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Ethnic/Racial Differences in Specific Mathematics Skills of Texas High School Boys: A Texas Multiyear Statewide Analysis

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Abstract

Investigated in this study was the extent to which differences were present in overall mathematics achievement for Texas high school boys by their ethnicity/race (i.e., Asian, White, Hispanic, and Black). Statewide data were obtained from the Texas Education Agency Public Education Information Management System on all high school boys for the 2004-2005 through the 2011-2012 school years. Inferential statistical procedures yielded statistically significant differences for all 8 school years. For each of the mathematics proficiency levels (i.e., Met Standard, Commended Performance, Higher Education Readiness Component), a stair-step effect was present. Asian boys outperformed White, Hispanic, and Black boys in all school years, with one exception in which Asian and White boys had similar proficiency levels. In all 8 school years, Black boys had the poorest mathematics achievement on each proficiency level, with Hispanic boys having the next poorest mathematics proficiency. Implications are discussed and suggestions for policy and practice are made.

1. Introduction

Education is viewed as a vehicle that prepares students to become citizens with gainful employment. Unfortunately, some students are unable to acquire a quality education, which limits their economic and social mobility. According to the [1], accomplishments in school can increase the likelihood of college, workplace, and economic success. Similarly, positive relationships exist between mathematics achievement and lifelong success [2]. Despite researchers (e.g., 3, 4, 5] who have identified a need for students to have positive mathematics experiences, many educators continue to struggle with the challenges affiliated with educating diverse groups of students.

1.1. Mathematics Achievement

For several decades, researchers (e.g., 6, 7, 5, 8] have examined the mathematics achievement of Asian, White, Hispanic, and Black students. The quality of instruction, level of poverty, environmental conditions, and parental education and support has been regarded by various researchers [e.g., 6, 9, 10] as pivotal factors that can influence the acquisition of the knowledge and skills needed to be proficient in mathematics. Considering these complex constructs, many school districts work to ensure systems are in place to combat the struggles associated with teaching all students regardless of ethnic/racial group membership. Gaps in mathematics achievement among different

ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) have been a concern for several researchers (e.g., 5, 7, 5]. [7] examined mathematics trend data reported by the National Center for Education Statistics for a sample of 9, 13, and 17-year-old students. White students consistently outperformed Black and Hispanic students over a 30-year period for each of the age groups. Similarly, [5] analyzed data from the National Assessment of Educational Progress and documented that in Grade 8 87% of Hispanic students and 91% of Black students were not proficient in mathematics. In contrast, [11] determined that 53% of Asian students and 63% of White students were not proficient in mathematics. Further, [12] reported that the average score on the National Assessment of Educational Progress exam for Grade 12 Hispanic and Black students was nearly equivalent to the average score of Grade 8 White students. These noted disparities in student achievement have been continuously documented across the United States.

1.2. Rationale for Mathematics Achievement Gaps

Closing the academic performance gaps between Asian, White, Hispanic, and Black students has been the focus of numerous researchers (e.g., 6, 3, 7, 5, 8, 13, 14]. According to [3], disparities in mathematics achievement between different ethnic/racial groups can be attributed to educational inputs (e.g., caring and well-trained teachers, quality educational resources, and policies that promote social justice). Supporting this notion, [15] asserted that teacher competency and availability of resources could also influence the mathematics experiences of students. According to [15], Hispanic and Black students need educators who are able to engage and motivate students despite their personal circumstances or economic status. In contrast, [7] examined the cognitive developmental levels of White and Black students. In their study, White students scored statistically significantly higher than their Black counterparts on an assessment of mathematics achievement. Additionally, White students were in the concrete operational stage of cognitive development, whereas most Black students were in the preoperational phase of development. [7] concluded that when controlling for cognitive development level, the mathematics achievement gap was statistically non-existent. In a related study, [16] also examined cognitive learning and development. An understanding of the cognitive learning styles of different ethnic/racial groups was determined to be essential in implementing instructional practices that improve mathematics skills and outcomes for all students.

1.3. Implications of Poor Mathematics Achievement

Disparities in mathematics achievement among Asian, White, Hispanic, and Black students have been well documented in the United States. Specifically, the performance of boys by ethnic/racial groups has been the primary focus of some researchers (e.g., 6, 17]. In Texas, Asian and White boys continue to outperform their Hispanic and Black peers on state assessments [18]. Despite Hispanic students accounting for the majority (51%) of the state's student population, this group's mathematic achievement scores lag behind the scores of Asian and White students. Hispanic student performance, however, on state assessments exceeds the academic performance of Black students [18].

The consequences of limited mathematics achievement can greatly influence future outcomes. Poorly developed mathematical skills and abilities can have a lasting influence on educational attainment and career advancement [2]. [19], in a statewide study in Texas over a 10-year period, analyzed the ACT test performance of students by ethnic/racial membership. The researchers documented that in 2011 the average ACT score of Asian (24.8) and White (23.2) students were at least 5 points higher than the average ACT score of Hispanic (18.5) and Black (17.5) students. [19] contended that many Black and Hispanic students were not prepared for the rigor of postsecondary expectations.

Given the body of research that exists on the relationship between successful mathematics achievement and economic stability, it is imperative that educational leaders, agencies, and policymakers generate and implement interventions with all ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) to overcome mathematics achievement barriers. Keeping in mind that competency in mathematics is necessary for entry into science, technology, engineering, and mathematics careers and disciplines, low performing students need the support necessary to improve their mathematical skills and abilities [1, 20]. Consequently, this intervention and assistance could aid in reducing the persistent achievement gaps that exists among Asian, White, Hispanic, and Black students.

1.4. Statement of the Problem

The achievement gap that exists among students continues to be a concern for educators, policymakers, and parents [21]. Many researchers [e.g., 22, 7, 23] have attempted to explain the differences in academic performance between Asian, White, Hispanic, and Black students. These researchers have asserted that factors such as student economic status, English language acquisition, and teacher quality may influence student academic success.

To reduce achievement disparities, students need to receive quality instructional and educational experiences so that learning gaps can diminish [8]. For many students, the cumulative effects of years of unequal opportunities, unsupportive systems, and expanding achievement gaps are revealed during the high school years [21]. According to the [24], the Black-White achievement gap for Grade 12 students continues to be unacceptably large (30 point scale score difference). Similarly, the achievement gap (21 point scale score difference) between Hispanic and White students is unacceptably large [24]. In contrast, Asian students continue to outperform their White, Hispanic, and Black counterparts, particularly in mathematics [25]. Therefore, regardless of

racial/ethnic membership, improving the learning academic achievement for low performing students should be a central focus of educational systems so that the existing achievement gaps are reduced.

1.5. Purpose of the Study

The purpose of this study was to determine the degree to which differences were present in overall mathematics achievement by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. Specifically addressed was basic proficiency in mathematics (i.e., the Met Standard), advanced proficiency in mathematics (i.e., the Commended Performance), and college-readiness in mathematics (i.e., the Higher Education Readiness Component) to ascertain whether ethnic/racial achievement gaps were present. Eight years of the Texas Assessment of Knowledge and Skills (TAKS) Exit-Level Mathematics assessment data were analyzed to determine the degree to which differences existed in overall mathematics achievement by the ethnic/racial membership of boys. Furthermore, after analyzing 8 years of school statewide data the extent to which trends were present in overall mathematics achievement was determined.

1.6. Significance of the Study

A large body of research exists on differences in student achievement among different ethnic/racial groups [26, 9, 27]. Several researchers (e.g., 6, 4, 20] have conducted research on the mathematics achievement gap between Asian, White, Hispanic, and Black students. As noted by the [28], success in high school mathematics is positively related with postsecondary success. Information reported in this study may provide insight into the differences between high school mathematics achievement levels among students of different ethnic/racial groups. Further, the findings could also be useful in bringing increased awareness to mathematics achievement deficits so that educators and policymakers can implement interventions that can improve the opportunities for student achievement and success at the high school level.

1.7. Research Questions

The following research questions were addressed in this investigation: (a) What is the difference in the TAKS Mathematics Met Standard by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; (b) What is the difference in the TAKS Mathematics Commended Performance by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; (c) What is the difference in the TAKS Mathematics Higher Education Readiness Component (HERC) standard by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; and (d) What is the extent to which trends were present in the overall mathematics performance by ethnicity/race (i.e., Asian, White, Hispanic, and Black) of Texas high school boys for the 2004-2005 through the 2011-2012 school years? The first three research questions were repeated for each of the 8 school years, whereas the fourth research question constituted an examination of all 8 school years for each of the three mathematics measures. As such, a total of 27 research questions constituted this research study.

2. Method

2.1. Research Design

In this empirical, multiyear investigation, a causal-comparative research design was present [29]. The independent variable of ethnicity/race was fixed and the dependent variables of student mathematics performance had previously occurred. In this study, archival data previously acquired from the Texas Education Agency Public Education Information Management System were examined to determine the degree to which differences were present in overall mathematics performance for four different ethnic/racial groups of Texas high school boys. The independent variable of ethnicity/race consisted of four groups: Asian, White, Hispanic, and Black boys enrolled in Texas high schools during the 2004-2005 through the 2011-2012 school years. The dependent variables in this study involved students either meeting or not meeting three TAKS Mathematics measures: Met Standard, Commended Performance, and the Higher Education Readiness Component. The analysis of existing data in this investigation constituted a causal-comparative research design [29].

2.2. Participants

In 2012, the State of Texas implemented a new standardized assessment system [30]. To measure student competence in core content areas, the State of Texas Assessment of Academic Readiness (STAAR), is given to students in Grades 3-8 [18]. For students in Grades 9-12, End-of-Course (EOC) exams are given [18]. Considering the concerns related to STAAR and EOC transition and implementation, data from these assessment measures were not included in this investigation.

Participants in this study were all Asian, White, Hispanic, and Black high school boys who took the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam in the 2004-2005 through the 2011-2012 school years. A Public Information Request form was previously submitted to the Texas Education Agency Public Education Information Management System for the data that were analyzed in this investigation. The data that were previously obtained from the Public Information Request were analyzed in a dissertation in which reading test scores were the focus [31]. The mathematics test performance of these Texas high school boys was analyzed in this dissertation.

2.3. Instrumentation

For this investigation, scores from the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam were analyzed. Specifically, the Met Standard, Commended

Performance, and the Higher Education Readiness Component scores were used to determine the extent to which differences were present in mathematics achievement by ethnicity/race for Texas high school boys. Achieving the Met Standard level indicates that a student met or slightly exceeded the state's minimum passing standard [32].

To achieve Commended Performance on the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam, a student must demonstrate a thorough understanding of the 10 assessed mathematics objectives. Performing at the Commended level indicates a student scored considerably above the state's passing standard [32]. Performance on the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam has been used as one of the predictors of post-secondary success. The Higher Education Readiness Component is a performance standard that is used to determine if students taking the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam are prepared for college-level course work [32]. Readers are directed to the Texas Education Agency website for additional information regarding the mathematics performance standards, the score reliabilities, and the score validities of the TAKS Mathematics assessment.

3. Results

Results of statistical analyses for high school boys who took the TAKS Exit-Level Mathematics exam will be described by overall performance measure. As previously described, the TAKS Exit-Level Mathematics performance measures are: (a) Met Standard; (b) Commended Performance; and (c) Higher Education Readiness Component. Results will be presented in chronological order beginning with the 2004-2005 school year and concluding with the 2011-2012 school year for each of the three performance measures.

Prior to conducting Pearson chi-square statistical procedures for Texas high school boys who took the TAKS Exit-Level Mathematics exam in the 2004-2005 through the 2011-2012 school years, underlying assumptions for using this procedure were checked. For each of the three performance measures, data consisted of the student either meeting that standard or not meeting that standard. As such, these data were independent of each other. In addition, with the large sample size, the available sample size per cell was more than five. Hence, the underlying assumptions of the Pearson chi-square were met [33].

3.1. Results for the TAKS Met Standard Research Question

For the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 6446.93$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .25, a small effect size [34]. Present in the results was a stair-step effect [35]. Asian boys had the highest percentage on the Met Standard, followed by White boys, and then by Hispanic boys and last by Black boys. The frequencies and percentages for this school year are delineated in Table 1.

Table 1. *Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years.*

School Year and Ethnicity/Race	Met Standard %age of Total and *n*	Did Not Meet Standard %age of Total and *n*
2004-2005		
Asian	88.50% (*n* = 2,545)	11.50% (*n* = 330)
White	82.10% (*n* = 42,384)	17.90% (*n* = 9,227)
Hispanic	64.80% (*n* = 23,144)	35.20% (*n* = 12,587)
Black	52.30% (*n* = 6,651)	47.70% (*n* = 6,061)
2005-2006		
Asian	88.00% (*n* = 2,679)	12.00% (*n* = 367)
White	79.80% (*n* = 40,923)	20.20% (*n* = 10,333)
Hispanic	62.30% (*n* = 23,224)	37.70% (*n* = 14,035)
Black	47.90% (n = 6,520)	52.10% (*n* = 7.093)
2006-2007		
Asian	88.40% (*n* = 2,649)	11.60% (*n* = 346)
White	82.20% (*n* = 41,583)	17.80% (*n* = 9,035)
Hispanic	65.70% (*n* = 25,977)	34.30% (*n* = 13,569)
Black	51.40% (*n* = 7,131)	48.60% (*n* = 6,734)

Regarding the 2005-2006 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 7003.51$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 26 [34]. Again, a stair-step effect was present [35]. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for this school year are presented in Table 1.

With respect to the 2006-2007 school year, the Pearson chi-square again revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 6715.23$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 25 [34]. Similar to the previous two years, a stair-step effect was clearly evident [35]. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Delineated in Table 1 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

Concerning the 2007-2008 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 5284.95$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .23, a small effect size [34]. Again, clearly evident in these results was a stair-step effect [35]. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2 are the frequencies and percentages for Met Standard by student ethnicity/race for this school year.

Table 2. *Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years.*

School Year and Ethnicity/Race	Met Standard %age of Total and *n*	Did Not Meet Standard %age of Total and *n*
2007-2008		
Asian	93.80% (*n* = 2,845)	6.20% (*n* = 187)
White	89.80% (*n* = 40,742)	10.20% (*n* = 4,604)
Hispanic	74.60% (*n* = 28,096)	25.40% (*n* = 9,563)
Black	66.50% (*n* = 7,711)	33.50% (*n* = 3,891)
2008-2009		
Asian	93.40% (*n* = 3,020)	6.60% (*n* = 212)
White	90.40% (*n* = 41,705)	9.60% (*n* = 4,406)
Hispanic	76.30% (*n* = 32,882)	23.70% (*n* = 10,212)
Black	67.10% (*n* = 8,611)	32.90% (*n* = 4,223)
2009-2010		
Asian	95.10% (*n* = 3,236)	4.90% (*n* = 167)
White	94.20% (*n* = 42,358)	5.80% (*n* = 2,627)
Hispanic	85.30% (*n* = 39,629)	14.70% (*n* = 6,810)
Black	79.20% (*n* = 10,507)	20.80% (*n* = 2,757)

Regarding the 2008-2009 school year, a statistically significant difference was yielded in the Met Standard, $\chi^2(3) = 5370.04$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .23, a small effect size [34]. Again, the "stair-step of achievement" (Carpenter et al., 2006, p. 117) was revealed in the frequencies and percentages. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Met Standard by student ethnicity/race for this school year are presented in Table 2.

With respect to the 2009-2010 school year, a statistically significant difference was revealed in the Met Standard, $\chi^2(3) = 3156.98$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 17 [34]. Similar to the previous five years, a stair-step effect [35] was present. Again, Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2 are the frequencies and percentages for Met Standard by student ethnicity/race for this school year.

For the 2010-2011 school year, a statistically significant difference was yielded in the Met Standard, $\chi^2(3) = 2216.73$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .14, a small effect size [34]. Again, a stair-step effect [35] was revealed. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Noted in Table 3 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

Table 3. *Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years.*

School Year and Ethnicity/Race	Met Standard %age of Total and *n*	Did Not Meet Standard %age of Total and *n*
2010-2011		
Asian	95.30% (*n* = 3,100)	4.70% (*n* = 154)
White	94.50% (*n* = 39,974)	5.50% (*n* = 2,347)
Hispanic	87.60% (*n* = 43,566)	12.40% (*n* = 6,153)
Black	91.90% (*n* = 10,160)	18.10% (*n* = 2,240)
2011-2012		
Asian	94.40% (*n* = 3,440)	5.60% (*n* = 204)
White	94.60% (*n* = 39,789)	5.40% (*n* = 2,254)
Hispanic	88.70% (*n* = 47,965)	11.30% (*n* = 6,113)
Black	83.30% (*n* = 10,663)	16.70% (*n* = 2,139)

In the 2011-2012 school year, a statistically significant difference was revealed in the Met Standard, $\chi^2(3) = 1878.05$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 13 [34]. In contrast to the previous seven years, the percentage on the Met Standard for White boys was slightly higher, 0.2%, than Asian boys. Other than this difference, Hispanic boys had the next lowest percentage of boys on the Met Standard, with Black boys having the lowest percentage. Delineated in Table 3 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

3.2. Results for the TAKS Commended Performance

Regarding the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in Commended Performance, $\chi^2(3) = 7790.96$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .28, a small effect size [34]. Present in the results was a stair-step effect [35]. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Commended Performance by ethnicity/race for this school year are revealed in Table 4.

Table 4. *Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years.*

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2004-2005		
Asian	45.70% (*n* = 1,316)	54.30% (*n* = 1,561)
White	26.10% (*n* = 13,479)	73.90% (*n* = 38,181)
Hispanic	8.50% (*n* = 3,050)	91.50% (*n* = 32,760)
Black	3.80% (*n* = 481)	96.20% (*n* = 12,255)
2005-2006		
Asian	48.50% (*n* = 1,478)	51.50% (*n* = 1,568)
White	26.40% (*n* = 13,530)	73.60% (*n* = 37,799)
Hispanic	10.70% (*n* = 3,988)	89.30% (*n* = 33,372)
Black	4.30% (*n* = 592)	95.70% (*n* = 13,082)
2006-2007		
Asian	53.20% (*n* = 1,594)	46.80% (*n* = 1,403)
White	29.00% (*n* = 14,718)	71.00% (*n* = 35,963)
Hispanic	12.00% (*n* = 4,777)	88.00% (*n* = 34,964)
Black	5.40% (*n* = 750)	94.60% (*n* = 13,185)

For the 2005-2006 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 7236.84$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 26 [34]. Again, present in the results was a stair-step effect [35]. Asian boys had the highest percentage on the Commended Performance,

followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 4 are the frequencies and percentages for Commended Performance by ethnicity/race for this school year.

Concerning the 2006-2007 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 7984.42$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .27, a small effect size [34]. Similar to the previous two years, a stair-step effect was evident [35]. Again, Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages of Commended Performance by student ethnicity/race are delineated in Table 4.

In the 2007-2008 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 8093.34$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 29 [34]. Again, clearly evident in these results was a stair-step effect [35]. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 5 are the frequencies and percentages for Commended Performance by student ethnicity/race for this school year.

Table 5. *Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years.*

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2007-2008		
Asian	63.50% (*n* = 1,924)	36.50% (*n* = 1,108)
White	39.00% (*n* = 17,667)	61.00% (*n* = 27,713)
Hispanic	18.40% (*n* = 6.937)	81.60% (*n* = 30,851)
Black	10.30% (*n* = 1,197)	89.70% (*n* = 10,471)
2008-2009		
Asian	67.00% (*n* = 2,167)	33.00% (*n* = 1,065)
White	43.60% (*n* = 20,116)	56.40% (*n* = 25,995)
Hispanic	22.00% (*n* = 9,475)	78.00% (*n* = 33,619)
Black	12.30% (*n* = 1,579)	87.70% (*n* = 11,255)
2009-2010		
Asian	63.10% (*n* = 2,146)	36.90% (*n* = 1,257)
White	40.40% (*n* = 18,173)	59.60% (*n* = 26,812)
Hispanic	20.30% (*n* = 9,409)	79.70% (*n* = 37,030)
Black	11.40% (*n* = 1,511)	88.60% (*n* = 11,753)

With respect to the 2008-2009 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 9006.77$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .29, a small effect size [34]. Again, the "stair-step of achievement" [35, p. 117] was present in the frequencies and percentages. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Commended Performance by student ethnicity/race for this school year are delineated in Table 5.

For the 2009-2010 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 8492.41$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 28 [34]. Clearly evident was a stair-step effect [35]. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 5 are the frequencies and percentages for Commended Performance by student ethnicity/race for this school year.

Regarding the 2010-2011 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 7765.60$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .27, a small effect size [34]. Again, a stair-step effect [35] was present. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages of Commended Performance by student ethnicity/race for this school year are revealed in Table 6.

Table 6. *Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years.*

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2010-2011		
Asian	66.40% (*n* = 2,160)	33.60% (*n* = 1,094)
White	39.10% (*n* = 16,531)	60.90% (*n* = 25,790)
Hispanic	21.00% (*n* = 10,464)	79.00% (*n* = 39,255)
Black	11.40% (*n* = 1,411)	88.60% (*n* = 10,989)
2011-2012		
Asian	71.70% (*n* = 2,611)	28.30% (*n* = 1,033)
White	47.70% (*n* = 20,051)	52.30% (*n* = 21,992)
Hispanic	27.50% (*n* = 14,864)	72.50% (*n* = 39,214)
Black	16.30% (*n* = 2,093)	83.70% (*n* = 10,709)

Concerning the 2011-2012 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 8404.58$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 27. Similar to the previous seven years, a stair-step effect was clearly evident [35]. Asian boys had the highest percentage on the Commended Performance. White boys had the next highest Commended Performance percentage, followed by Hispanic boys, and then Black boys. Delineated in Table 6 are the frequencies and percentages of Commended Performance by student ethnicity/race for this school year.

3.3. Results for the Higher Education Readiness Component

For the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in the Higher Education Readiness Component, $\chi^2(3) = 10939.28$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .33, a moderate effect size. Present in the results was a stair-step effect [35]. Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black

boys. The frequencies and percentages for this school year are delineated in Table 7.

Table 7. *Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years.*

School Year and Ethnicity/Race	Met HERC Standard	Did Not Meet HERC Standard
	%age of Total and *n*	%age of Total and *n*
2004-2005		
Asian	75.70% (*n* = 2,177)	24.30% (*n* = 700)
White	60.50% (*n* = 31,274)	39.50% (*n* = 20,386)
Hispanic	33.20% (*n* = 11,876)	66.80% (*n* = 23,934)
Black	21.10% (*n* = 2,686)	78.90% (*n* = 10,050)
2005-2006		
Asian	77.20% (*n* = 2,353)	22.80% (*n* = 693)
White	60.60% (*n* = 31,115)	39.40% (*n* = 20,214)
Hispanic	36.50% (*n* = 13,649)	63.50% (*n* = 23,711)
Black	21.90% (n = 2,990)	78.10% (*n* = 10,684)
2006-2007		
Asian	80.20% (*n* = 2,405)	19.80% (*n* = 592)
White	65.00% (*n* = 32,966)	35.00% (*n* = 17,715)
Hispanic	40.90% (*n* = 16,240)	59.10% (*n* = 23,501)
Black	25.40% (*n* = 3,540)	74.60% (*n* = 10,395)

Regarding the 2005-2006 school year, the Pearson chi-square revealed a statistically significant difference in the Higher Education Readiness Component, $\chi^2(3) = 10027.25$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was moderate,. 31. Again, a stair-step effect was present [35]. Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Frequencies and percentages for this school year are presented in Table 7.

With respect to the 2006-2007 school year, a statistically significant difference was yielded in the Higher Education Readiness Component, $\chi^2(3) = 10311.73$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was moderate,. 31. Similar to the previous two years, a stair-step effect was evident [35]. Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Delineated in Table 7 are the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

Concerning the 2007-2008 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 8533.92$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .30, a moderate effect size. Again, clearly evident in these results was a stair-step effect [35]. Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 8 are the frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year.

Table 8. *Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years.*

School Year and Ethnicity/Race	Met HERC Standard	Did Not Meet HERC Standard
	%age of Total and *n*	%age of Total and *n*
2007-2008		
Asian	86.40% (*n* = 2,620)	13.60% (*n* = 412)
White	73.40% (*n* = 33,264)	26.60% (*n* = 12,080)
Hispanic	49.20% (*n* = 18,572)	50.80% (*n* = 19,149)
Black	37.50% (*n* = 4,360)	62.50% (*n* = 7,261)
2008-2009		
Asian	89.00% (*n* = 2,869)	11.00% (*n* = 356)
White	77.80% (*n* = 35,380)	22.20%% (*n* = 10,080)
Hispanic	56.10% (*n* = 23,539)	43.90% (*n* = 18,384)
Black	42.70% (*n* = 5,245)	57.30% (*n* = 7,030)
2009-2010		
Asian	89.90% (*n* = 3,059)	10.10% (*n* = 343)
White	80.50% (*n* = 35,814)	19.50% (*n* = 8,652)
Hispanic	60.80% (*n* = 27,565)	39.20% (*n* = 17,754)
Black	48.90% (*n* = 6,228)	51.10% (*n* = 6,498)

Regarding the 2008-2009 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 8237.34$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .28, a small effect size. Again, a stair-step effect was present [35]. Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year are delineated in Table 8.

For the 2009-2010 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 7218.76$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 26. Clearly evident was a stair-step effect [35]. Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 8 are the frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year.

With respect to the 2010-2011 school year, a statistically significant difference was yielded in the Higher Education Readiness Component, $\chi^2(3) = 5387.69$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .23, a small effect size. Again, a stair-step effect [35] was revealed. Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Table 9 contains the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

Table 9. *Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years.*

School Year and Ethnicity/Race	Met HERC Standard	Did Not Meet HERC Standard
	%age of Total and *n*	%age of Total and *n*
2010-2011		
Asian	91.10% (*n* = 2,964)	8.90% (*n* = 289)
White	81.40% (*n* = 34,163)	18.60% (*n* = 7,826)
Hispanic	65.10% (*n* = 31,830)	34.90% (*n* = 17,094)
Black	53.80% (*n* = 6,460)	46.20% (*n* = 5,539)
2011-2012		
Asian	91.20% (*n* = 3,321)	8.80% (*n* = 321)
White	84.70% (*n* = 35,408)	15.30% (*n* = 6,375)
Hispanic	70.40% (*n* = 37,469)	29.60% (*n* = 15,742)
Black	58.80% (*n* = 7,287)	41.20% (*n* = 5,102)

Concerning the 2011-2012 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 4975.36$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small,. 21. Similar to the previous seven years, a stair-step effect was evident [35]. Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 9 are the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

4. Discussion

In this study, the degree to which differences were present in mathematics achievement as a function of ethnicity/race (i.e., Asian, White, Hispanic, and Black) was examined for boys in Texas high schools during the 2004-2005 through the 2011-2012 school years. For the 8-year time period examined, statistically significant differences in mathematics achievement in each school year were yielded by student ethnicity/race. Following these statistical analyses, the presence of trends in mathematics achievement by ethnicity/race was determined. Results are summarized in the next section.

Table 10. *Cramer's Vs for the TAKS Mathematics Met Standard, Commended Performance, and HERC Standard by Student Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years.*

School Year	Met Standard	Commended Performance	HERC Standard
2004-2005	0.25 (Small)	0.28 (Small)	0.33 (Moderate)
2005-2006	0.26 (Small)	0.26 (Small)	0.31 (Moderate)
2006-2007	0.25 (Small)	0.27 (Small)	0.31 (Moderate)
2007-2008	0.23 (Small)	0.29 (Small)	0.30 (Moderate)
2008-2009	0.23 (Small)	0.29 (Small)	0.28 (Small)
2009-2010	0.17 (Small)	0.28 (Small)	0.26 (Small)
2010-2011	0.14 (Small)	0.27 (Small)	0.23 (Small)
2011-2012	0.13 (Small)	0.27 (Small)	0.21 (Small)

4.1. Met Standard

Students who met or exceeded the state's minimum score on the TAKS Exit-Level Mathematics exam during the 2004-2005 through the 2011-2012 school years achieved the Met Standard proficiency level. For the 2004-2005 through the 2010-2011 school years, Asian boys had the highest Met Standard percentage, followed by White boys. For the 2011-2012 school year, Asian and White boys had a similar performance on the TAKS Mathematics Met Standard. During the 8-year time period, statistically significantly lower percentages of Hispanic and Black boys Met Standard than did Asian and White boys. Black boys had the lowest Met Standard percentages in each year of the 8-year time span. In agreement with Carpenter et al. (2006), a stair-step effect was present in student achievement by ethnicity/race for the Met Standard proficiency level.

4.2. Commended Performance

Students who performed considerably above the state's passing standard on the TAKS Exit-Level Mathematics exam during the 2004-2005 through the 2011-2012 school years achieved Commended Performance. For the 2004-2005 through the 2011-2012 school years, Asian boys had the highest Commended Performance percentages, followed by White boys, then Hispanic boys, and last Black boys. During the 8-year span, statistically significantly lower percentages of Hispanic and Black boys achieved Commended Performance than Asian and White boys. Black boys had the lowest Commended Performance percentages in each year of the 8-year time span. Again congruent with Carpenter et al. (2006), a stair-step effect was present in Commended Performance achievement by ethnicity/race.

4.3. Higher Education Readiness Component

Students who took the TAKS Exit-Level Mathematics assessment during the 2004-2005 through the 2011-2012 school years and who met the Higher Education Readiness Component standard were identified as being prepared for college-level course work. For these 8 school years, higher percentages of Asian boys met the Higher Education Readiness Component standard than White, Hispanic, and Black boys. White boys had the next highest percentages of meeting the Higher Education Readiness Component, followed by Hispanic boys and then Black boys. Black boys had the lowest percentages of students who met the Higher Education Readiness Component in each year of the 8-year span. Again, the presence of a stair-step effect [34] was revealed in these results.

4.4. Connection with Existing Literature

Several researchers (e.g., 6, 26, 5, 8, 13] have identified that disparities exist in academic achievement among Asian, White, Hispanic, and Black students. Specifically, [6], [21], and [5] documented the presence of mathematics achievement gaps among different racial/ethnic groups (i.e., Asian, White, Hispanic, and Black). Comparatively, in 2015, the [36] reported that the average mathematics scale score for Grade 12 Asian boys was 176 and for White boys was 162. Their average mathematics scale scores were at least 20

points higher than the average scale score for Hispanic boys, 141, and for Black boys, 132. Results of this research investigation are commensurate with historical and recent trend data that Asian and White boys have similar levels of mathematics achievement. Differences in mathematics achievement between these two groups of students and Hispanic and Black boys continue to be expansive.

4.5. Implications for Policy and Practice

At each level of proficiency (i.e., Met Standard, Commended Performance, and Higher Education Readiness Component) analyzed in this investigation, Hispanic and Blacks boys had the lowest levels of mathematics achievement. Evidenced in the analysis of this longitudinal investigation were vast disparities in mathematics achievement among different racial/ethnic groups (i.e., Asian, White, Hispanic, and Black). Asian and White boys consistently outperformed Hispanic and Black boys each year. Despite the implementation of the [37], many school systems were unable to overcome the challenges associated with educating diverse students. As such, large differences exist in mathematics achievement among ethnic/racial groups of students (i.e., Asian, White, Hispanic, and Black). To overcome these barriers, educators and practitioners should focus on restructuring educational policies and practices so that all students can have an opportunity to achieve positive academic outcomes.

An additional implication educators should be cognizant of is the effect of successful mathematical experiences on future outcomes. [1] stated that proficiency in mathematics is critical to secondary and postsecondary success. Conversely, the lack of mathematics achievement can influence school attendance rates, drop-outs rates, and college-readiness rates [22]. Each of these areas is vital to the success of young learners.

Texas educators and policymakers have multiple years of data and research to support the need for targeted interventions for Hispanic and Black boys. Teacher quality, along with instructional design and delivery, are key areas that should be considered when educating diverse student groups. Further, noting the increasing population of Hispanic students and the poor levels of mathematics achievement in Hispanic and Black boys as compared to their Asian and White peers, changes must be made to help ensure these at-risk groups can have improved educational outcomes.

4.6. Suggestions for Future Research

Examined in this study was the relationship between ethnic/racial group membership and the mathematics performance of each group as determined by the TAKS Exit Level Mathematics examination. Results from this investigation could be used to encourage future researchers to expand this study by examining multiple content areas (e.g., reading, science, and social studies). Additionally, mathematics performance of elementary and middle school boys could be investigated to determine the extent to which differences exist in mathematics achievement for boys by ethnic/racial group (i.e., Asian, White, Hispanic, and Black). Further, expanding this study to include mathematics assessment data from multiple states could support the notion that alarming gaps in mathematics achievement continue to exist among different racial/ethnic groups.

Research regarding the mathematics proficiency of girls by ethnicity/race (i.e., Asian, White, Hispanic, and Black) could also be instrumental in examining overall mathematics achievement among these ethnic/racial groups. This examination would be relevant in drawing conclusions and identifying trends in mathematics achievement on the TAKS Exit-Level Mathematics assessment. Additionally, school systems that recognize and understand the implications of poor mathematics achievement on future life outcomes for different ethnic racial groups could better plan and intervene with each specific group. Improving the experiences and outcomes for all students should be one of the primary goals of educators [15].

In 2012, the State of Texas transitioned to a new assessment system. The State of Texas Assessment of Academic Readiness, (STAAR) and End of Course (EOC) exams could be considered as sources for assessment data for future investigations. Since its existence, however, the implementation of the STAAR and EOC exams has been problematic. As more reliable data become available, scores from the STAAR and EOC exams could be examined by researchers to determine the degree to which differences exists in mathematics achievement between different ethnic/racial groups. In this investigation, statistically significant differences were revealed among the mathematics proficiency levels of different ethnic/racial groupings. Readers are encouraged to investigate further the relationship between mathematics skills and ethnicity/race. Additional variables that could be considered are whether differences exist in mathematics achievement by level of economic status for different ethnic/racial groups.

5. Conclusion

The purpose of this research study was to examine the degree to which differences were present in overall mathematics achievement by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. An analysis of 8 years of statewide data was conducted and revealed the presence of statistically significant differences in TAKS Exit-Level Mathematics proficiency among Asian, White, Hispanic, and Black boys. For the 2004-2005 through the 2011-2012 school years, Asian and White boys outperformed Hispanic and Black boys at each measure of proficiency (i.e., Met Standard, Commended Performance, and High Education Readiness Component). As referenced by several researchers (e.g., 6, 3, 5, 8, 11, 28, 14, 24], disparaging differences in mathematics achievement exists among Asian, White, Hispanic, and Black students.

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