievement scores decrease as grade levels increase, particularly focusing on exploring the dramatic, statistically significant declines experienced in the 6th and 9th grades. Understanding root causes of this trend may provide insight into interventions to improve achievement.

Finally, future research should consider intersectional approaches to understand how factors like race/ethnicity, gender, socio-economic status, migrant status, and other characteristics interact and influence students' math experiences and achievements in complex ways.

Acknowledgements

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APPENDIX

Table 1. Sample by gender

Gender	Frequency	%
Female	555	49
Male	583	51
Total	**1138**	**100**

Table 2. Sample by race/ethnicity

Race/Ethnicity	Frequency	%
White	735	65
Black	73	6
Hispanic/Latinx	131	12
Asian	131	12
American Indian and Pacific Islander	5	<1
More than one race	63	6
Total	**1138**	**100**

Table 3. Sample by Grade Level

Grade Level	Frequency	%
Fourth Grade	296	24
Fifth Grade	182	15
Sixth Grade	158	13
Seventh Grade	169	14
Eighth Grade	113	9
Ninth Grade	315	26
Total	**1233**	**100**

Table 4. Sample by Individual Education Plan (IEP) Status

IEP Status	Frequency	%
No	1039	84
Yes	194	16
Total	**1233**	**100**

Figure 1. Distribution of standardized math achievement scores by race/ethnicity

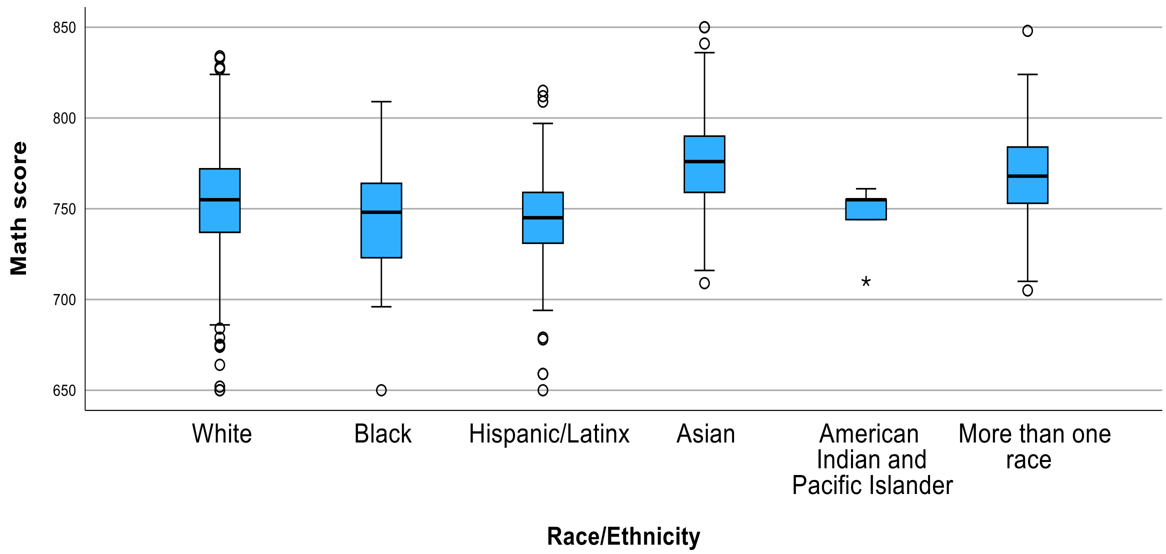

Figure 2. Distribution of classroom climate scale scores by race/ethnicity

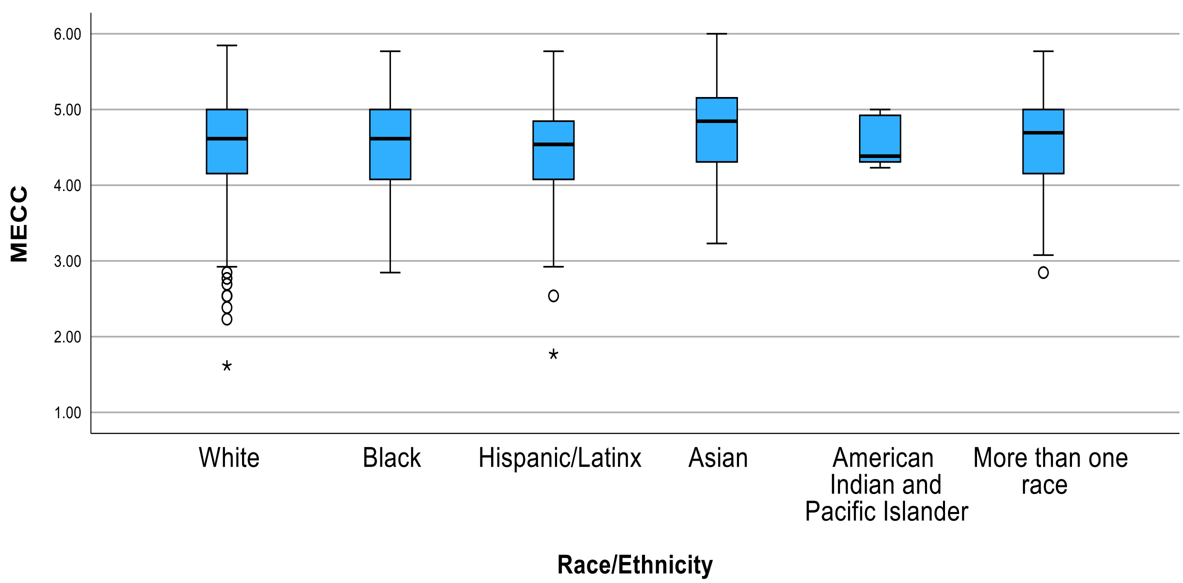

Figure 3. Distribution of math motivation scale scores by race/ethnicity

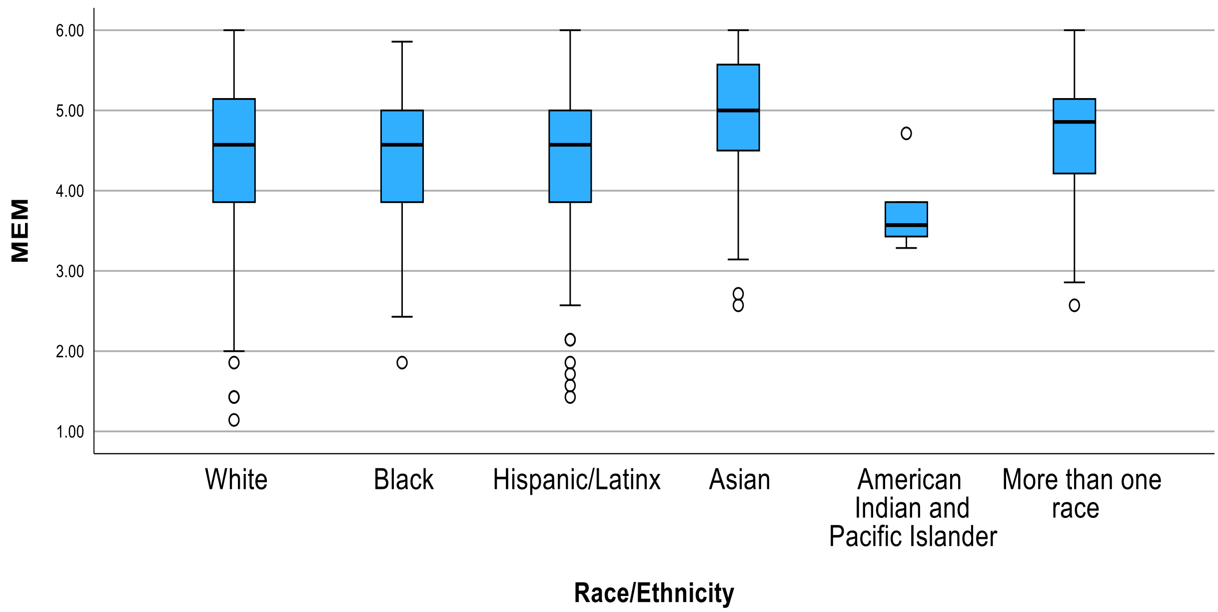

Figure 4. Distribution of instructional practices scale scores by race/ethnicity

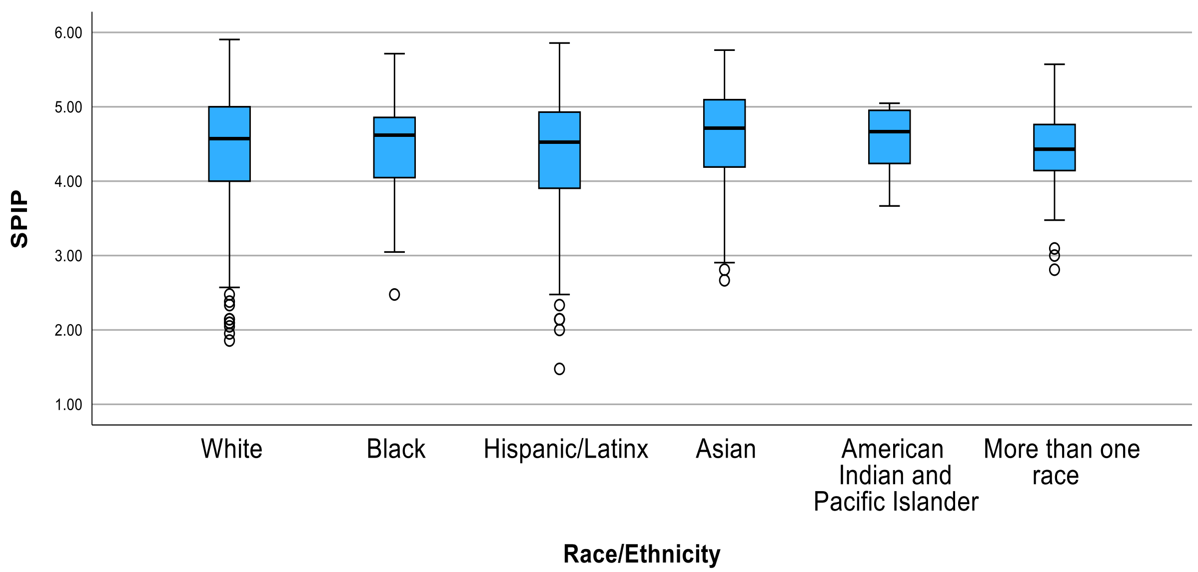

Figure 5. Distribution of perceived usefulness of instructional practices scale scores by race/ethnicity

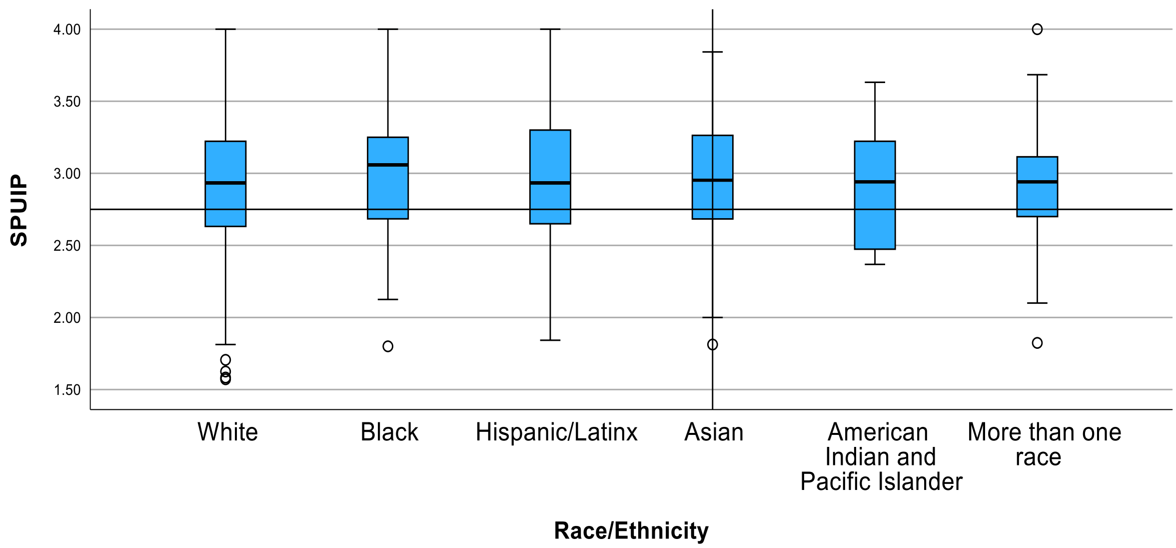

Figure 6. Distribution of student parental support scale scores by race/ethnicity

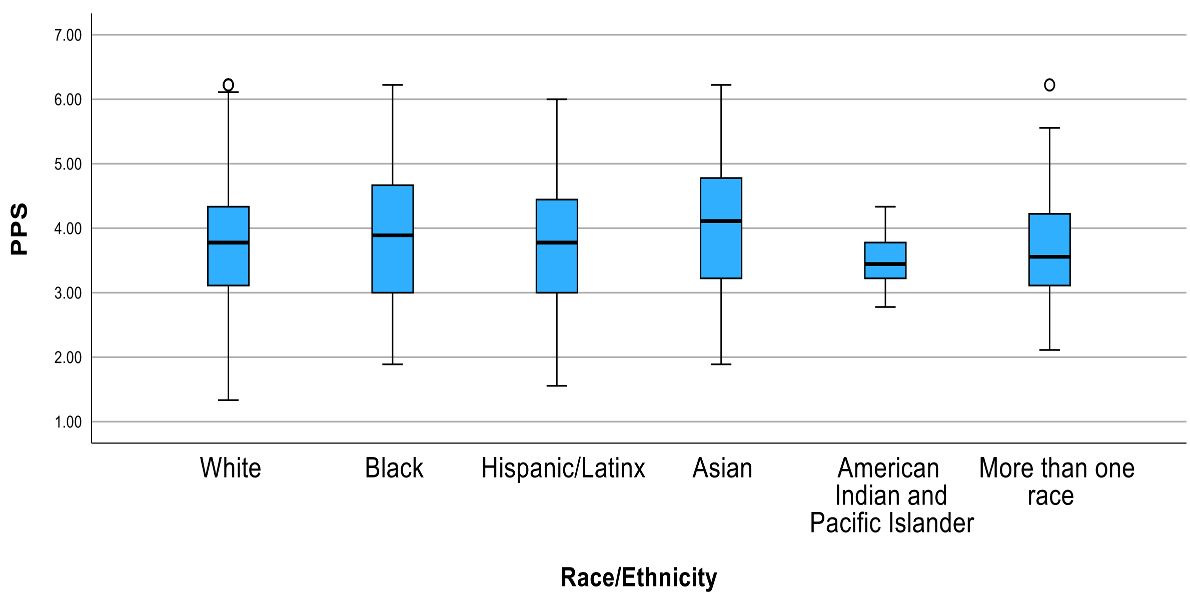

Figure 7. Distribution of standardized math achievement scores by gender

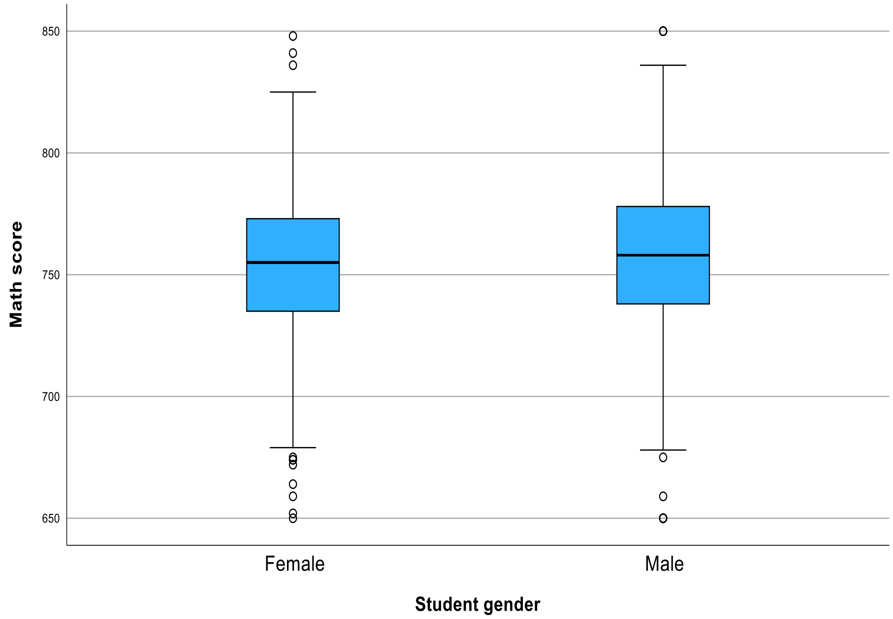

Figure 8. Distribution of standardized math achievement scores by grade level

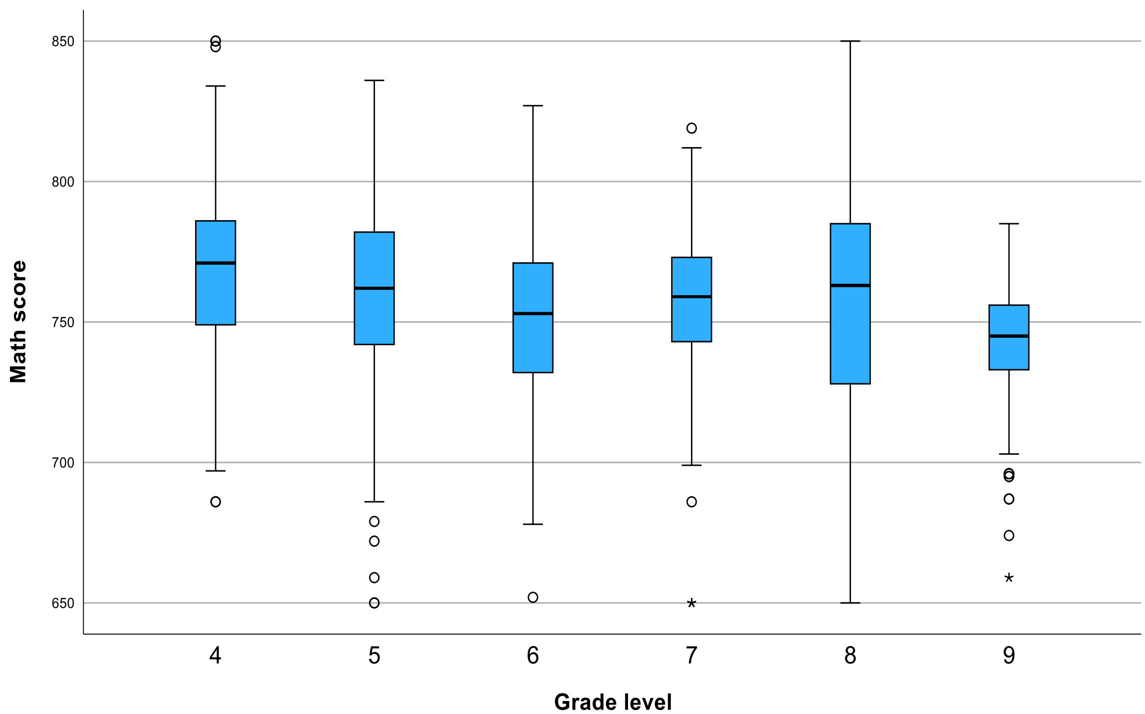

Table 5. Linear Regression Models for Youth and Teen Math Mindset Scales Predicting Math Standardized Achievement Raw Score for White Students

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	**Math Score**	**Math Score**	**Math Score**	**Math Score**
Classroom Climate Scale	6.159***				
	(1.429)				
Motivation Scale		10.848***			
		(0.953)			
Instructional Practices Scale			3.487***		
			(1.244)		
Usefulness of Instructional Practice Scale				4.328**	
				(2.064)	
Parent Support Scale					-2.345**
					(1.020)
Gender	-8.042***	-6.096***	-7.506***	-6.667***	-7.071***
(Female compared to male)	(1.794)	(1.690)	(1.828)	(1.858)	(1.852)
IEP Status	-26.927***	-23.151***	-27.815***	-28.388***	-28.051***
(“Yes” compared to “No”)	(2.358)	(2.236)	(2.413)	(2.412)	(2.413)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Grade Level – 5th Grade	-9.212***	-7.401***	-9.156***	-8.352***	-6.992**
(Compared to 4th grade)	(3.015)	(2.825)	(3.066)	(3.118)	(3.174)
Grade Level – 6th Grade	-18.187***	-17.037***	-19.038***	-19.254***	-17.070***
(Compared to 4th grade)	(3.064)	(2.871)	(3.160)	(3.185)	(3.222)
Grade Level – 7th Grade	-11.344***	-10.511***	-11.346***	-11.682***	-10.216***
(Compared to 4th grade)	(3.037)	(2.846)	(3.135)	(3.176)	(3.209)
Grade Level – 8th Grade	-16.120***	-13.101***	-15.870***	-16.372***	-16.096***
(Compared to 4th grade)	(3.409)	(3.205)	(3.482)	(3.600)	(3.616)
Grade Level – 9th Grade	-23.761***	-17.826	-24.503***	-24.474***	-24.374***
(Compared to 4th grade)	(2.528)	(2.435)	(2.557)	(2.592)	(2.577)
Constant	748.533***	724.783***	760.848***	763.438***	784.232***
	(6.901)	(4.978)	(5.961)	(6.568)	(4.170)
Observations	784	784	762	744	735
R-squared	0.264	0.354	0.256	0.258	0.257

Standard errors in parentheses
*** p < 0.01, **p<0.05, *p<0.1

Table 6. Linear Regression Models for Youth and Teen Math Mindset Scales Predicting Math Standardized Achievement Raw Score for Black Students

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Classroom Climate Scale	15.154***				
	(4.671)				
Motivation Scale		16.226***			
		(2.934)			
Instructional Practices Scale			13.391***		
			(4.696)		
Usefulness of Instructional Practice Scale				4.473	
				(7.196)	
Parent Support Scale					0.962
					(3.206)
Gender	-5.672	-5.025	-4.410	-6.829	-6.396
(Female compared to male)	(6.553)	(5.821)	(6.828)	(7.377)	(7.742)
IEP Status	-25.135***	-20.396**	-24.262**	-20.896**	-20.527*
(“Yes” compared to “No”)	(9.139)	(7.942)	(9.445)	(9.972)	(10.368)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	**Math Score**	**Math Score**	**Math Score**	**Math Score**
Grade Level – 5th Grade	-20.399*	-14.305	-11.273	-8.023	-8.491
(Compared to 4th grade)	(10.347)	(9.193)	(10.899)	(12.010)	(12.448)
Grade Level – 6th Grade	-25.391**	-22.381**	-19.095*	-17.543	-17.857
(Compared to 4th grade)	(10.976)	(9.696)	(10.914)	(11.845)	(12.182)
Grade Level – 7th Grade	-6.188	-5.018	-1.153	-0.382	-1.521
(Compared to 4th grade)	(10.044)	(8.956)	(10.108)	(10.957)	(11.159)
Grade Level – 8th Grade	11.275	27.658*	21.977	19.132	9.312
(Compared to 4th grade)	(16.125)	(14.557)	(16.375)	(17.484)	(21.445)
Grade Level – 9th Grade	-25.734***	-15.608**	-22.521***	-22.273**	-23.459**
(Compared to 4th grade)	(7.630)	(7.032)	(7.917)	(8.717)	(8.982)
Constant	697.177***	688.877***	701.760***	748.306***	758.308***
	(20.972)	(14.482)	(22.645)	(22.804)	(12.308)
Observations	79	79	76	74	73
R-squared	0.308	0.446	0.298	0.207	0.176

Standard errors in parentheses

*** p < 0.01, **p<0.05, *p<0.1

Table 7. Linear Regression Models for Youth and Teen Math Mindset Scales Predicting Math Standardized Achievement Raw Score for Hispanic/Latinx Students

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Classroom Climate Scale	3.383				
	(3.349)				
Motivation Scale		9.333***			
		(2.292)			
Instructional Practices Scale			5.556**		
			(2.615)		
Usefulness of Instructional Practice Scale				-1.218	
				(4.690)	
Parent Support Scale					-3.157
					(2.371)
Gender	-7.747*	-6.231	-6.681	-8.873*	-6.557
(Female compared to male)	(4.598)	(4.330)	(4.599)	(4.546)	(4.648)
IEP Status	-38.108***	-37.339***	-37.047***	-39.381***	-41.836***

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	**Math Score**	**Math Score**	**Math Score**	**Math Score**
(“Yes” compared to “No”)	(6.564)	(6.232)	(6.958)	(7.025)	(7.358)
Grade Level – 5th Grade	-9.079	-7.703	-8.858	-6.719	-8.222
(Compared to 4th grade)	(7.230)	(6.836)	(7.232)	(7.340)	(7.621)
Grade Level – 6th Grade	-15.158*	-15.403*	-15.544*	-16.428**	-15.584*
(Compared to 4th grade)	(8.318)	(7.901)	(8.328)	(8.151)	(8.391)
Grade Level – 7th Grade	-15.916**	-13.913*	-14.306*	-19.092**	-20.214**
(Compared to 4th grade)	(7.792)	(7.340)	(7.976)	(7.677)	(7.788)
Grade Level – 8th Grade	-4.057	1.140	-3.334	-10.371	-12.175
(Compared to 4th grade)	(8.404)	(8.026)	(9.215)	(9.244)	(9.306)
Grade Level – 9th Grade	-21.369***	-15.561**	-19.870***	-24.245***	-25.668***
(Compared to 4th grade)	(6.452)	(6.284)	(6.548)	(6.577)	(6.682)
Constant	746.300***	717.875***	735.901***	767.703***	776.774***
	(16.123)	(11.817)	(13.234)	(15.545)	(10.538)
Observations	152	152	144	136	132
R-squared	0.257	0.329	0.262	0.280	0.304

Standard errors in parentheses
*** p < 0.01, **p<0.05, *p<0.1

Table 8. Linear Regression Models for Youth and Teen Math Mindset Scales Predicting Math Standardized Achievement Raw Score for Asian Students

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Classroom Climate Scale	4.943				
	(3.814)				
Motivation Scale		13.320***			
		(2.861)			
Instructional Practices Scale			4.338		
			(3.258)		
Usefulness of Instructional Practice Scale				0.661	
				(5.216)	
Parent Support Scale					-3.105
					(2.234)
Gender	-3.226	-1.217	-2.163	-2.794	-4.000
(Female compared to male)	(4.363)	(4.085)	(4.386)	(4.480)	(4.385)
IEP Status	-26.878***	-22.527**	-26.148**	-28.740***	-18.221
(“Yes” compared to “No”)	(9.951)	(9.354)	(10.865)	(10.919)	(11.585)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Grade Level – 5th Grade	-15.208**	-13.765**	-14.123**	-12.811*	-6.857
(Compared to 4th grade)	(7.010)	(6.527)	(7.019)	(7.149)	(7.128)
Grade Level – 6th Grade	-19.937***	-21.577***	-20.076***	-16.614**	-14.352*
(Compared to 4th grade)	(7.196)	(6.650)	(7.506)	(7.461)	(7.384)
Grade Level – 7th Grade	-13.183*	-13.899**	-13.348*	-10.731	-10.380
(Compared to 4th grade)	(6.808)	(6.337)	(6.923)	(7.173)	(7.010)
Grade Level – 8th Grade	2.544	1.562	-2.172	-1.097	0.093
(Compared to 4th grade)	(8.676)	(8.054)	(9.753)	(9.881)	(9.611)
Grade Level – 9th Grade	-31.433***	-26.220***	-31.229***	-29.995***	-31.129***
(Compared to 4th grade)	(6.643)	(6.319)	(6.694)	(6.869)	(6.665)
Constant	769.252***	724.938***	771.899***	788.539***	802.839***
	(18.344)	(15.202)	(15.519)	(16.467)	(9.752)
Observations	146	146	138	135	131
R-squared	0.238	0.334	0.225	0.209	0.210

Standard errors in parentheses
*** p < 0.01, **p<0.05, *p<0.1

Table 9. Linear Regression Models for Youth and Teen Math Mindset Scales Predicting Math Standardized Achievement Raw Score for Multi-Racial Students

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	**Math Score**	**Math Score**	**Math Score**	**Math Score**
Classroom Climate Scale	4.887				
	(4.491)				
Motivation Scale		12.189***			
		(3.447)			
Instructional Practices Scale			1.482		
			(5.917)		
Usefulness of Instructional Practice Scale				-1.119	
				(7.615)	
Parent Support Scale					-5.395
					(3.446)
Gender	2.866	3.201	4.164	4.669	6.337
(Female compared to male)	(5.913)	(5.339)	(5.953)	(6.172)	(6.258)
IEP Status	-26.457***	-28.120***	-27.798***	-28.207***	-26.713***
(“Yes” compared to “No”)	(7.586)	(6.894)	(7.716)	(7.818)	(7.751)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
	Math Score	Math Score	Math Score	Math Score	Math Score
Grade Level – 5th Grade	-17.280**	-10.567	-18.275**	-17.175*	-18.177**
(Compared to 4th grade)	(8.075)	(7.660)	(8.337)	(8.777)	(8.635)
Grade Level – 6th Grade	-29.916***	-30.270***	-29.852***	-29.583***	-29.005***
(Compared to 4th grade)	(9.863)	(9.000)	(10.063)	(10.182)	(10.023)
Grade Level – 7th Grade	-13.453	-12.944	-14.958	-16.121	-15.308
(Compared to 4th grade)	(10.222)	(9.275)	(10.967)	(10.587)	(10.292)
Grade Level – 8th Grade	-6.993	-5.466	-9.026	-9.297	-4.371
(Compared to 4th grade)	(11.029)	(10.084)	(11.215)	(11.413)	(12.007)
Grade Level – 9th Grade	-41.486***	-35.519***	-42.297***	-43.006***	-44.023***
(Compared to 4th grade)	(8.935)	(8.379)	(9.421)	(9.297)	(9.138)
Constant	765.713***	729.106***	782.004***	791.995***	807.749***
	(21.641)	(17.822)	(27.935)	(23.414)	(13.882)
Observations	67	67	66	64	63
R-squared	0.399	0.495	0.391	0.395	0.425

Standard errors in parentheses
*** p < 0.01, **p<0.05, *p<0.1