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Research

Ethnic/Racial Differences in Mathematics Performance of Texas Grade 3 Students: A Statewide, Multiyear Study [1]

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Abstract:

Write a short summary of the article in English here. The "Abstract" you will write In this investigation, the extent to which differences were present in the mathematics achievement by the ethnicity/race of Grade 3 students in Texas were analyzed. Data obtained from the Texas Education Agency Public Education Information Management System for all Texas Grade 3 students who took the State of Texas Assessment of Academic Readiness Mathematics exam were examined for the 2016-2017, 2017-2018, and 2018-2019 school years. In all three years analyzed, statistically significant differences were revealed in overall mathematics achievement and in all four Mathematics Reporting categories. Inferential statistical analyses revealed a clear stair-step effect. Asian students were the highest performing ethnic/racial group in all four Mathematics Reporting categories and all three performance level standards, followed by White, Hispanic, and Black students. Suggestions for future research and implications for policy and practice were provided.

Keywords: Mathematics achievement, Ethnicity/race, STAAR Grade 3, Texas.

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[1] Based on a doctoral dissertation titled Differences in Mathematics Achievement as A Function of Ethnicity/Race and Economic Status of Texas Grade 3 Students: A Multiyear, Statewide Investigation

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INTRODUCTION

In 2001, the United States Department of Education passed the No Child Left Behind Act in which states and school districts were required to report the progress they were making on closing ethnic/racial achievement gaps (U.S. Department of Education, 2005). A focus was placed on closing the White-Black and White-Hispanic achievement gaps in the content areas of reading and mathematics. In 2015, a new education policy, the Every Students Succeeds Act, was enacted with mandates of a continued focus on the narrowing of achievement gaps. Maintained in this new law was state and school district accountability to continue to work toward closing racial/ethnic achievement gaps (U.S. Department of Education, 2017). Despite policies targeted at closing these achievement gaps, many researchers (e.g., Braun, Chapman, & Vezzu, 2010; Growe & Montgomery, 2003; Reardon, Cimpian, & Weathers, 2015; Reardon & Galindo, 2009; Reardon, Kalogrides, & Shores, 2019; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009) have established that the achievement gap is not closing at an appropriate rate. In fact, researchers (e.g., Fryer & Levitt, 2006; Kuhfeld, Gershoff, & Paschall, 2018; Lee & Burkham, 2002; McDonough, 2015; Reardon, 2011) have documented how students of color enter school with disparities which continue to be present as children progress through school.

Also mandated in the previously mentioned federal laws were that state education leaders and school practitioners must disaggregate student assessment data to ensure all student groups are mastering the content. According to the Nation's Report Card (2019a), only 41% of Grade 4 students in the United States were at or above the proficient level on the National Assessment of Educational Progress Mathematics assessment. Within that percentage, 70% were Asian, 52% were White, 27% were Hispanic, and 20% were Black (The Nation's Report Card, 2019a). These percentages are congruent with previous researchers (e.g., Harris, 2018; Jencks & Phillips, 1998; Lee, 2002; McGown, 2016; Reardon & Galindo, 2009; Saw & Chang, 2018; Schleeter, 2017) who established that Asian students had the highest test scores, followed by White students, Hispanic students, and then Black students in mathematics. These data are indicative of a 32% gap between White and Black students and a 25% gap between White and Hispanic students. Compared to 2009, the White-Black achievement gap and the White-Hispanic achievement gap decreased three and four percentage points, respectively, over 10 years (The Nation's Report Card, 2019a). In Grade 8, one third of the students in the United States were at or above proficient on the National Assessment of Educational Progress Mathematics assessment (The Nation's Report Card, 2019b). Of those students, 64% were Asian, 44% were White, 20% were Hispanic, and 14% were Black. The White-Black and White-Hispanic achievement gaps present for Grade 8 students were almost identical to the gaps present for Grade 4 students.

With regard to the state of interest in this study, Texas, achievement gaps by ethnicity/race in reading have been well documented. In 2018, Harris addressed the presence of ethnic/racial differences in the reading performance of Texas Grade 4 students.

Analyzed in her study were three years of data (i.e., 2012-2013, 2013-2014, 2014-2015) from the state-mandated reading assessment, the State of Texas Assessment of Academic Readiness (STAAR) Reading exam, to determine whether ethnic/racial (i.e., Asian, Black, Hispanic, and White) differences were present. In her study, statistically significant ethnic/racial achievement gaps were present in reading for all three school years. Regarding the three reading reporting categories, Asian students outperformed White, Hispanic, and Black students (Harris, 2018). Similarly, White students outperformed Hispanic and Black students. In all three STAAR Reading Reporting categories, Hispanic students had higher reading test scores than their Black peers. With respect to passing rates, Harris (2018) also documented that Asian students had the highest passing rates on the STAAR Level II Final Satisfactory Performance Standard in reading, followed by White students, Hispanic students, and then Black students. Consistent with the national scores previously discussed, racial/ethnic achievement gaps in reading were clearly present on the Texas state-mandated assessment for Grade 4 students.

McGown (2016) conducted a similar study of Texas Grade 3 students. She analyzed the Texas state-mandated reading assessment for the same three school years (i.e., 2012-2013, 2013-2014, 2014-2015) as Harris (2018), with the difference being that her sample consisted of Grade 3 students and the Harris study sample were Grade 4 students. Established in the McGown (2016) investigation were the presence of statistically significant ethnic/racial differences in reading. Similar to Harris (2018), statistically significant differences were present for all four student groups. Regarding the three STAAR Reading Reporting categories, Asian students outperformed White, Hispanic, and Black students (McGown, 2016). Similarly, White students outperformed Hispanic and Black students. In all STAAR Reading Reporting categories, Hispanic students had higher reading test scores than their Black peers. With respect to passing rates, McGown (2016) also determined that Asian students had the highest passing rates on the STAAR Level II Final Satisfactory Performance Standard in reading, followed by White students, Hispanic students, and then Black students. Consistent with the national scores previously discussed and with the Harris (2018) investigation on Grade 4 students, racial/ethnic achievement gaps in reading were clearly present on the Texas state-mandated assessment for Grade 3 students.

In another study conducted in Texas, Schleeter (2017) addressed differences in reading achievement by the ethnicity/race of Grade 3 English Language Learners. Analyzed in his study were the same three school years of data (i.e., 2012-2013, 2013-2014, 2014-2015) as Harris (2018) and McGown (2016) from the Texas state-mandated reading assessment. Similar to Harris (2018) and McGown (2016), statistically significant differences were present for all four student groups. Regarding all three school years, Asian English Language Learners outperformed White English Language Learners, followed by Black English Language Learners, and then Hispanic English Language Learners (Schleeter, 2017).

As of this investigation, only one published article was located in which performance on the Texas state-mandated assessment in mathematics was addressed. In that article, Davenport and Slate (2019) analyzed the degree to which differences were present in the STAAR Mathematics performance of Texas Grade 3 students by their economic status (i.e., Not Poor, Moderately Poor, and Extremely Poor) at the Approaches Grade Level, Meets Grade Level, and Masters Grade Level performance standards. Grade 3 students who were Not Poor had the highest passing rates on the Approaches Grade Level performance level, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. A clear stair-step effect (Carpenter, Ramirez, & Severn, 2006) was present at the Approaches Grade Level performance level. Similarly, at the Meets Grade Level performance level, Grade 3 students who were Not Poor had the highest passing rates, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. Finally, for the Masters Grade Level performance level, Grade 3 students who were Not Poor had the highest passing rates, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. Thus, at all three indicators of mathematics performance, a stair-step effect (Carpenter et al., 2006) was present, with respect to economic status. The highest passing rates were consistently present for students who were not in poverty; the next best passing rates were present for students who were eligible for the reduced-price lunch program; and the lowest passing rates were present for students who were eligible for the free lunch program.

In a comprehensive analysis of the previous Texas state-mandated assessment, the Texas Assessment of Knowledge and Skills, Alford-Stephens (2016) analyzed the mathematics performance of Texas high school boys by their ethnicity/race (i.e., Asian, Black, Hispanic, and White). She analyzed data from the 2004-2005 through the 2011-2012 school years. In her multiyear, statewide analyses, she documented the presence of statistically significant ethnic/racial differences in mathematics performance in each of the eight school years examined. Throughout the 8-year time period, Asian boys had the highest met standard percentage, followed by White boys. White boys had a higher met standard percentage than Hispanic boys and Black boys. For all eight years analyzed, Black boys had the lowest met standard percentage. A stair-step effect (Carpenter et al., 2006) was present, with respect to ethnicity/race at the met standard proficiency level. These findings were consistent with previous literature of ethnic/racial achievement gaps in mathematics.

Statement of the Problem

Since the United States Supreme Court decision in Brown vs. The Board of Education of Topeka, education has been viewed as a way for all individuals, regardless of their background, to succeed in life (Colleen & Carlos, 2001). However, researchers (e.g., Barton & Coley, 2010; Paschall, Gershoff, & Kuhfeld, 2018) have established achievement gaps based on ethnicity/race are still present, although some researchers (e.g., Burchinal et al.,

2011; Reardon & Portilla, 2016) have discussed how gains have been made that have resulted in slight decreases in the gaps from 1998 to 2010. Reardon and Galindo (2009) reported the gaps in achievement between White and Hispanic students were narrowing at a faster pace than the gaps between White and Black students. Documented in the 2019 Nation's Report Card was a mathematics achievement gap of 32 percentage points between White and Black students in Grade 4 and a 24 percentage point gap between White and Hispanic students in Grade 4.

The State of Texas gives school campuses and school districts accountability scores on their closing of achievement gaps between the subpopulations they serve (Texas Education Agency, 2019). Researchers (e.g., Alford-Stephens, 2016; Harris, 2018; McGown, 2016; Schleeter, 2017) have established the presence of achievement gaps in Texas which are consistent with national research on ethnic/racial achievement gaps in that Asian and White students are achieving at a higher level than their peers who are Black and Hispanic in the area of reading. An extensive search of the extant research literature, however, revealed the presence of only one published article (Davenport & Slate, 2019) on the mathematics performance of Texas students.

Purpose of the Study

The purpose of this study was to determine the degree to which ethnicity/race (i.e., Asian, Black, Hispanic, and White) of Texas Grade 3 students is related to their mathematics performance. Specifically addressed herein was the degree to which differences were present by the ethnicity/race of Texas Grade 3 students on the STAAR Mathematics Reporting Categories. Also examined was the extent to which ethnic/racial differences existed in the percentages of Texas Grade 3 students achieving at the three performance levels (i.e., Approaches Grade Level, Meets Grade Level, and Masters Grade Level). The final purpose of this study was to determine if any trends were present in the reporting categories and performance levels across three school years (i.e. 2016-2017, 2017-2018, 2018-2019) by the ethnicity/race of Texas Grade 3 students.

Significance of the Study

Prior researchers (e.g., Harris, 2018; McGown, 2016; Schleeter, 2017) have documented the presence of statistically significant differences in the reading performance of Texas students on the state-mandated assessment over a 3-year time period. Alford-Stephens (2016) established ethnic/racial differences in the mathematics performance of Texas students on the previously used state-mandated assessment over an 8-year time period. Currently, the published research literature regarding the mathematics performance of Texas students by ethnicity/race on the current state-mandated assessment is minimal. Findings from this study can increase the literature on this topic. In addition, policymakers and practitioners can use these findings to understand how students from different ethnic/racial backgrounds learn and understand different mathematical concepts.

Research Questions

In this study, the following overarching research question was addressed: What is the difference in mathematics performance by the ethnicity/race (i.e., Asian, White, Hispanic, and Black) of Texas Grade 3 students? Specific subquestions under this overarching research question were: (a) What is the difference in numerical representations and relationships by the ethnicity/race of Texas Grade 3 students?; (b) What is the difference in computations and algebraic relationships by the ethnicity/race of Texas Grade 3 students?; (c) What is the difference in geometry and measurement by the ethnicity/race of Texas Grade 3 students?; (d) What is the difference in data analysis and personal financial literacy by the ethnicity/race of Texas Grade 3 students?; (e) What is the difference in performance on the Approaches Grade Level standard by the ethnicity/race of Texas Grade 3 students?; (f) What is the difference in performance on the Meets Grade Level standard by the ethnicity/race of Texas Grade 3 students?; (g) What is the difference in performance on the Masters Grade Level standard by the ethnicity/race of Texas Grade 3 students?; and (h) What is the degree to which trends are present in mathematics by the ethnicity/race of Texas Grade 3 students? The first seven research subquestions were addressed for three school years, whereas the last research question involved a comparison of results across all three school years.

METHOD

Research Design

For this study, the research design was a quantitative, non-experimental, causal comparative (Johnson & Christensen, 2020). Because the independent variables and dependent variables had already taken place, a causal comparative design was used to find relationships between independent and dependent variables (Johnson & Christensen, 2020). In this study, the mathematics achievement of Grade 3 students in Texas was analyzed to determine the extent to which ethnic/racial differences might be present. The independent variable in this study is the ethnicity/race (i.e., Asian, White, Hispanic, Black) of Grade 3 students in Texas. The dependent variables in this study were the STAAR Mathematics Reporting Categories (i.e., Reporting Category 1, Reporting Category 2, Reporting Category 3, and Reporting Category 4) and the three STAAR Mathematics performance levels (i.e., Approaches Grade Level, Meets Grade Level, Masters Grade Level) for Grade 3 Students in Texas.

Participants and Instrumentation

Participants in this study were Grade 3 students in Texas who had taken the STAAR Mathematics assessment during the 2016-2017, 2017-2018, and 2018-2019 school years. Data were requested from the Texas Education Agency Public Education Information Management System. Analyses were conducted based on student ethnicity/race (i.e., Asian, White, Hispanic, Black), performance level (i.e., Approaches Grade Level, Meets Grade Level, Masters Grade Level), and across the four STAAR Mathematics Reporting Categories

(i.e. Reporting Category 1, Reporting Category 2, Reporting Category 3, and Reporting Category 4).

Mathematics achievement was determined based on the four STAAR Mathematics Reporting Categories. In Reporting Category 1, students are assessed over their ability to understand numerical representations and relationships. STAAR Mathematics Reporting Category 2 measures student ability to understand algebraic relationships and computations. Assessed in Reporting Category 3 is the ability for students to understand geometry and measurement. Finally, in Reporting Category 4, student ability to understand data analysis and financial literacy is measured.

In addition to the STAAR Mathematics Reporting Categories, three performance level standards were analyzed in this study. In 2017, the Texas Education Agency introduced three performance levels to determine how well students performed on the STAAR Mathematics Assessment (Texas Education Agency, 2017). The Approaches Grade Level standard predicts that students will be likely to succeed in the next grade level or course with targeted academic interventions to assist in the student's academic progress (Texas Education Agency, 2017). In the Meets Grade Level standard, students will be expected to succeed in the next grade level with some form of short-term, targeted academic interventions. Students who perform in the Masters Grade Level standard are expected to succeed in the next grade level. The students in this category will need very little to no academic intervention (Texas Education Agency, 2017).

Readers are directed to the Texas Education Agency website (www.tea.gov) for detailed information about the test reliabilities and test validities of the STAAR Mathematics exam. Extensive documentation is present there of strong test reliabilities and of strong correlations (i.e., test validities) for this STAAR exam with other measures.

Ethical Considerations

Only archival, pre-existing data were analyzed in this multiyear investigation. The Texas Education Agency that provided the data to the authors of this study first de-identified all student data so that no students could be identified. Accordingly, no ethical risks or harm was possible from conducting this investigation.

RESULTS

Prior to conducting multivariate analysis of variance (MANOVA) statistical procedures, its underlying assumptions were checked. Specifically examined were data normality, Box's Test of Equality of Covariance and the Levene's Test of Equality of Error Variance. Although a majority of these assumptions were not met, the robustness of the MANOVA procedure made it appropriate to use in this study (Field, 2009). Results of statistical analyses by the ethnicity/race of Grade 3 students in Texas who took the STAAR

Mathematics assessment will be described by Mathematics Reporting Category in chronological order for the 2016-2017, 2017-2018, and 2018-2019 school years.

Overall Results Across All Three School Years

With respect to the 2016-2017 school year, the MANOVA revealed a statistically significant difference in overall mathematics performance by the ethnicity/race of Texas Grade 3 students, Wilks' $\Lambda = .90$, $p < .001$, partial $\eta^2 = .04$, small effect size (Cohen, 1998). Regarding the 2017-2018 school year, the MANOVA yielded a statistically significant difference, Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, in overall mathematics performance as a function of student ethnicity/race. According to Cohen (1988), the effect size for this statistically significant difference was small. Concerning the 2018-2019 school year, a statistically significant difference was again present in overall mathematics performance, Wilks' $\Lambda = .87$, $p < .001$, partial $\eta^2 = .04$. Using Cohen's (1988) criteria, the effect size was small. In all three school years, effect sizes were small for the statistically significant differences in overall mathematics performance of Texas Grade 3 students by their ethnicity/race.

Mathematics Reporting Category 1 Results Across All Three School Years

Following the overall results of the MANOVA, univariate follow-up Analysis of Variance (ANOVA) procedures were calculated to determine whether statistically significant differences were present in STAAR Mathematics Reporting Category 1 scores by student ethnicity/race for all three school years. Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 212283) = 6662.25$, $p < .001$, partial $\eta^2 = .09$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 176326) = 5166.69$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 165811) = 5946.50$, $p < .001$, partial $\eta^2 = .10$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 1, the effect sizes for the statistically significant differences on the STAAR Mathematics Reporting Category 1 by ethnicity/race were moderate for all three school years.

To determine which ethnic/racial pairings were statistically significantly different, Scheffe' post hoc procedures were conducted. Statistically significant differences on the STAAR Mathematics Reporting Category 1 were revealed for all of the ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.72 more items correctly than White students, 1.68 more items correctly than Hispanic students, and 2.31 more items correctly than Black students. Similarly, White students answered 0.96 more items correctly than Hispanic students and 1.59 more items correctly than Black students. Hispanic students answered 0.63 more items correctly, on average, than Black students.

Black students were the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.60 more items correctly than White students, 1.42 more items correctly than Hispanic students, and 2.11 more items correctly than Black students. Similarly, White students answered 0.82 more items correctly than Hispanic students and 1.51 more items correctly than Black students. Hispanic students answered 0.68 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.70 more items correctly than White students, 1.60 more items correctly than Hispanic students, and 2.15 more items correctly than Black students. Similarly, White students answered 0.90 more items correctly than Hispanic students and 1.45 more items correctly than Black students. Hispanic students answered 0.55 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2018-2019 school year.

For STAAR Mathematics Reporting Category 1, a clear stair-step effect (Carpenter, Ramirez, & Severn, 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 1.

Table 1

Descriptive Statistics for the STAAR Mathematics Reporting Category 1 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	6.96	1.53
White	75,677	6.23	1.73
Hispanic	106,539	5.27	2.05
Black	23,486	4.64	2.15

2017-2018			
Asian	6,149	7.10	1.44
White	63,223	6.50	1.64
Hispanic	87,533	5.68	1.92
Black	19,425	4.99	2.07
2018-2019			
Asian	6,730	6.96	1.40
White	61,628	6.27	1.60
Hispanic	79,354	5.37	1.81
Black	18,103	4.81	1.93

Mathematics Reporting Category 2 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 212283) = 6195.78$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 176326) = 6714.64$, $p < .001$, partial $\eta^2 = .10$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 165811) = 6801.15$, $p < .001$, partial $\eta^2 = .11$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 2, effect sizes were moderate for all three school years.

Following the three follow-up ANOVA procedures, Scheffe' post hoc procedures were conducted to determine which ethnic/racial pairings were statistically significantly different. Statistically significant differences on the STAAR Mathematics Reporting Category 2 were revealed for all of the ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 1.42 more items correctly than White students, 2.84 more items correctly than Hispanic students, and 4.00 more items correctly than Black students. Similarly, White students answered 1.42 more items correctly than Hispanic students and 2.59 more items correctly than Black students. Hispanic students answered 1.16 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 1.43 more items correctly than White students, 3.06 more items correctly than Hispanic students, and 4.05 more items correctly than Black students. Similarly, White students answered 1.64 more items correctly than Hispanic students and 2.63 more items correctly than Black students. Hispanic students answered 0.99 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 1.21 more items correctly than White students, 2.82 more items correctly than Hispanic students, and 3.88 more items correctly than Black students. Similarly, White students answered 1.61 more items correctly than Hispanic students and 2.67 more items correctly than Black students. Hispanic students answered 1.06 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2018-2019 school year.

For STAAR Mathematics Reporting Category 2, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 2.

Table 2

Descriptive Statistics for the STAAR Mathematics Reporting Category 2 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	11.55	2.36
White	75,677	10.13	2.90
Hispanic	106,539	8.71	3.39
Black	23,486	7.54	3.55
2017-2018			
Asian	6,149	11.36	2.25

White	63,223	9.93	2.76
Hispanic	87,533	8.30	3.19
Black	19,425	7.31	3.38
2018-2019			
Asian	6,730	11.51	2.17
White	61,628	10.30	2.66
Hispanic	79,354	8.69	3.07
Black	18,103	7.63	3.31

Mathematics Reporting Category 3 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 212283) = 5894.83$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 176326) = 5030.75$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 165811) = 4897.95$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 3, effect sizes were moderate for all three school years.

Next, Scheffe' post hoc procedures revealed the presence of statistically significant differences on the STAAR Mathematics Reporting Category 3 for all ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.76 more items correctly than White students, 1.53 more items correctly than Hispanic students, and 2.05 more items correctly than Black students. Similarly, White students answered 0.76 more items correctly than Hispanic students and 1.29 more items correctly than Black students. Hispanic students answered 0.53 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.88 more items correctly than White students, 1.59 more items correctly than Hispanic students, and 2.13 more items correctly than Black students. Similarly, White students answered 0.71 more items correctly than Hispanic students and 1.25 more items correctly than Black students. Hispanic students

answered 0.54 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.63 more items correctly than White students, 1.31 more items correctly than Hispanic students, and 1.91 more items correctly than Black students. Similarly, White students answered 0.67 more items correctly than Hispanic students and 1.28 more items correctly than Black students. Hispanic students answered 0.60 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2018-2019 school year.

For the STAAR Mathematics Reporting Category 3, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 3.

Table 3

Descriptive Statistics for the STAAR Mathematics Reporting Category 3 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	5.76	1.44
White	75,677	5.00	1.65
Hispanic	106,539	4.24	1.74
Black	23,486	3.71	1.79
2017-2018			
Asian	6,149	5.92	1.40
White	63,223	5.04	1.60
Hispanic	87,533	4.33	1.71
Black	19,425	3.79	1.76

2018-2019			
Asian	6,730	6.16	1.24
White	61,628	5.53	1.45
Hispanic	79,354	4.85	1.66
Black	18,103	4.25	1.76

Mathematics Reporting Category 4 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 212283) = 4058.93$, $p < .001$, partial $\eta^2 = .05$, small effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 176326) = 3211.55$, $p < .001$, partial $\eta^2 = .05$, small effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 165811) = 2535.16$, $p < .001$, partial $\eta^2 = .04$, small effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 4, effect sizes were small for all three school years.

Scheffe' post hoc procedures were next conducted and revealed the presence of statistically significant differences on the STAAR Mathematics Reporting Category 4 for all ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.44 more items correctly than White students, 0.80 more items correctly than Hispanic students, and 1.21 more items correctly than Black students. Similarly, White students answered 0.36 more items correctly than Hispanic students and 0.78 more items correctly than Black students. Hispanic students answered 0.42 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.28 more items correctly than White students, 0.63 more items correctly than Hispanic students, and 1.00 more items correctly than Black students. Similarly, White students answered 0.35 more items correctly than Hispanic students and 0.72 more items correctly than Black students. Hispanic students answered 0.37 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.33 more items correctly than White students, 0.58 more items correctly than Hispanic students, and 0.89

more items correctly than Black students. Similarly, White students answered 0.25 more items correctly than Hispanic students and 0.56 more items correctly than Black students. Hispanic students answered 0.31 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2018-2019 school year.

With respect to the STAAR Mathematics Reporting Category 4, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Table 4 contains the descriptive statistics for these analyses.

Table 4

Descriptive Statistics for the STAAR Mathematics Reporting Category 4 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	3.30	0.95
White	75,677	2.87	1.08
Hispanic	106,539	2.51	1.16
Black	23,486	2.09	1.21
2017-2018			
Asian	6,149	3.44	0.84
White	63,223	3.16	0.95
Hispanic	87,533	2.81	1.12
Black	19,425	2.44	1.20
2018-2019			
Asian	6,730	3.38	0.82
White	61,628	3.05	0.91
Hispanic	79,354	2.80	0.95

Black	18,103	2.49	1.01

Results for the STAAR Mathematics Approaches Grade Level Standard Across All Three School Years

Student performance on the STAAR Mathematics Approaches Grade Level standard was examined next through the use of Pearson chi-square procedures. This statistical procedure was the optimal statistical procedure to use because dichotomous data were present for the STAAR Mathematics Approaches Grade Level standard (i.e., met or did not meet this standard) and categorical data were present for ethnicity/race (i.e., Asian, White, Hispanic, Black). As such, the Pearson chi-square is the preferred statistical procedure when both variables are categorical (Field, 2009). Because a large sample size was present, the assumptions for using a chi-square were met.

With respect to the STAAR Mathematics Approaches Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 11683.95$, $p < .001$, small effect size, Cramer's V of .24 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Approaches Grade Level standard than White, Hispanic, and Black students. Asian students had 6.5% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 21.1% more than Hispanic students, and 34.9% more than Black students. White students had 14.6% more students who met this standard than Hispanic students and 28.6% more than Black students. Hispanic students had 14% more students who met this standard than Black students. Black students had the lowest percentages who met the Approaches Grade Level standard for the 2016-2017 school year. Table 5 contains the frequencies and percentages for this school year.

Table 5

Frequencies and Percentages for the STAAR Mathematics Approaches Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	6,280	95.40	305	4.60
White	67,260	88.90	8,417	11.10

Hispanic	79,193	74.30	27,346	25.70
Black	14,165	60.30	9,321	39.70
2017-2018				
Asian	5,959	96.90	190	3.10
White	57,892	91.60	5,331	8.40
Hispanic	68,490	78.20	19,043	21.80
Black	12,610	64.90	6,815	35.10
2018-2019				
Asian	6,526	97.00	204	3.00
White	56,853	92.30	4,775	7.70
Hispanic	62,648	78.90	16,706	21.10
Black	11,827	65.30	6,276	34.70

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 9605.03$, $p < .001$, small effect size, Cramer's V of .23 (Cohen, 1988). As delineated in Table 5, Asian students had 5.3% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 18.7% more than Hispanic students, and 32% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 26.7% more than Black students. Hispanic students had 13.3% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 9657.93$, $p < .001$, small effect size, Cramer's V of .24 (Cohen, 1988). As presented in Table 5, Asian students had 4.7% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 18.1% more than Hispanic students, and 31.7% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 27% more than Black students. Hispanic students had 13.6% more students who met this standard than Black students.

With respect to the STAAR Mathematics Approaches Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Approaches

Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Results for the STAAR Mathematics Meets Grade Level Standard Across All Three School Years

With respect to the STAAR Mathematics Meets Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 16728.56.95$, $p < .001$, small effect size, Cramer's V of .28 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Meets Grade Level standard than White, Hispanic, and Black students. Asian students had 22.2% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 44.4% more than Hispanic students, and 58.1% more than Black students. White students had 22.2% more students who met this standard than Hispanic students and 25.9% more than Black students. Hispanic students had 16.7% more students who met this standard than Black students. Black students had the lowest percentages who met the Meets Grade Level standard for the 2016-2017 school year. Table 6 contains the frequencies and percentages for this school year.

Table 6

Frequencies and Percentages for the STAAR Mathematics Meets Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	5,740	87.20	845	12.80
White	49,208	65.00	26,469	35.00
Hispanic	45,616	42.80	60,923	57.20
Black	6,845	29.10	16,641	70.90
2017-2018				
Asian	5,479	89.10	670	10.90
White	42,615	67.40	20,608	32.60

Hispanic	38,003	43.40	49,500	56.60
Black	5,798	29.80	13,627	70.20
2018-2019				
Asian	5,988	89.00	742	11.00
White	42,728	69.30	18,900	30.70
Hispanic	35,616	44.90	43,738	55.10
Black	5,514	30.50	12,589	69.50

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 15786.91$, $p < .001$, moderate effect size, Cramer's V of .30 (Cohen, 1988). As delineated in Table 6, Asian students had 21.7% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 44.7% more than Hispanic students, and 59.3% more than Black students. White students had 23% more students who met this standard than Hispanic students and 36.6% more than Black students. Hispanic students had 14.6% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 15848.13$, $p < .001$, moderate effect size, Cramer's V of .31 (Cohen, 1988). As presented in Table 6, Asian students had 4.7% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 18.1% more than Hispanic students, and 31.7% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 27% more than Black students. Hispanic students had 13.6% more students who met this standard than Black students.

With respect to the STAAR Mathematics Meets Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Meets Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Results for the STAAR Mathematics Masters Grade Level Standard Across All Three School Years

With respect to the STAAR Mathematics Masters Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 15205.24$, $p < .001$, small effect size, Cramer's V of .27 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Masters Grade Level standard than White, Hispanic, and Black students. Asian students had 30.5% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 48.1% more than Hispanic students, and 56.4% more than Black students. White students had 17.6% more students who met this standard than Hispanic students and 25.9% more than Black students. Hispanic students had 8.3% more students who met this standard than Black students. Black students had the lowest percentages who met the Masters Grade Level standard for the 2016-2017 school year. Table 7 contains the frequencies and percentages for this school year.

Table 7

Frequencies and Percentages for the STAAR Mathematics Masters Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	4,538	68.90	2,047	31.10
White	29,088	38.40	46,589	61.60
Hispanic	22,171	20.80	84,368	79.20
Black	2,925	12.50	20,561	87.50
2017-2018				
Asian	4,269	69.49	1,880	30.60
White	24,395	38.60	38,828	61.40
Hispanic	16,733	19.10	70,800	80.90
Black	2,159	11.10	17,266	88.90
2018-2019				

Asian	4,688	69.70	2,042	30.30
White	25,540	41.40	36,088	58.60
Hispanic	16,128	20.30	63,226	79.70
Black	2,176	12.00	15,927	88.00

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 15178.82$, $p < .001$, small effect size, Cramer's V of .29 (Cohen, 1988). As delineated in Table 7, Asian students had 30.8% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 50.3% more than Hispanic students, and 58.3% more than Black students. White students had 19.5% more students who met this standard than Hispanic students and 27.5% more than Black students. Hispanic students had 8% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 15383.09$, $p < .001$, moderate effect size, Cramer's V of .30 (Cohen, 1988). As presented in Table 7, Asian students had 28.3% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 49.4% more than Hispanic students, and 57.7% more than Black students. White students had 21.1% more students who met this standard than Hispanic students and 29.4% more than Black students. Hispanic students had 8.3% more students who met this standard than Black students.

With respect to the STAAR Mathematics Masters Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Masters Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Trends in Mathematics Performance by Student Ethnicity/Race

In analyzing the mathematics achievement of Grade 3 students in Texas across the three years of data that were examined, trends in scores were present by ethnicity/race. In each STAAR Mathematics Reporting Category and in all three years investigated, a clear stair-step effect was observed (Carpenter et al., 2006). In all instances Asian students had the highest mathematics achievement, followed by White students, then Hispanic students and finally Black students. Concerning the STAAR Mathematics Performance Level standards, the same stair-step effect was present. Statistically significantly higher percentages of Asian

students met each of the three STAAR Mathematics Performance Level Standards, followed by White students, then Hispanic students, and finally by Black students. These trends are revealed in Figures 1 through 7.

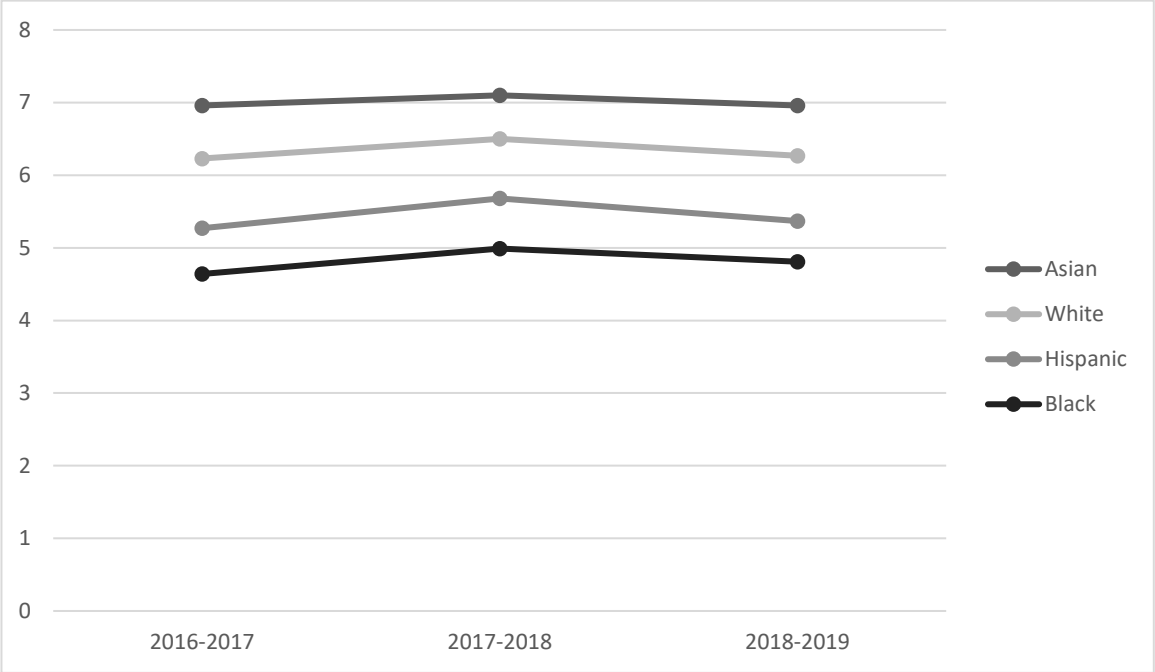

Figure 1. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 1 for the 2016-2017, 2017-2018, and 2018-2019 school years*

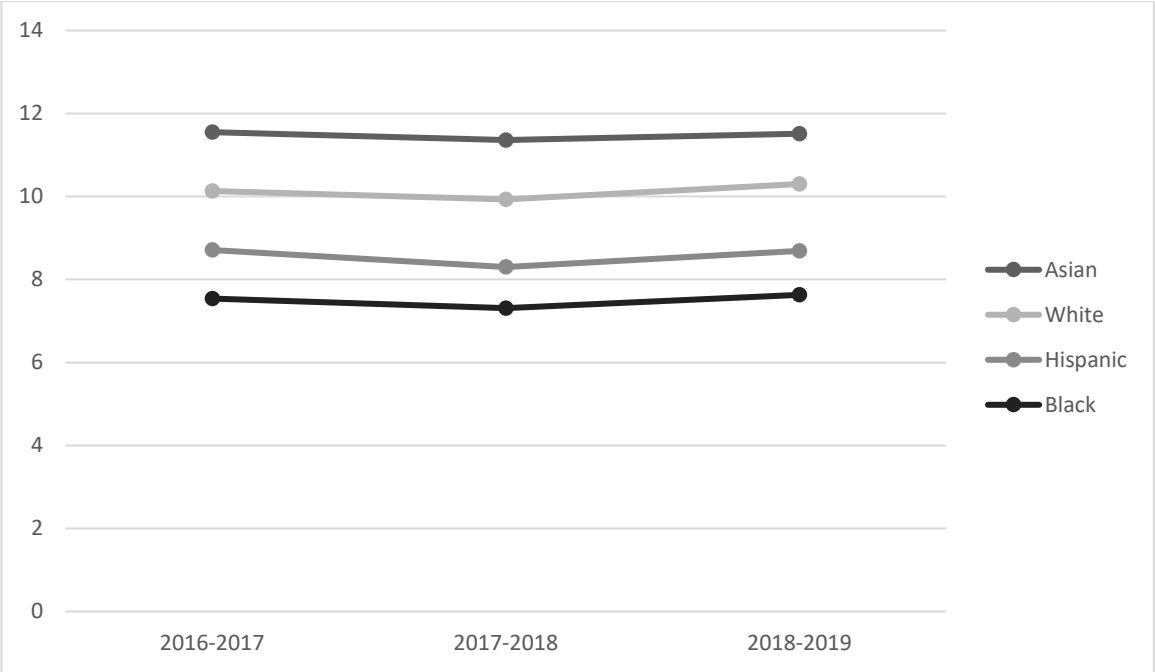

Figure 2. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 2 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

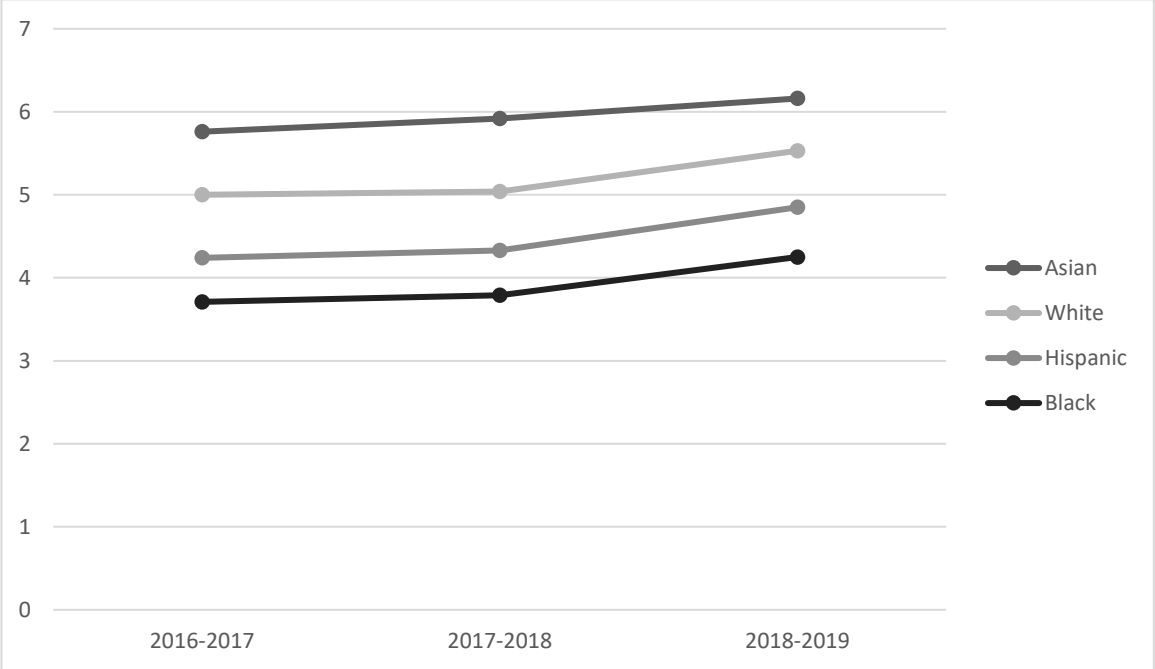

Figure 3. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 3 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

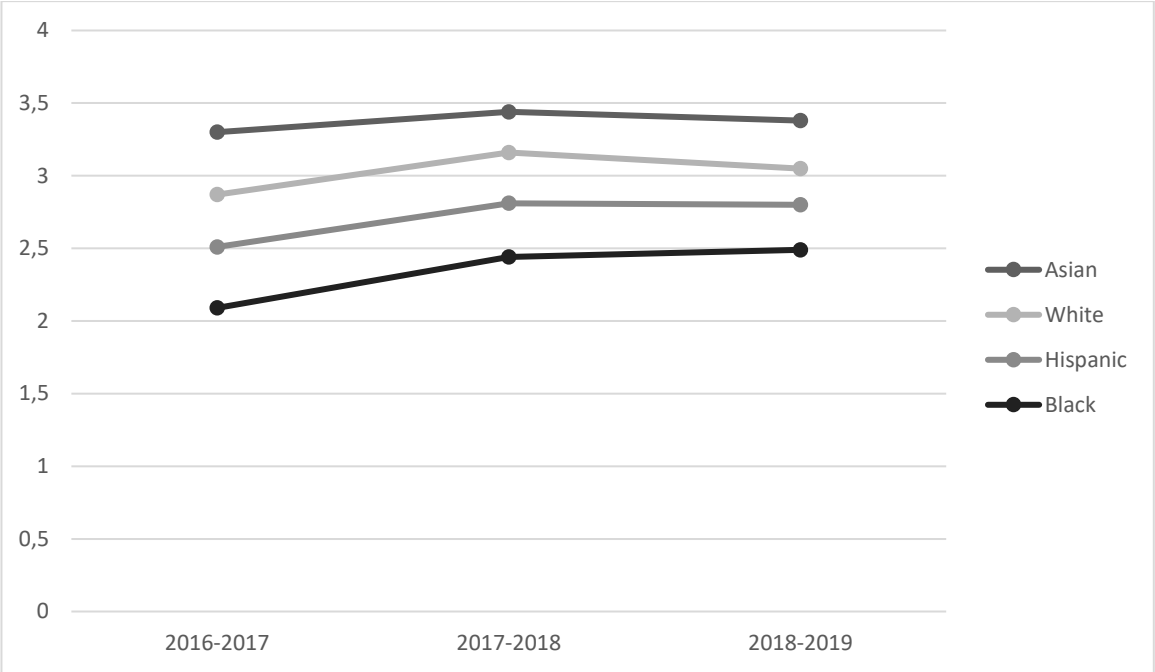

Figure 4. *Average scores by ethnicity/race of Grade 3 Students in Texas for the STAAR Grade 3 Mathematics Reporting Category 4 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

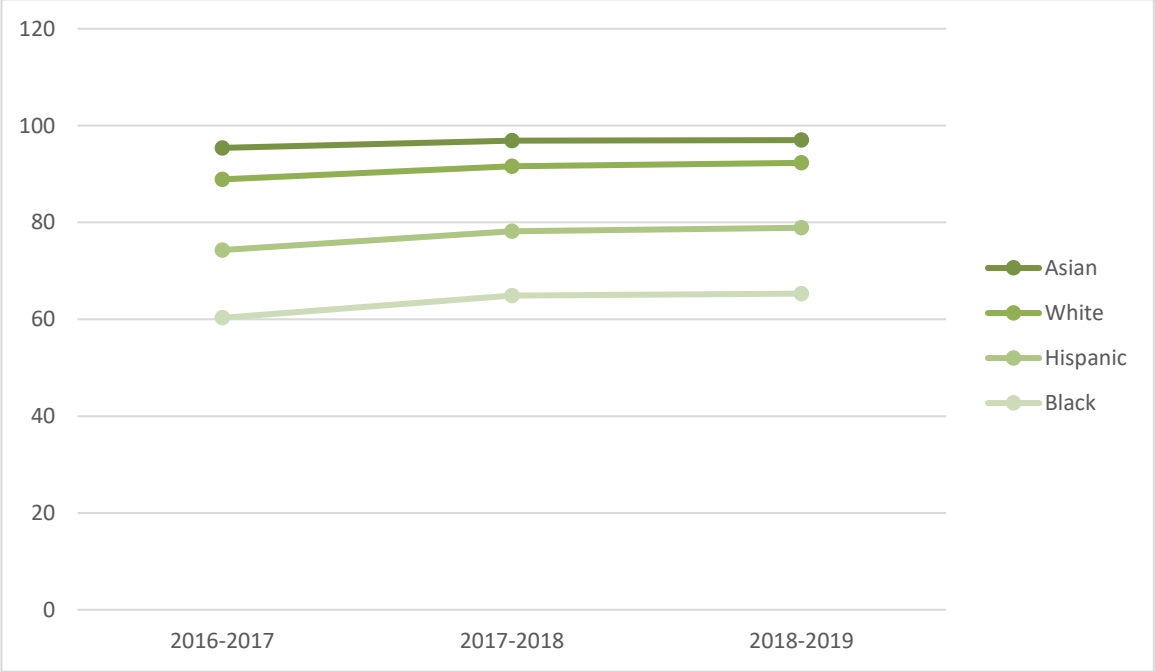

Figure 5. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Approaches Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

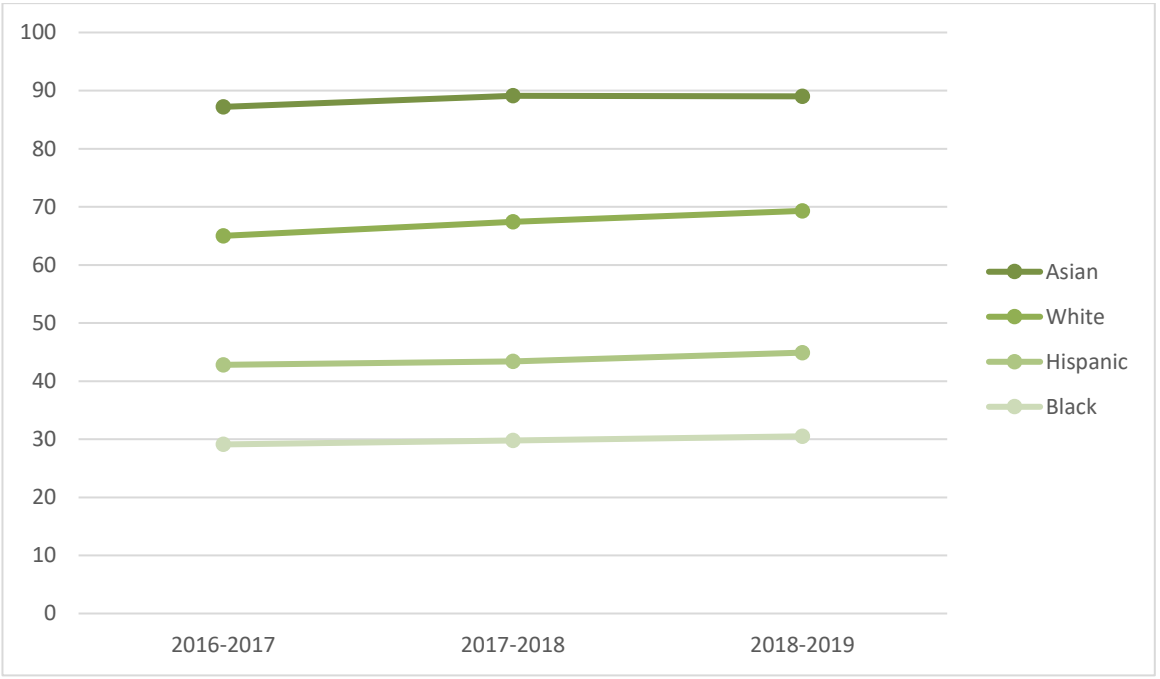

Figure 6. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Meets Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

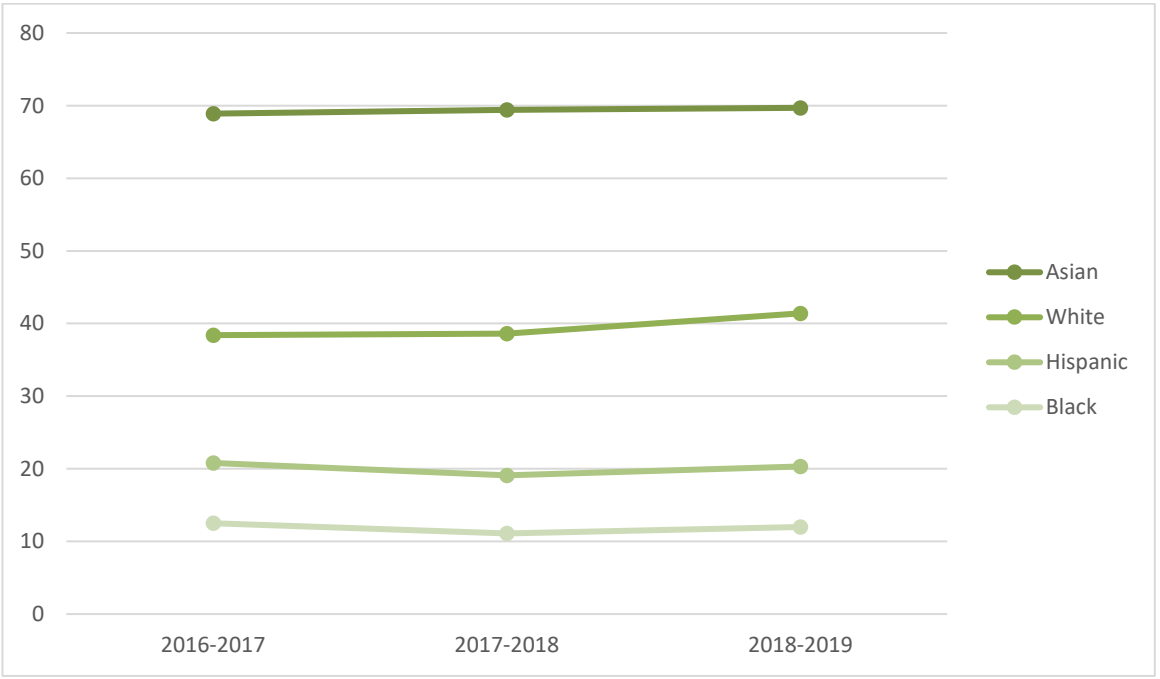

Figure 7. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Masters Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

DISCUSSION

The mathematics achievement of Grade 3 students by their ethnicity/race was investigated in this statewide, multiyear study. Mathematics achievement was determined using two different sets of measures: (a) number of test items answered correctly in each STAAR Mathematic Reporting Category and (b) percentages of students who met the three performance level standards. Statistically significant results were present in all of the mathematics achievement measures in all three school years examined.

Connections to Existing Literature

As revealed in this study, ethnic/racial differences were present in the mathematics achievement of Grade 3 students. These findings were congruent with the results of other researchers (Alford-Stephens, 2016; Harris, 2018; McGown, 2016) who established the presence of ethnic/racial achievement gaps being present for students in Texas. Their investigations, as well as the findings discussed in this article, provide evidence for a clear stair-step effect (Carpenter et al., 2006) in student mathematics achievement. Asian students consistently outperformed White students, Hispanic students, and Black students. In addition, results are commensurate with national research of substantial ethnic/racial academic gaps (e.g., Braun, Chapman, & Vezzu, 2010; Growe & Montgomery, 2003; Reardon, Cimpian, & Weathers, 2015; Reardon & Galindo, 2009; Reardon, Kalogrides, & Shores, 2019; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009). The Nation's Report Card (2019) revealed a similar clear stair-step effect (Carpenter et al., 2006) as this study with Asian students having the best performance, followed by White students, Hispanic students, and Black students.

Implications for Policy and for Practice

Based upon the results discussed herein, several implications for policy and practice can be recommended. Black and Hispanic students continue to be outperformed by Asian and White students in mathematics achievement. First, with respect to policy, funds should be provided to districts and schools who have a high population of Black and Hispanic students to assist with mathematics interventions and resources. Second, teacher preparation programs must ensure prospective teachers are learning about the challenges faced by students from different ethnic/racial backgrounds. Prospective teachers should be taught strategies that will allow them to meet the academic, social, and emotional needs of their students. Last, annual professional development should be mandated to provide teachers with the latest research evidence regarding how students from different ethnic/racial backgrounds are progressing in mathematics. Trainings should be required yearly so teachers can learn about new strategies and resources to assist them in their classrooms.

Concerning practice, district and campus leaders must monitor student performance in mathematics before Grade 3 when state testing begins for students. Second, with the monitoring of student achievement in earlier grades, earlier interventions should be put in place for students struggling to master mathematical concepts and skills. Progress monitoring should be implemented by districts and schools to ensure all interventions are effective for students, especially students from historically low performing groups. Finally, school leaders should utilize assessment scores from the Grade 3 STAAR Mathematics exam to choose proper interventions and remediations for students to ensure growth for the next school year.

LIMITATIONS AND RECOMMENDATIONS

Several recommendations for future research can be offered based on the results of this statewide, multiyear investigation. First, researchers should determine if similar gaps are present in the mathematics achievement of students in other grade levels as a function of student ethnicity/race. Second, researchers should examine how economic status may affect the mathematics achievement of Black and Hispanic boys. A similar study should also be conducted for Black and Hispanic girls. Third, researchers should conduct this study in other states to determine the extent to which findings presented herein would be generalizable to other states. In this particular study, the focus was only on ethnic/racial differences. Therefore, researchers should analyze if mathematical differences are present based upon other student demographics. Last, researchers should include qualitative and mixed studies to obtain a better understanding regarding the relationship between ethnicity/race and mathematics achievement.

CONCLUSION

The purpose of this research study was to determine the extent to which differences were present in the mathematics achievement of Texas Grade 3 students as a function of their ethnicity/race. Analysis of three school years of Texas statewide data yielded statistically significant differences in the mathematics achievement by ethnicity/race. In all three school years, a stair-step effect (Carpenter et al., 2006) was clearly present. Asian students consistently outperformed White, Hispanic, and Black students in all four STAAR Mathematic Reporting Categories as well as all three STAAR Mathematics Performance Level standards. White students outperformed Hispanic and Black students. Black students were consistently the lowest performing ethnic/racial group. Findings were consistent with prior researchers (e.g., Alford-Stephen, 2016; Braun et al., 2010; Growe & Montgomery, 2003; Harris, 2018; McGown, 2016; Reardon et al., 2015; Reardon & Galindo, 2009; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009).

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